BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of San Diego Gas & Electric Company (U 902 E) for Authority to Update Electric Rate Design Regarding Residential Default Time-Of-Use Rates and Fixed Charges	Application 17-12-____

PREPARED DIRECT TESTIMONY OF

LESLIE WILLOUGHBY

ON BEHALF OF SAN DIEGO GAS & ELECTRIC COMPANY

CHAPTER 4

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

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SDGE
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I. OVERVIEW AND PURPOSE

The purpose of my testimony is to provide an overview of the time-of-use ("TOU") load impact studies that are relevant to California's Mass TOU Default rollout and this Rate Design Window ("RDW") Application. The first and second interim analyses for the Opt-In TOU Pilot calculated the impact of TOU rates on energy consumption and the results showed statistically significant load reduction during the on-peak hours between 4pm-9pm. The same analyses also showed, on average, minimal bill impacts across the various climate zones. It is expected that SDG&E's Mass TOU Default in 2019 will produce similar or smaller absolute[1] load impact results than the Opt-In TOU Pilot, but the aggregate MW reductions will be significantly higher.

The next section of my testimony provides background information related to SDG&E's Opt-In TOU Pilot and Default TOU Pilot. Followed by Opt-In TOU Pilot's load impact and bill impact analyses, and a brief intro to SDG&E' Rate 3. Section III details the analyses conducted by Sacramento Municipal Utility District ("SMUD") for their Smart Pricing Options ("SPO") pilot study. Section IV relates SDG&E's Default TOU in 2018 to SMUD's study in terms of expected load impacts. Section V provides a formal discussion on the expected load impacts for SDG&E's Mass TOU Default in 2019. Section VI concludes my testimony.

A. Background Information

In 2013, the CPUC opened a residential rate reform rulemaking ("R.") 12-06-013 that directed the California investor-owned utilities ("IOUs") to propose new rate designs that were

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[1] For example, the absolute load impact of .06 kW is equivalent to the energy consumed by a 60 Watt light bulb over the period of an hour.

in support of and consistent with the CPUC's 10 guiding residential rate design principles. SDG&E proposed that it conduct an Opt-In TOU Pilot[2] and eventually a Default TOU Pilot[3] that would test new TOU rate designs that included an on-peak period that was later in the afternoon/evening.

In D.15-07-001, the Commission directed the IOUs to conduct an Opt-In TOU Pilot and a Default TOU Pilot prior to rolling out TOU to all residential customers.[4] All three IOUs along with the Energy Division, external stakeholders, and Nexant Consulting began planning the residential Opt-In TOU Pilot in the summer and fall of 2015.

The residential Opt-In TOU Pilot began in the summer of 2016 and has had two interim reports issued. The first interim report covered most of the summer months in 2016[5] and the second interim report covered the first year (Jul. 2016 – Jun. 2017) of the pilot. The third and final report scheduled to be completed March 31, 2018 will provide results for the 2nd summer of the Opt-In TOU Pilot.

Additionally, D.15-07-001 directed SDG&E to include supporting documentation regarding its Default TOU Pilot rate that includes, at a minimum, load response studies.[6] For this reason, SDG&E is including both Opt-In TOU Pilot interim reports in Attachments A and B to this testimony. A brief overview of the Opt-In TOU Pilot results, descriptions and load impact

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[2] R.12-06-013, Prepared Direct Testimony of Leslie Willoughby - Chapter 3 at LW-1, lines 16-18.
[3] R.12-06-013, Prepared Rebuttal Testimony of Leslie Willoughby - Chapter 5 at LW-4, lines 4-16.
[4] D.15-07-001 required the IOUs to file Tier 3 advice letters that provide process design, and authorization to track pilot costs along with cost recovery for both the Opt-In TOU and Default TOU Pilots. D.15-07-001 at 166-170.
[5] The initial rollout for SDG&E started at the end of June and most of the customers were enrolled during July.
[6] D.15-07-001 at 301-302.

results from SDG&E's three experimental TOU rates are provided, as well as the initial bill impact results from the first year of the Opt-In TOU Pilot.

Also included is an overview of the Sacramento Municipal Utility District study.[7] SMUD conducted both an Opt-In TOU and Default TOU study in 2012-2103 that contains information about load impacts relevant to SDG&E's Mass TOU Default and is included in Attachment C.

On May 25, 2017, the CPUC adopted SDG&E's Default TOU Pilot plan in Resolution E-4848. Additionally, the resolution states that SDG&E must provide load and bill impacts from the first summer of the Default TOU Pilot in the fall of 2018 and its final Default TOU Pilot load and bill impacts in its November 1, 2019 Progress on Residential Rate Reform ("PRRR") report.[8] This testimony will discuss similarities and differences between these studies and SDG&E's Mass TOU Default. The expected load impacts from SDG&E's proposed Mass TOU Default are utilized by Witness Benjamin Montoya for satisfying the requirement of calculating cost savings due to GHG reductions.[9]

II. SDG&E'S OPT-IN TOU PILOT

A. SDG&E Opt-In TOU Pilot Rates

The two TOU rates that SDG&E tested had the same on-peak periods which were from 4pm-9pm daily. SDG&E's TOU-DR-E1 rate (known as "Rate 1") was a three-part TOU rate that had an on-peak, off-peak period and a super off-peak period, while TOU-DR-E2 (known as "Rate 2") was a two-part time of use rate with an on-peak and off-peak period. Both TOU rates had seasonal differences as well as moderate price signals that were an approximately 2 to 1 ratio

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[7] Potter et. al., SmartPricing Options Final Evaluation (Sept. 5, 2014).
[8] Resolution E-4848 at 29, OP 7.
[9] D.15-07-001 at 301.

of on-peak to super off-peak during the summer. Table LW-1, below, shows the periods for both experimental TOU rates.

Table LW-1 TOU Rate Periods for the Opt-In TOU pilot

RATE 1	Weekdays	Weekends & Holidays
Summer		
On-Peak	4 p.m. - 9 p.m.	4 p.m. - 9 p.m.
Off-Peak	6 a.m. - 4 p.m.	2 p.m. - 4 p.m.
	9 p.m. - 12 a.m.	9 p.m. - 12 a.m.
Super Off-Peak	12 a.m. - 6 a.m.	12 a.m. - 2 p.m.
Winter		
On-Peak	4 p.m. - 9 p.m.	4 p.m. - 9 p.m.
Off-Peak	12 a.m. - 4 p.m.	2 p.m. - 4 p.m.
	9 p.m. - 12 a.m.	9 p.m. - 12 a.m.
Super Off-Peak	12 a.m. - 6 a.m.	12 a.m. - 2 p.m.
RATE 2	**Weekdays**	**Weekends & Holidays**
Summer		
On-Peak	4 p.m. - 9 p.m.	4 p.m. - 9 p.m.
Off-Peak	12 a.m. - 4 p.m.	12 a.m. - 4 p.m.
	9 p.m. - 12 a.m.	9 p.m. - 12 a.m.
Winter		
On-Peak	4 p.m. - 9 p.m.	4 p.m. - 9 p.m.
Off-Peak	12 a.m. - 4 p.m.	12 a.m. - 4 p.m.
	9 p.m. - 12 a.m.	9 p.m. - 12 a.m.

Certain customers were excluded from participating in the Opt-In TOU Pilot, including, but not limited to, the following major categories: medical baseline; customers that cannot be disconnected from service without an in-person visit from a utility representative or requesting a 3rd party notification; Net Energy Metered ("NEM") customers[10] that do not have a true-up in March; customers with less than 12 months of interval data; customers already on a TOU rate (such as customers on the Opt-In TOU Pilot study); and Direct Access customers. While the

[10] For a full list of Default TOU Pilot exclusions see Direct Testimony of SDG&E witness Chris Bender.

Default TOU Pilot will allow some NEM customers,[11] as well as group bill customers, customers on medical baseline will still be excluded.

SDG&E recruited approximated 15,804 customers into its Opt-In TOU Pilot. The overall opt-in rate was about 7%, which was within the range that SDG&E expected, but significantly less than the 16% that SMUD observed.[12] Customers that agreed to be in the pilot were randomly assigned to one of two experimental TOU rates or a control group. Customers were also segmented by climate zone (Cool, Moderate or Hot[13]), CARE and Non-CARE.[14] For discussion purposes in my testimony I will refer to SDG&E's Opt-In TOU Pilot rates as they are discussed and presented in the two interim pilot reports as SDG&E's "Rate 1" and "Rate 2."

B. Opt-In TOU Pilot Load Impacts

1. Opt-In TOU Pilot First Interim Report Results

Table LW-2, below, shows results from the California Statewide Opt-In TOU Pricing Pilot's Interim Evaluation ("Opt-In TOU Pilot First Interim Report").[15] All climate regions showed that there were significant load reductions for the average weekday during the on-peak period. However, SDG&E's Weekly Alert Emails ("WAEs") did not provide any statistically significant load reductions for the first summer.[16] The first part of Table LW-2 shows the overall load impact results by rate for all climate zones. The second part (middle table) shows the load

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[11] NEM customers with an annual bill true-up in March will be allowed in the Default TOU Pilot.
[12] Attachment C, hereto: SMUD SmartPricing Options Pilot Evaluation: Submitted to SMUD at 1-2, Nexant (Aug. 6, 2014).
[13] For purposes of the pilot, SDG&E's coastal climate zone is the Cool zone, its inland zone is the Moderate zone and the mountain and desert zones are the Hot zone.
[14] Although the CARE and non-CARE groups also include FERA, the terminology "CARE" and "non-CARE" will be used hereafter for simplicity.
[15] California Statewide Opt-In Time-of-Use Pricing Pilot: Interim Evaluation, Nexant and Research into Action (April 11, 2017).
[16] Opt-In TOU Pilot First Interim Report at 5.

impacts by climate zones. The third table provides more detail by showing the load impact results by climate zones and by CARE and non-CARE customer segments separately. From the first table, both Rate 1 and Rate 2 experienced similar absolute load impacts of 0.04 kw. Rate 1, however, showed slightly higher load impacts in percentage terms than Rate 2 (5.4 % vs 4.6%, respectively). On average CARE customers had lower load impacts than non-CARE customers.[17] Additionally, customers in the Cool region saw lower peak period load reductions than customers in the Moderate region. SDG&E's Hot zone showed the highest peak load reductions at 6.8%, whereas CARE customers in the Cool zone on Rate 1 showed the lowest peak load reductions during the 2016 summer at around 2%. Cool CARE customers on Rate 2 also showed lower peak period percentage impacts compared to their equivalents in the Moderate region (2.6% vs 5.3%, respectively). Moreover, both TOU Rate's non-CARE customers in the Cool region had lower percentage impacts and absolute impacts in comparison to their Moderate counterparts.[18]

[17] Opt-In TOU Pilot First Interim Report at 5.
[18] Opt-In TOU Pilot First Interim Report at 392-396.

Table LW-2

Opt-In TOU Pilot First Summer Results for the average weekday

On-Peak Period (4pm-9pm)

Opt-In Pilot First Interim Report Results

June 2016-October 2016

	All CZ	
AvgWkdyPkPer	%Impact	AbsImpct (kw)
Rate1	5.40	0.04
Rate2	4.60	0.04

	Cool		Moderate		Hot	
AvgWkdyPkPer	%Impact	AbsImpct (kw)	%Impact	\bsImpct (kw)	%Impact	\bsImpct (kw)
Rate1	4.70	0.03	6.10	0.06		
Rate2	4.10	0.03	5.10	0.05	6.80	0.08

	Cool				Moderate			
	CARE		non-CARE		CARE		non-CARE	
AvgWkdyPkPer	%Impact	AbsImpct (kw)	%Impact	\bsImpct (kw)	%Impact	\bsImpct (kw)	%Impact	\bsImpct (kw)
Rate1	1.70	0.01	5.20	0.04	5.20	0.04	6.30	0.06
Rate2	2.60	0.02	4.30	0.03	5.30	0.04	5.10	0.05
Rate2-WAE**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

*Gray area not statistically significant

**WAE-Incremental Impacts

2. Opt-In TOU Pilot Second Interim Report Results

The Opt-In TOU Pilot Second Interim Report[19] ("Opt-In TOU Pilot Second Interim Report") analyzed a full 12 months of data from customers in the Opt-In TOU Pilot. Results show that although load impacts are small during the winter months for both Rate 1 and Rate 2, the load impacts are statistically significant,[20] albeit smaller than in the summer months. Echoing results from the first interim report, the top part of Table LW-3 indicates that Rate 1 experienced higher load impacts in both percentage and absolute terms than Rate 2. In contrast to the Opt-In TOU Pilot First Interim Report, where the Cool region had smaller load impacts than compared to the Moderate region, as shown in the middle part of Table LW-3 customers in the Cool region were able to reduce their peak period load slightly more than their counterparts

[19] Attachment B, hereto: California Opt-In Time Of Use Pricing Pilot, Second Interim Evaluation, Nexant Inc and Research Into Action (Nov. 1, 2017).

[20] Opt-In TOU Pilot Second Interim Report at 3.

in the Moderate region[21] (for Rate 1: 2.4% vs 2.2% and for Rate 2: 1.7% vs 1.6%, respectively). Customers in the Hot region still had the largest peak period load reduction at almost 4%.[22]

For the bottom portion of Table LW-3, below, it is interesting to note that when comparing the non-CARE and CARE separately, for example, the results for the CARE groups in the Cool and Moderate zone are almost trivial and not statistically significant at any level (see grayed area), whereas for the non-CARE groups the percentage load impacts are more than six times for those on Rate 1 (Cool CARE vs non-CARE: -0.3% vs 2.9% and Moderate CARE vs non-CARE: 0.4% vs 2.6%). These results indicate fundamental differences between CARE and non-CARE customer load impacts.

Table LW-3
Opt-In TOU Pilot Second Interim Report Winter Results for the
On-Peak Period (4pm-9pm)

Opt-In Pilot Second Interim Report Results
Nov 2016-April 2017

	All CZ	
AvgWkdyPkPer	%Impact	AbsImpct (kw)
Rate1	2.30	0.02
Rate2	1.70	0.01

	Cool		Moderate		Hot	
AvgWkdyPkPer	%Impact	AbsImpct (kw)	%Impact	AbsImpct (kw)	%Impact	AbsImpct (kw)
Rate1	2.40	0.02	2.20	0.02		
Rate2	1.70	0.01	1.60	0.01	3.90	0.04

	Cool				Moderate			
	CARE		non-CARE		CARE		non-CARE	
AvgWkdyPkPer	%Impact	AbsImpct (kw)	%Impact	AbsImpct (kw)	%Impact	AbsImpct (kw)	%Impact	npct (kw)
Rate1	-0.30	0.00	2.90	0.02	0.40	0.00	2.60	0.02
Rate2	0.50	0.00	1.90	0.01	1.30	0.01	1.70	0.01
Rate2-WAE**	<0.00	<0.00	<0.00	<0.00	0.01	0.01	0.01	0.01

*Gray area not statistically significant
**WAE-Incremental Impacts

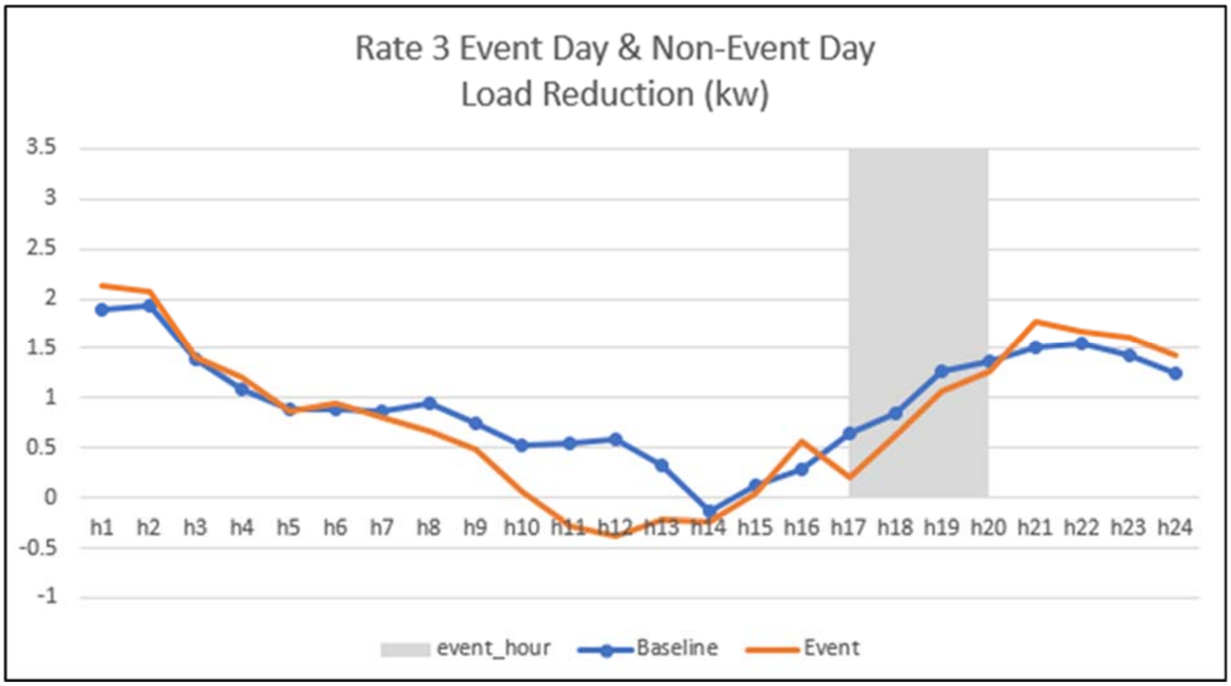
[21] The percentage impacts are different, but the absolute load impacts are nearly the same.
[22] Opt-In TOU Pilot Second Interim Report at 187.

C. SDG&E's Rate TOU-DR-E3 (Rate 3)

SDG&E's TOU-DR-E3 (Rate 3) marketed as "Whenergy HourlyX" is an experimental hourly dynamic rate, available as the third rate in SDG&E's Opt-In TOU Pilot. SDG&E's goal was to enroll 50-200 customers, including customers that had solar and electric vehicles. SDG&E enrolled approximately 65 customers with most of those being SDG&E employees. There are four main components to this rate: 1) a fixed monthly charge, 2) a two-period base rate, 3) an hourly commodity rate based on California Independent System Operator ("CAISO") day-ahead hourly prices, and 4) a dynamic hourly adder when forecasted load exceeds trigger values. This experimental schedule will remain effective until December 31, 2017 or until the completion of the pilot study. Due to the complexity of the rate, it was decided by the TOU working group that this rate would be primarily a demonstration rate or proof of concept rate. SDG&E planned to have limited enrollment (under 200 customers) on Rate 3 and there was no formal Measurement and Evaluation planned.

Initial analysis comparing pre- and post-event results indicated load reduction at the aggregate level (in total there are about 65 customers on Rate 3). However, individual load shapes appeared to be noisy and difficult to infer results from. As an example, load curves of several SDG&E employees who are participating on the rate showed that they were more likely to shift their electricity usage during the event window rather than reducing usage. Chart LW-1 provides an illustrative example of one of the system event days for SDG&E's "Rate 3" customers. This graphic shows a system wide event on June 17th where the plain solid line shows reductions at the beginning of the event, and slight deterioration of the load impact near the end of the event. There is a slight snap back after the event as customers likely returned to using their air conditioning and other high intensity end uses.

Chart LW-1



D. Bill Impacts

Bill impacts for SDG&E's Opt-In TOU Pilot were generally small, and the first interim evaluation which covered the summer months of July-October in 2016 showed relatively low impacts, with the majority of customers falling into the neutral category. Neutral impacts were defined as +/- $3. The Opt-In TOU Pilot's second interim report's bill impacts covered the winter months of the first year and were generally less than 1% in either direction for the CARE customers, and less than 2.6% for the non-CARE customers for both Rate 1 and 2, respectively.[23]

Table LW-4 above, shows the largest decrease as $28 for non-CARE customers in the Cool climate region on Rate 2, and the largest annual bill increase was $20 for the general population on Rate 2 in the Hot climate region.[24] Table LW-4, below, shows CARE and non-CARE customers on either rate experienced a decrease in their bill when both structural and

[23] Opt-In TOU Pilot Second Interim Report at 5.
[24] *Id.* at 5.

behavioral impacts are considered, with the exception of CARE customers in the Cool region on Rate 1. Overall, customers on Rate 2, which is the two-period rate, saw higher percentage bill impacts as compared to customers on Rate 1; however the difference is less than half of a percent.

Table LW-4
Annual Bill Impacts from the Opt-In TOU Pilot Second Interim Report

Rate 1				
	Cool		Moderate	
AnnBilImpct($)*	CARE	non-CARE	CARE	non-CARE
OAT	473	1055	622	1253
TOU w/no chg in Behv	470	1053	624	1265
TOU w/chg in Behv	475	1031	621	1239
Structual Impct	-3	-2	2	12
Total Bill Impct (Struc + Behv)	2	-24	-1	-14
%Impact	0.4%	-2.3%	-0.2%	-1.1%

Rate 2					
	Cool		Moderate		Hot
AnnBilImpct($)	CARE	non-CARE	CARE	non-CARE	
OAT	492	1071	648	1285	1433
TOU w/no chg in Behv	491	1065	652	1291	1449
TOU w/chg in Behv	488	1043	635	1284	1453
Structual Impct	-1	-6	4	6	16
Total Bill Impct (Struc + Behv)	-4	-28	-13	-1	20
%Impact	-0.8%	-2.6%	-2.0%	-0.1%	1.4%

*Bill Impacts are based on the 1st yr of study: Jul. 2016 - Jun. 2017 (neg. indicate a bill decrease)
OAT: Otherwise Applicable Tariff, the rate a customer would be on if they weren't enrolled on the TOU rate such as DR/DRLI
TOU: Time-of-Use rate

E. Customer Attrition

Over the first summer of the pilot, a total of 1,178 customers (approximately 7.5%) left the pilot due to ineligibility or actively dropped out (1.6% opted out and 5.9% became ineligible). Customers opting out did not statistically differ between the two rates.[25] SDG&E

[25] Opt-In TOU Pilot First Interim Report at 342.

continues to see low opt-out rates, as they ranged from 1% - 3.5% after 12 months. The Cool climate zone experienced the lowest opt-out rate at 2%.[26]

As of October 2017, SDG&E's total attrition for the Opt-In TOU Pilot has been approximately 27%[27] and within SDG&E's expectations. Prior to the Opt-In TOU Pilot, SDG&E conducted an analysis of customer churn and found that, on average, customers change addresses and move in and out of the service territory at about a rate of 25% annually. SDG&E planned for a 25% total attrition rate and factored in its customer churn rate into its recruitment targets for the Opt-In TOU Pilot.

III. SMUD STUDY

SMUD's Smart Pricing Options ("SPO") pilot was approved in August 2011. One of the key differences between SMUD's SPO and SDG&E's Opt-In TOU Pilot is that the SPO pricing plan is only applicable during the summer months between June to September. The on-peak hours were 4pm to 7pm. By comparison, the rates offered under SDG&E's Opt-In TOU Pilot are applicable year-round (with both summer and winter differentials) starting from June 2016 to December 2017 and the on-peak period is longer going from 4pm to 9pm. The SPO pilot is also more complex because it offered three rate options:

1) Time-of-Use (TOU)

2) Critical Peak Pricing (CPP)

3) A TOU-CPP combination

In addition, there are two recruitment strategies (Opt-In and Default) and one technology offer of an In-Home Display ("IHD"). The three time-varying pricing plans mentioned above were in effect from the beginning of June to September 2012 and 2013. Table LW-5, below,

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[26] Opt-In TOU Pilot Second Interim Report at 174.
[27] SDG&E's internal weekly tracking report for October 30th, 2017.

shows the overall summer weekday average peak period load impacts for the Opt-In and Default TOU groups. At first glance, these results might indicate that the load impacts for the Opt-In treatment with IHD offer are larger than for the Opt-In treatment without IHD (absolute impact 0.16 vs 0.21, respectively). However, after correcting for pre-treatment differences across the various groups, the load impact differences are not statistically significant. Therefore, as SMUD's final evaluation indicated there is no evidence that the IHD significantly increased load impacts associated with the three rate options. Further, the final evaluation suggested that absolute load impacts increased by as much as a factor of 10 across customers segmented into quartiles, suggesting that any Opt-In program will likely be more cost-effective if marketing resources primarily focus on high-usage customers.[28]

Table LW-5
SMUD Load Impacts[29]

Average Hourly Impacts for Opt-in TOU and Default TOU Groups

TrtPlan	Abs. Impact	SE	95% CI_Lower	95% CI_Upper	%Impact
Opt-in TOU w/o IHD	0.16	0.02	0.12	0.21	9.4%
Opt-in TOU w/IHD	0.21	0.02	0.18	0.25	11.9%
Default TOU w/IHD	0.11	0.01	0.08	0.14	5.8%
Default TOU & CPP w/IHC	0.17	0.03	0.11	0.22	8.7%

*IHD - in home display (technology offer)

The SMUD study has been recognized as one of the best studies in recent times due to its careful planning and experimental design. SMUD, as its name indicates, is a municipal utility with customers in Sacramento California. The typical customer in SMUD's service territory experiences warmer summer weather conditions and uses more energy than SDG&E's customers do. The SMUD study results show higher load impacts on average than what has been seen in SDG&E's Opt-In TOU Pilot results. This result is not surprising, since SDG&E's service territory experiences milder weather and San Diego customers have a lower saturation of central

[28] SMUD SmartPricing Options Pilot Evaluation: Submitted to SMUD at 4, Nexant (Aug. 6, 2014).
[29] *Id.* at 4.

air-conditioning. It is also expected that SDG&E's Default TOU study load impact results will be lower than or similar to its Opt-In TOU Pilot study results which are generally lower than the SMUD results presented in table LW-5 above.

IV. SMUD OPT-IN VERSUS DEFAULT TOU PILOT LOAD IMPACTS

The CPUC stated that the SMUD pilot represented "the most significant and relevant experience with TOU pilot design," and encouraged the IOUs to engage with SMUD to ensure their key lessons learned could be applied by the IOUs.[30] The California IOUs have incorporated, where feasible, the experimental design that was employed in the SMUD pilot in an effort to compare the Opt-In and Default TOU Pilot results. The SMUD study found that while only 16% of its customers opted into TOU rates, nearly 94% of its customers stayed on TOU rates when they were defaulted into TOU.[31] The SMUD study also showed the average opt-in TOU load impacts to be significantly higher than the average defaulted TOU customer load impacts. However, compared to the relatively small percentage of customers that opted-in and the very large percentage of customers that remained on default TOU, the default TOU load impacts are estimated to be significantly higher in aggregate Mega Watt Hours ("MWH") load impacts.[32]

V. SDG&E MASS TOU DEFAULT LOAD IMPACT ESTIMATES

SDG&E recently completed an ex ante load impact analysis that provides hourly estimates for the average residential customer on the "TOU-DR1" rate for SDG&E's Mass TOU Default. These forecasted load impact results for 2020 are utilized in the GHG cost saving's calculation provided in the Direct Testimony of Ben Montoya.

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[30] D.15-07-001 at 93.
[31] SMUD SmartPricing Options Pilot Evaluation: Submitted to SMUD at 3, Nexant (Aug. 6, 2014).
[32] *Id.* at 4. Nexant noted that there was approximately three times the MWHs when estimating the full population effect of opt-in versus default TOU.

The general methodology developed by SDG&E's consultant utilizes a random sample of approximately 14,000 SDG&E residential customers in the calculation of reference loads. Regression models analyzed historical data in explaining the relationship between customer usage, weather,[33] and other regular usage patterns to simulate reference loads. Percentage load impacts were simulated by TOU pricing period and day type using the simulated reference loads, expected TOU prices, and assumed elasticity values (derived from the statewide SPP study). The percentage load impacts were then applied to the simulated reference loads to calculate the average customer load impacts.

SDG&E believes that its Mass Default TOU will produce much larger load reductions in aggregate than the Opt-in TOU Pilot, which is similar to SMUD's Study results. The simulated results for SDG&E's Mass TOU Default estimated that approximately 180 MWHs of load would be reduced during the on-peak period for a 1 in 2 weather scenario on a typical August weekday, whereas the first interim results from the Opt-In TOU Pilot yielded about 14 MWHs.[34]

VI. SUMMARY AND CONCLUSION

The intent of this testimony is to provide a summary of the load impacts and bill impacts from SDG&E's Opt-In TOU Pilot. The Opt-In TOU Pilot began in June 2016 and thus far has produced two interim reports. As my testimony shows, both the absolute load impact (kw) from the two interim analyses are small but significant and no specific climate zones (Cool, Moderate or Hot) or customer segments (CARE or non-CARE) were above 0.08 kW. The percentage impact from the two reports ranges from about zero to about 6%. Furthermore, the bill impacts from the 1st year of the study (July 2016 – June 2017) also showed small percentage impacts,

[33] SDG&E assumed a 1 in 2 weather year for this analysis.

[34] For illustrative purposes 1,000,000 customers were used for the Default TOU versus 70,000 for the Opt-In TOU. The Opt-In TOU load reduction is based on a summer weekday and the Default TOU load reduction is based on an August Weekday.

indicating that on the whole customers in the Opt-In TOU Pilot did not see a significant increase in their bill by simply being on a TOU rate. Some customer segments even saw their total bill amount decrease after behavioral modification.[35]

After carefully analyzing the information present from SDG&E's Opt-In TOU Pilot and the SMUD's study, a full Mass TOU Default in 2019 to 1.3 million residential customers in San Diego county could potentially yield significant reductions in peak period demand, but is not expected to result in tangible bill impacts for most of SDG&E's customers. Lastly, in support of the GHG cost savings calculation requirement, an hourly ex ante load impact analysis was conducted and the resulting load impacts were utilized for 2020.

This concludes my prepared direct testimony.

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[35] Opt-In TOU Pilot Second Interim Report at 205.

VII. STATEMENT OF QUALIFICATIONS

My name is Leslie Willoughby. My business address is 8306 Century Park Court, San Diego, California 92123. I am employed by SDG&E as Electric Load Analysis Manager in the Customer Pricing Department. In my current position, I am responsible for managing and conducting load and energy research analysis.

I attended San Diego State University in San Diego, CA, where I graduated with a Bachelor of Science in Business Administration in 1983. I continued to attend San Diego State University where I graduated with an MA in Economics in 1989. In 1990, I was employed by SDG&E to work in the Load Research Section of the Marketing Department as an Associate Economic Analyst. Over the past 25 years I have held positions of increasing responsibility within the company that have included Load and Energy Research.

I have previously testified before the Commission.

ATTACHMENT A

CALIFORNIA STATEWIDE OPT-IN TOU PRICING PILOT -INTERIM

APRIL 11TH 2017.

Interim Evaluation

Nexant
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California Statewide Opt-in Time-of-Use Pricing Pilot

Interim Evaluation

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1 Executive Summary

This report summarizes the first interim evaluation of California's statewide, opt-in time-of-use (TOU) pricing pilots implemented by Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE) and San Diego Gas and Electric Company (SDG&E). These pilots were implemented in response to California Public Utilities Commission (CPUC) Decision 15-07-001. A key objective of the pilots is to develop insights that will guide the IOUs applications to be filed in January 2018 proposing the implementation of default TOU pricing for all residential electricity customers and the CPUC's policy decisions regarding default pricing.

Collectively, the pilots implemented across the three investor owned utilities (IOUs) are testing nine different TOU rate options. For eight of the nine options, more than 50,000 households were enrolled and assigned to one of the TOU rates or retained in the study on the standard tiered rate (the otherwise applicable tariff, or OAT) to act as a control group for those who were placed on the new tariffs. The ninth rate option is a complex, dynamic rate that SDG&E is testing on a very small group of customers. Recruitment for this rate began in late August and evaluation of the rate is not included in this report.

All eight TOU pilot tariffs have peak periods that primarily cover late afternoon and evening hours year round. Most of the rates have peak periods ending at 9 PM and some have peak periods that don't start until 6 PM. As such, these pilots are among the first in the industry to study the magnitude of load reductions during evening hours.

Another key focus of the pilot tariffs is the willingness and ability of consumers to respond to time-varying price signals that vary across more than two daily rate periods and across more than two seasons. Low prices in midday in the spring—when excess supply conditions sometimes exist—is also something that has not been previously tested. Some of the tariffs have the same pricing structure on weekends as on weekdays, which is yet another atypical tariff feature. For most other existing TOU tariffs, off-peak prices apply on the weekend. In short, these pilots are breaking new ground both in California and in the industry with regard to the timing of peak periods, the use of TOU pricing on weekends in addition to weekdays, the frequency of price changes, and the response of customers to low daytime prices during excess supply conditions.

In addition to assessing the impacts of each tariff, these pilots are also studying the impact of selected technologies and information services. These include estimating TOU load impacts for households with smart thermostats in SCE's service territory and households that receive usage alerts via email in SDG&E's service territory. In PG&E's service territory, TOU customers were offered the option of downloading a smart phone app that conveys a variety of useful information to TOU participants.

1.1 Experimental Design

A key objective of any pilot or experiment is to establish a causal link between the experimental treatments (e.g., TOU rates, enabling technology, etc.) and the outcomes of interest (e.g., load impacts, changes in bills, customer satisfaction, etc.). The best way to do this is through what is referred to as a randomized control trial (RCT) research design. With this approach, participants are offered a treatment and, after they agree to accept it, are randomly assigned to either the treatment or control condition. This ensures that treatment and control customers are identical in every way except for exposure to the treatment and any difference that might occur due to random sampling error. As such, any observed difference in load during the peak period between treatment and control customers, for example, is due either to the treatment of interest (e.g., TOU pricing) or random chance. An RCT design was used in these pilots.

A key challenge in designing the pilots was deciding how to gain insights from residential opt-in TOU pilots that might help inform policy decisions for residential default TOU pricing. Default TOU pricing cannot be implemented prior to January 2018, even as a pilot rate. An important difference between opt-in and default conditions is the mix of customers that are enrolled under each condition. With default enrollment, there are three types of customers who remain on the tariff: those who would enroll on the tariff if it was marketed on an opt-in basis (referred to as “always takers”); those who are unaware that their tariff changed; and those who are aware and would not have enrolled on an opt-in basis but, for a variety of reasons (e.g., inertia, transaction costs associated with switching out, etc.), do not opt out from default enrollment. This latter group—referred to as “complacents”—is likely to be less engaged than the always takers, thus reducing average load reductions per participant compared with traditional opt-in enrollment. However, aggregate load reductions could be much higher under default pricing if the lower average load reduction was offset by significantly higher enrollment.

In order to better represent the mix of customers that are likely to be enrolled under default conditions, the pilots were implemented through what came to be called a “pay-to-play” (PTP) recruitment strategy. Under this approach, rather than recruit customers onto a specific rate by educating them about the features and potential customer benefits associated with the rate, as would be done for a typical opt-in pilot or program, prospective participants were offered an economic incentive for agreeing to be in the pilot and were then randomly assigned to one of three[1] rate options or to the control condition after agreeing to participate. Since a key motivation for enrolling on the study is likely to be the PTP incentive rather than the attractiveness of any particular rate feature, this approach may enroll a reasonable number of participants who would likely be complacents, and even some who might be unaware, under a default enrollment strategy.

Another important aspect of the pilot design concerns assessment of whether TOU rates may cause unreasonable hardship for selected customer segments. Public Utility Code Section 745 requires that the CPUC ensure that any default TOU rate schedule does not cause unreasonable hardship for senior citizens or economically vulnerable customers in hot climate regions. In order to provide insights on this important issue, a stratified sampling and recruitment plan was developed. Each IOU service territory was divided into three climate regions designated as hot, moderate, and cool. Within the hot regions for PG&E and SCE, senior households[2] and CARE/FERA[3] customers with incomes greater and less than 100% of Federal Poverty Guidelines (FPG) were oversampled for one rate in each service territory. Oversampling was not possible in SDG&E’s hot climate region because the region only contains about 16,000 customers.

[1] For SDG&E, participants were assigned to one of two rate options or the control group.

[2] Senior households are defined as households with one or more members aged 65 or older.

[3] California Alternate Rates for Energy (CARE) and Family Electric Rate Assistance (FERA).

1.2 Pilot Evaluation

Evaluation of the opt-in pilots focused on a number of important research objectives, including:

- Determining the change in electricity use in different time periods for different customer segments from each rate treatment and in response to the various technology and information treatments summarized above;
- Estimating the distribution of bill impacts associated with each rate option both before and after enrolling on the TOU rates;
- Assessing the extent to which the TOU rates cause unreasonable hardship among selected customer segments such as seniors and economically vulnerable customers in hot climate areas;
- Determining satisfaction with and perceptions about, understanding of and reported changes in behavior associated with different treatment options.

Load impacts for each rate and technology treatment were estimated by comparing loads for customers randomly assigned to each TOU tariff (e.g., treatment customers) with loads for customers randomly assigned to the OAT (e.g., control customers). The difference in loads between treatment and control customers in each rate period before customers are placed on the TOU rate (e.g., the pretreatment period) is subtracted from the difference after customers are placed on the rate (e.g., the treatment period) to ensure that there is no bias in the estimated impact due to random chance. This is referred to as a "difference-in-differences" (DiD) analysis. When applied to data collected through an RCT design, DiD analysis produces the most accurate load impact estimates possible through experimental research.

Bill impacts were estimated in a similar manner to load impacts in that a DiD analysis was conducted in order to control for exogenous factors that might impact bills between the pre- and post-treatment periods.

Assessing the extent to which TOU rates cause unreasonable hardship among selected customer segments such as seniors and economically vulnerable customers in hot climate regions is done primarily through survey questions designed to measure hardship. Responses between treatment and control customers are compared to determine if TOU rates significantly increase the percent of customers that report hardship conditions. Satisfaction with, perceptions about, understanding of and reported changes in behavior associated with different rate and other treatment options are also determined through surveys. The entire treatment and control group population was surveyed using an email, mail, and phone (EMP) mixed-mode survey approach. Response rates varied across customer segments and treatment cells but were excellent in all cases. The lowest response rate was around 65% and the highest exceeded 90%. The survey was designed, managed, and analyzed by Research Into Action (RIA).

1.3 Overall Findings

This evaluation covers only a few summer months following shortly after customers were enrolled onto the new rates in June and July of 2016. As such, while this evaluation has produced a large volume of preliminary information that will be useful in guiding California's pricing strategy, it must be kept in mind that the findings are preliminary and both load and bill impacts are going to differ significantly during winter months. The actions and perceptions of TOU pilot participants may be quite different over the course of a full year and even over the course of summer 2017 when customers will have had the experience of summer 2016 to rely on for input to their behavioral decisions.

It is also important to note that when interpreting results, policymakers must keep in mind that statistically significant differences do not necessarily translate into material differences. This is especially true for survey findings since the large sample sizes for program participants, combined with the decision to survey all participants, means that even very small differences in survey metrics can be found to be statistically significant. For example, a difference in an average survey rating of 6.0 and 6.5 on an 11 point scale might prove to be statistically significant but have little practical significance.

With these cautions in mind, the remainder of this section provides a high level summary of key findings.

1.3.1 Load Impacts

Key findings for load impacts include the following:

- As previously mentioned, all eight tariffs tested in these pilots had a substantial portion of the peak period covering key evening hours. Indeed, the common hours across all eight tariffs are from 6 to 8 PM. Some tariffs had peak periods extending until 9 PM and some had shoulder periods extending until midnight. **A key finding from the pilots is that customers can and will respond to TOU price signals during evening hours.** Statistically significant load reductions were found for all rates tested for each IOU service territory as a whole and for all climate regions. Table 1.1-1 summarizes the percentage and absolute peak period load reductions for each rate and service territory.[4] As seen, the lowest load impact occurred for SCE's Rate 3, showing an average reduction of 2.7% and 0.03 kW, and the highest occurred for PG&E's Rate 2, which had an average percentage reduction of 6.1% and 0.06 kW.

Table 1.1-1: Peak Period Load Reductions

Utility	Metric	Rate 1	Rate 2	Rate 3
PG&E	Peak Period Hours	4-9 PM	6-9 PM	4-9 PM
	% Impact	5.8%	6.1%	5.5%
	Absolute Impact (kW)	0.06 kW	0.06 kW	0.06 kW
SCE	Peak Period Hours	2-8 PM	5-8 PM	4-9 PM
	% Impact	4.4%	4.2%	2.7%
	Absolute Impact (kW)	0.06 kW	0.06 kW	0.03 kW
SDG&E	Peak Period Hours	4-9 PM	4-9 PM	N/A
	% Impact	5.4%	4.6%	N/A
	Absolute Impact (kW)	0.04 kW	0.04 kW	N/A

[4] The values in the table represent the average reduction for each peak period for each rate. They do not represent average reductions for a common set of hours. As such, variation in average load reductions across rates may be due to a differences in the peak-to-off-peak price ratios as well as differences in the length and timing of the peak period.

- Another important policy question given shifting load patterns at some utilities is the magnitude of peak period load reductions on weekends. Peak period load reductions on weekends and the pattern of load reductions across rate periods on weekends were generally similar to weekday impacts. **That is, customers can and will respond to TOU price signals on weekends.**
- Also often of interest when examining TOU rates is whether peak period reductions consist primarily of load shifting or load reductions without significant shifting. TOU rates may even increase usage during the low cost off-peak hours more than the reduction during peak hours, thus leading to an overall increase in usage. The preliminary findings covering the initial summer period found that **changes in daily usage ranged from very small negative values (e.g., an increase) to reductions as high as 4%.**
- **For PG&E, absolute reductions in peak period energy use were largest in the hot climate region, second largest in the moderate region and smallest in the cool region and differences across regions were statistically significant for all three PG&E rates.** Percentage reductions also followed this pattern at PG&E but the differences were not always statistically significant. This pattern was also found at SDG&E. **However, at SCE, the pattern of load reductions was not the same.** In general, the differences across regions were smaller than at PG&E or SDG&E and in some cases, the largest load reductions were found in the cool climate region and the smallest in the hot region. It is noteworthy that SCE's hot region has many more hot days than PG&E's hot region and SCE's moderate region is much hotter than PG&E or SDG&E's moderate region. This, combined with the fact that some of SCE's rates had long shoulder periods during which prices were higher than during the off-peak period may have made it difficult for customers in hot regions to reduce energy use and still stay reasonably comfortable.
- **For the service territory as a whole for all three utilities, CARE/FERA customers had lower average percent and absolute peak period load reductions than non-CARE/FERA customers for all rates.** This pattern was typically (although not universally) true at PG&E and SDG&E for all rates and climate regions. Once again, SCE had a different result for some rates and climate regions. In selected cases, CARE/FERA customers even had larger load reductions than non-CARE/FERA customers in SCE's service territory.
- **Senior households in both PG&E's and SCE's hot climate region had load reductions very similar to those for the general population in the hot climate region.** This was true for senior households overall as well as for senior households that were and were not on CARE/FERA rates.
- **Households with incomes below 100% of the Federal Poverty Guidelines (FPG) in hot climate regions did not reduce peak period loads in PG&E's service territory but had load reductions similar to those of the general population in SCE's hot climate region.**
- SCE recruited customers who already owned smart thermostats into the study and randomly assigned these customers to rate and treatment groups to estimate the magnitude of load impacts for customers with smart thermostats. **Absolute load impacts for smart thermostat owners were similar to those for the general population even though they had larger usage overall and, therefore, might be expected to have larger load reductions.** SCE plans to work with the smart thermostat provider in the lead-up to summer 2017 to see if an offer to optimize usage in light of being on TOU rates might produce larger load reductions.
- SDG&E tested whether delivery of weekly summaries of usage and bills to TOU customers would produce greater load reductions compared with households on TOU rates that did not receive this information. **Differences in load impacts between customers who did and did not receive Weekly Alert Emails in SDG&E's service territory were not statistically significant.**

- PG&E offered a smart phone app that would provide a variety of information to those who downloaded it that might help them to manage their energy use. **The number of customers who successfully downloaded the app was quite low and there were not enough users to determine whether the app had an impact.**

1.3.2 Bill Impacts

Key findings concerning bill impacts include the following:

- **At both PG&E and SCE, average monthly bills during this summer period were higher for all TOU rates than they would have been on the OAT for all customer segments and all climate regions.** Average monthly bill increases over three summer months ranged from a low of roughly $5 to as much as $40**. Most segments on average were only able to offset a small proportion of the structural bill increase by reducing or shifting usage.** It is important to keep in mind that these bill increasers are likely to be the worst that will occur over any time period during the pilots. It should also be noted that some of the increases would be largely or completely offset by enrollment bill credits that were distributed during the summer as part of the pay-to-play recruitment package.
- **Absolute bill impacts were typically largest in the hot climate region, second largest in the moderate region and smallest in the cool region.**
- **Bill impacts at SDG&E were quite different from those at PG&E and SCE**, with very small structural impacts and with some customer segments being able to more than offset small structural bill increases with load shifting or conservation behavior and, thus, had slightly lower bills even during the summer period than they would have had on the OAT.

The stark contrast between the relatively large bill increases for TOU customers during the summer months at PG&E and SCE relative to SDG&E is noteworthy and should be examined carefully as the IOUs develop pricing strategies for default enrollment starting in 2019. This significant difference did not stem from SDG&E having significantly more modest peak-to-off-peak price differentials or smaller differentials between peak prices and the OAT price relative to the other two utilities. Indeed, SDG&E's price differentials were larger than for several of the pilot rates at PG&E and SCE. Rather, the much more modest bill impacts at SDG&E had to do with the fact that both SDG&E's OAT and TOU rates are seasonally price differentiated, with higher prices in the summer than in the winter. SCE and PG&E's OATs are not seasonally differentiated, but their TOU rates are. As a result, the summer bill differentials between their TOU and OAT rates were much greater than SDG&E's.

Another point to keep in mind is that bill volatility across seasons can be managed through tools designed specifically to address bill volatility, such as balanced payment plans, which allow customers to pay the same bill each month based on historical usage and current rates (with periodic true-ups). The extent to which this option might mute TOU price signals is subject to debate but will be examined in the default pilots that the IOUs will implement in 2018.

A final point to keep in mind as default tariff options are designed is that all customers who will be defaulted onto TOU rates in 2019 will receive bill protection for the first full year on the new tariff. As such, while summer bills may be higher than under the OAT, customers who stay for a full year will not pay a higher bill than they would under the OAT.

In summary, while bill volatility is a legitimate concern in light of the relatively large bill increases experienced by many pilot participants over the few summer months covered by this initial evaluation period, it is not at all clear that a good solution to this problem is to mute the TOU price signal. Seasonal bill volatility exists even under the OAT in California due to tiered pricing and variation in usage over seasons. Importantly, SDG&E's pilot tariffs had TOU price signals higher than some of the PG&E and SCE pilot rates that were associated with much higher bill volatility. Designing TOU tariffs that account for the seasonal differentiation in the OAT (or lack thereof), and offering balanced payment programs, combined with first year bill protection, may be better solutions that will protect customers while improving economic efficiency through TOU prices that more accurately reflect cost causation.

1.3.3 Customer Attrition

Customer attrition is driven by three very different factors. One is customers who move, referred to as customer churn. Another is customers who become ineligible as a result of factors such as installing solar, going onto medical baseline, or switching to service from a Community Choice Aggregator (CCA). The final factor is customers who consciously opt out of the rate because they are unhappy being on a TOU rate. Key findings concerning customer attrition include the following:

- Cumulative opt-out rates between the enrollment date and the end of December have been quite low for nearly all rates and customer segments. For PG&E, the cumulative percent of treatment customers who dropped off the rate was between 1% and 2% and at SCE it was between 1.5% and 3%.
- There is no material difference in the cumulative percent of opt outs across tariffs at PG&E or SDG&E. At SCE, the cumulative percent of opt outs for Rate 3 was 3% for the service territory as a whole but was much higher, roughly 10%, for CARE/FERA customers in the hot climate region.
- The number of customers dropping off the TOU rates was highest in the hot region, second highest in the moderate region and lowest in the cool climate region for all tariffs (but still very low in all cases except for SCE's Rate 3 in the hot climate region).
- Opt out rates were slightly lower for CARE/FERA customers in PG&E's service territory compared with non-CARE/FERA customers and the opposite was true in SCE's service territory but the differences were small in all cases except for Rate 3 at SCE.
- Overall attrition ranged from as low as 4% to as high as 18% with the highest being for CARE/FERA customers in SCE's hot climate region on Rate 3. Given that the pilot planning assumption was that total attrition would be roughly 25% over the course of the two summer periods, this segment may be at risk of having sample sizes that are lower than ideal by summer 2017.
- Attrition has also been high in PG&E's moderate and cool climate regions for some segments due primarily to customers switching to CCAs, which are quite active in PG&E's service territory. With CCA growth expected to continue, some sample sizes at PG&E may also be at risk of being smaller than required to meet target levels of statistical precision by summer 2017. However, there is some cushion in these sample size estimates and unless the pace of CCA recruitment increases dramatically over current projections, this problem should be manageable.

1.3.4 Survey Findings

Key findings from the surveys that were administered include the following:

- An important policy question is whether TOU rates might increase economic hardship for selected customer segments in the hot climate region for PG&E and SCE and the moderate climate region for SDG&E. The surveys included questions pertaining to economic hardship and responses to several questions were combined to produce an economic index. The value of this index was compared between treatment and control customers to determine whether the TOU rates increase the value of the index. **There were no statistically significant differences in the economic index values between treatment and control customers for segments of interest at PG&E or SDG&E. At SCE, Rate 3 CARE/FERA customers and Rate 2 customers with incomes between 100% and 200% of FPG had higher economic index scores when compared with control group customers.** For context, the size of the difference in the economic index score is equivalent to the difference in value of the index from using one additional non-income based method to pay bills or from having difficulty paying one additional bill over the summer.
- The surveys also asked customers whether they had sought medical attention due to excessive heat and these responses were compared between treatment and control customers. These comparisons were made only for customers who reported requiring air conditioning due to a medical condition. **No difference in the health index between treatment and control customers was found at PG&E or SDG&E. At SCE, about 10% more Rate 1 and Rate 3 CARE/FERA customers reported seeking medical attention due to excessive heat when compared with control customers.**
- **At PG&E and SCE, satisfaction ratings with the TOU rate and with the utility were typically slightly lower for TOU rate customers than for control customers and these differences were sometimes statistically significant but they were always less than 1 point on an 11 point scale.** Put another way, none of these differences are likely to be judged as material. At SDG&E, customers on the TOU rates sometimes had higher satisfaction ratings than control customers.
- The surveys revealed that **a very large percent of customers on TOU rates received summer bills that were higher than expected.** This is also true of control customers since summer bills are typically higher for many customers in California. However, **the percentage difference on this metric between treatment and control customers was statistically significant for the majority of rates, customer segments, and climate regions at PG&E and SCE.** For some segments, rates and climate regions, more than 50% of customers said their bills were higher than expected. This is an important finding that should influence not only the timing of enrollment for customers on TOU rates (e.g., enrolling customers during fall or winter, not in late spring or early summer) but also the content of ME&O materials, which could do a better job of preparing customers for higher than expected bills in the summer period (while reminding them about lower bills at other times of the year).
- **The surveys also showed a significant disparity in understanding of the timing of the peak period between CARE/FERA and non-CARE/FERA customers.** For some rates and climate regions, between 30% and 40% of CARE/FERA customers could not identify a single hour that fell in the peak period rate window, while the percent of non-CARE/FERA customers that had the same level of misunderstanding was often significantly lower or even in the single digits. This disparity could partly be due to the fact that more CARE/FERA customers have English as a second language, but there may be other explanations. Nexant recommends that this issue be carefully addressed and studied further in the upcoming default pilots where there is a much

greater emphasis on and opportunity to develop and test ME&O options and content for all segments.

- **For all three utilities, customers on TOU rates were more likely to take time-specific actions than customers on the OAT.** For example, while a similar proportion of customers from control and treatment groups indicated they turned off their lights to conserve energy, a larger proportion of treatment customers indicated they shifted doing laundry and running the dishwasher during peak hours. This trend suggests that while fewer treatment customers understood the nuances of their rates, they did know and act on actions that helped them shift use.

2 Introduction

In Decision 15-07-001, the California Public Utilities Commission (CPUC or the Commission) ordered California's three investor owned utilities (IOUs) to conduct certain "pilot" programs and studies of residential Time-of-Use (TOU) electric rate designs (TOU Pilots and Studies) beginning the summer of 2016, and to file applications no later than January 1, 2018 proposing default TOU rates for residential electric customers. The IOUs were also directed to form a working group (TOU Working Group) to address issues regarding the TOU pilots and to hire one or more qualified independent consultants to assist with the design and implementation of the TOU Pilots and Studies. The TOU Working Group (WG) was comprised of 37 entities and included almost 100 people. Nexant, Inc. was engaged as the independent consultant.

On December 17, 2015, Nexant delivered a detailed report summarizing the design of the proposed opt-in pilots.[5] This report was relied upon by and incorporated into the Advice Letters filed by each IOU requesting approval of and funding for the pilots that each IOU would implement.[6] In February and March, 2016, the Commission issued resolutions approving the pilot designs and funding, with modifications from the original plan.[7]

At the outset of the WG process, the WG developed the following objectives to help guide pilot design:

- Consider treatment options and pilot designs for 2016/2017 that will provide useful insights for development of the IOU's January 1, 2018 application for default pricing that may begin as early as 2019;
- Estimate load impacts by rate period for different tariff structures that vary in terms of
  - the timing and length of rate periods
  - the number of rate periods
  - changes in rate periods and price ratios across seasons
  - possible other features such as low or negative prices during excess supply conditions;
- Assess customer understanding/acceptance/engagement/satisfaction with various TOU rate options;
- Calculate bill impacts for customers on each pilot TOU rate relative to the otherwise applicable tariff (OAT);
- Assess the degree of hardship that might result from default TOU rates on senior citizen households and economically vulnerable customers (and perhaps others) in hot areas as directed by Public Utilities Code Section 745;
- Assess the incremental effect of enabling technology on load impacts, bill impacts, and customer satisfaction;
- Assess adoption rates for enabling technology for customers on TOU rates; and
- Assess the effectiveness of alternative information, education, and outreach options.

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[5] George, S., Sullivan, M., Potter, J., & Savage, A. (2015). Time-of-Use Pricing Opt-in Pilot Plan. *Nexant, Inc.* (hereafter referred to as the TOU Pilot Design Report).

[6] SCE: Advice Letter 3335-E; PG&E: Advice Letter 4764-E; and SDG&E: Advice Letter 2835-E.

[7] SCE: Resolution E-4761; PG&E: Resolution E-4762; and SDG&E: Resolution E-4769.

Collectively, the pilots implemented across the three IOUs are testing nine different TOU rate options. For eight of the nine options, more than 50,000 households were enrolled and assigned to one of the TOU rates or retained in the study on the standard tiered rate to act as a control group for those who were placed on the new tariffs. The ninth rate option is a complex, dynamic rate that SDG&E is testing on a very small group of customers. Recruitment for this rate began in late August and led to enrollment of roughly 65 customers.

All eight TOU pilot tariffs have peak periods that primarily cover late afternoon and evening hours year round. This later peak period is driven by the increasing penetration of solar in California and is a significant departure from the vast majority of pilots and tariffs that have been implemented previously in California and elsewhere. With most of the rates having peak periods ending at 9 PM and some with peak periods that don't start until 6 PM, these pilots will be among the first in the industry to study the magnitude of load reductions during evening hours.

Focus on Evening Peak Periods

While numerous TOU tariffs have been examined in pilot settings and through evaluation of full scale programs, few historical studies have included tariffs with peak periods that extend well into the evening period when most household members are home and when cooling loads diminish in many of the populous climate zones in California. Most of the tariffs included in the pilots evaluated in this report have peak periods that primarily cover the evening hours. Determining the magnitude of demand reductions during evening hours will provide useful insights for setting pricing policies that help manage load increases in evening hours when output from solar resources drops.

Another key focus of the pilot tariffs is the willingness and ability of consumers to respond to time-varying price signals that vary across more than two daily rate periods and across more than two seasons. Low prices in midday in the spring—when excess supply conditions sometimes exist—is also something that has not been previously tested. Some of the tariffs have the same pricing structure on weekends as on weekdays, which is yet another atypical tariff feature. For most other existing TOU tariffs, off-peak prices apply on the weekend. In short, these pilots will break new ground both in California and in the industry with regard to the timing of peak periods, the use of TOU pricing on weekends in addition to weekdays, the frequency of price changes, and the response of customers to low daytime prices during excess supply conditions.

In addition to assessing the impacts of each tariff, these pilots are also studying the impact of various technologies and information services. These include estimating TOU load impacts for households with smart thermostats in SCE's service territory and households that receive usage alerts via email in SDG&E's service territory. In PG&E's service territory, TOU customers were offered the option of downloading a smart phone app that conveys a variety of useful information to TOU participants, including: pricing information; TOU-specific performance feedback; bill projections, and energy saving tips informed by user specific end use load disaggregation, in order to encourage energy savings. SCE is also testing whether "enhanced" education and outreach to customers on TOU rates influences demand response and customer satisfaction.

2.1 Experimental Design[8]

A key objective of any pilot or experiment is to establish a causal link between the experimental treatments (e.g., TOU rates, enabling technology, etc.) and the outcomes of interest (e.g., load impacts, changes in bills, customer satisfaction, etc.). The best way to do this is through what is referred to as a randomized control trial (RCT) research design. With this approach, participants are offered a treatment and, after they agree to accept it, are randomly assigned to either the treatment or control condition. This ensures that the treatment and control customers are identical in every way except for exposure to the treatment and any difference that might occur due to random sampling error. As such, any observed difference in load during the peak period between treatment and control customers, for example, is due either to the treatment of interest (e.g., TOU pricing) or random chance.

A Unique, Internally Valid Experimental Design

The opt-in pilots are randomized control trials (RCTs), which ensures that the estimated load impacts are internally valid. A unique aspect of the pilot design is that customers were asked to enroll into the pilot with the knowledge that they would be randomly assigned to one of several rate options. They were given limited information about the specific structure of the rate options. Enrollment was encouraged through payment of financial incentives. It is believed that this “pay-to-play” approach will induce a larger number of “complacent” customers who are prevalent when default enrollment is used.

A key challenge faced by the TOU Working Group was deciding how to gain insights from residential opt-in TOU pilots that might help inform policy decisions for residential default TOU pricing. An important difference between opt-in and default conditions is the mix of customers that are enrolled under each condition. With default enrollment, there are three types of customers who remain on the tariff: those who would enroll on the tariff if it was marketed on an opt-in basis (referred to as “always takers”); those who are unaware that their tariff changed; and those who are aware and would not have enrolled on an opt-in basis but, for a variety of reasons (e.g., inertia, transaction costs associated with switching out, etc.), do not opt out from default enrollment. This latter group—referred to as “complacents”—is likely to be less engaged than the always takers. Unaware customers are, by definition, unengaged. Because of the presence of complacent and unaware customers, average load reductions have been found to be lower under default enrollment compared with opt-in enrollment. However, aggregate load reductions could be much higher under default pricing if the lower average load reduction was offset by significantly higher enrollment.[9]

In order to better represent the mix of customers that are likely to be enrolled under default conditions, the TOU Working Group decided to implement what is being called a “pay-to-play” (PTP) recruitment strategy. Under this approach, rather than recruit customers onto a specific rate by educating them about the features and potential customer benefits associated with the rate, as would be done for a typical opt-in pilot or program, prospective participants were offered an economic incentive for

[8] More details on pilot design and the reasons underlying the design decisions can be found the TOU Pilot Design Report.

[9] SmartPricing Options Final Evaluation. September 5, 2014. https://www.smartgrid.gov/files/SMUD-CBS_Final_Evaluation_Submitted_DOE_9_9_2014.pdf

agreeing to be in the pilot and were then randomly assigned to one of three[10] rate options or to the control condition after agreeing to participate. Since a key motivation for enrolling on the study is likely to be the PTP incentive rather than the attractiveness of any particular rate feature, this approach may enroll a reasonable number of participants who would likely be complacents, and even some who might be unaware, under a default enrollment strategy.

Another important aspect of the pilot design concerns assessment of whether TOU rates may cause unreasonable hardship for selected customer segments. Public Utility Code Section 745 requires that the CPUC ensure that any default TOU rate schedule does not cause unreasonable hardship for senior citizens or economically vulnerable customers in hot climate regions. In order to provide insights on this important issue, a stratified sampling and recruitment plan was developed. Each IOU service territory was divided into three climate regions designated as hot, moderate, and cool.[11] Within the hot regions for PG&E and SCE, senior households[12] and CARE/FERA[13] customers with incomes greater and less than 100% of Federal Poverty Guidelines (FPG) were oversampled for one rate in each service territory. Oversampling was not possible in SDG&E's hot climate region because the region only contains about 16,000 customers. For the remaining rates in PG&E and SCE's hot climate regions and for all rates in the mild and cool climate regions for all three utilities, an equal number of CARE/FERA and non-CARE/FERA customers were recruited, which means that CARE/FERA customers were oversampled in those zones as well since they make up less than half of the regional population.

2.2 Pilot Evaluation

Evaluation of the opt-in pilots focused on a number of important research objectives, including:

- Determining the change in electricity use in different time periods for different customer segments from each rate treatment and in response to the various technology and information treatments summarized above;
- Estimating the distribution of bill impacts associated with each rate option both before and after enrolling on the TOU rates;
- Assessing the extent to which the TOU rates cause unreasonable hardship among selected customer segments such as seniors and economically vulnerable customers in hot climate areas;
- Determining satisfaction with and perceptions about, understanding of and reported changes in behavior associated with different treatment options.

Load impacts for each rate and technology treatment were estimated by comparing loads for customers randomly assigned to each TOU tariff (e.g., treatment customers) with loads for customers randomly assigned to the OAT (e.g., control customers). The difference in loads between treatment and control customers in each rate period before customers are placed on the TOU rate (e.g., the pretreatment period) is subtracted from the difference after customers are placed on the rate (e.g., the treatment

[10] For SDG&E, participants were assigned to one of two rate options or the control group.

[11] See Appendix Volume I for a summary of the geographic regions included in the hot, moderate, and cool climate regions for each IOU.

[12] Senior households are defined as households with one or more members aged 65 or older.

[13] California Alternate Rates for Energy (CARE) and Family Electric Rate Assistance (FERA).

period) to ensure that there is no bias in the estimated impact due to random chance. This is referred to as a "difference-in-differences" (DiD) analysis. When applied to data collected through an RCT design, DiD analysis produces the most accurate load impact estimates possible through experimental research.

> **This Is An Interim Evaluation**
>
> When considering the key findings summarized in this report, it is important to keep in mind that the results represent impacts during the initial few summer months of a longer term pilot. Estimates of load, bill, economic and health impacts will almost certainly differ during non-summer months or over the course of a full year.

Bill impacts were estimated in a similar manner to load impacts in that a DiD analysis was conducted in order to control for exogenous factors that might impact bills between the pre- and post-treatment periods. Bill impacts were estimated as the difference between bills using pre- or post-treatment loads based on the TOU tariff compared with the OAT. Average bill impacts are reported as well as changes in the percent of customers who experience bill impacts above a certain threshold. It is important to note that bill impacts for this interim evaluation are being reported for the summer rate period when the majority of customer's bills will be higher under TOU rates compared with the OAT. Average bill impacts over the course of a year will be significantly lower than those reported here.

Assessing the extent to which TOU rates cause unreasonable hardship among selected customer segments such as seniors and economically vulnerable customers in hot climate areas is done primarily through survey questions designed to measure hardship. Responses between treatment and control customers are compared to determine if TOU rates significantly increase the percent of customers that report hardship conditions. Satisfaction with, perceptions about, understanding of, and reported changes in behavior associated with different rate and other treatment options are also determined through surveys. The entire treatment and control group population was surveyed using an email, mail, and phone (EMP) mixed-mode survey approach. Response rates varied across customer segments and treatment cells but were excellent in all cases. The lowest response rate was around 65% and the highest exceeded 90%. The survey was designed, managed, and analyzed by Research Into Action (RIA).

2.3 Report Organization

The remainder of this report is organized as follows. Section 3 contains a summary of the evaluation methodologies that were used to produce the results reported in subsequent sections. A more detailed methodological discussion for the load and bill impacts is contained in Appendix Volume I, which is comprised of the detailed Load Impact Evaluation Plan that was produced by Nexant in October 2016. Appendix Volume II contains a detailed discussion of the survey approach and implementation process written by RIA.

Sections 4, 5 and 6 summarize the load impact, bill impact and survey results for PG&E, SCE, and SDG&E, respectively. Each section starts with a brief summary of the treatments included in each utility's pilots, the sampling plan, the recruitment process, and other elements of pilot implementation. More detailed discussion of these implementation efforts is contained in Appendix Volume I. Following this summary, load impacts by rate period are presented for each rate option and relevant customer segment. The next subsection discusses bill impacts and this is followed by a summary of key survey findings. The survey discussion focuses on key research issues such as hardship and does not contain a full accounting of all survey research findings. A detailed summary of the responses to each survey question is contained in Appendix Volume II. The final subsections of Sections 4 through 6 provide a high level summary and synthesis of the impact and survey results for each IOU.

Section 7 provides a comparison of results across the utilities as well as overall conclusions that can (or cannot) be drawn from the entire body of research. While the pilots were designed jointly and are meant to be complementary, they were not designed specifically to allow cross-utility comparisons in most instances. For example, it is not appropriate to compare Rate 1 from SCE's pilot to Rate 2 from PG&E's pilot and conclude that one rate produced greater load impacts than the other due to differences in rate structure because differences in other factors, such as climate, customer demographics, customer satisfaction, perceptions about the utility, economic conditions and perhaps others may partially or fully explain any observed differences in the load impacts between the two rate options. Nevertheless, cross-utility comparisons are likely to be made by reviewers and some comparisons are more valid than others. As such, we provide a brief comparison of some key findings across utilities in this final section.

Appendix A to this report contains a list of Microsoft Excel files that have been filed as electronic tables in conjunction with the primary report. These electronic tables allow the reader to access the underlying data that created the figures and tables in the report, and to determine actual values for data points within the figures.

A large volume of supplemental and useful information is contained in two appendix volumes. As mentioned above, Appendix Volume I contains the load and bill impact evaluation plan report that was produced in October 2016. This 200 page report contains more detailed descriptions of the implementation process for each pilot, including copies of most of the marketing, education and outreach materials used by each utility. This appendix also contains a detailed validation analysis that was conducted by Nexant to determine if the internal validity of the experimental design was retained through implementation (it was for nearly all treatments). Finally, this volume assesses the extent to which each utility met the very specific requirements of the resolutions issued by the CPUC approving the pilot designs and budgets.

Appendix Volume II, written by RIA, provides a detailed discussion of the design and implementation of the surveys that were conducted. It also contains summaries of responses to each survey question.

Interested readers may also wish to review the TOU Pilot Design Report,[14] which contains a detailed discussion of research issues and explanations for the design decisions that were made by the TOU Working Group. The IOU advice letters[15] and the CPUC resolutions may also contain information of interest.[16]

[14] George, S., Sullivan, M., Potter, J., & Savage, A. (2015). Time-of-Use Pricing Opt-in Pilot Plan. *Nexant, Inc.*

[15] SCE: Advice Letter 3335-E; PG&E: Advice Letter 4764-E; and SDG&E: Advice Letter 2835-E.

[16] SCE: Resolution E-4761; PG&E: Resolution E-4762; and SDG&E: Resolution E-4769.

3 Methodology

As discussed in Section 2, this interim report provides load impacts and bill impacts for each of eight rate treatments tested across the three IOUs for various customer segments and climate regions. The incremental load impacts for SDG&E's Weekly Alert Emails and for SCE's enhanced education treatment are also estimated. Analysis of survey data assessing hardship, customer satisfaction and other variables of interest is also provided. This section summarizes the methodological approaches used to estimate the metrics of interest for each pilot treatment. The discussion is organized into three broad sections summarizing the approach for estimating load impacts, bill impacts, and survey analysis.

3.1 Load Impact Analysis

The estimation of load impacts by rate period and changes in annual and seasonal energy use for each pilot rate are key pilot objectives. Estimating load impacts for other pilot treatments, such as smart thermostats and usage alerts, is also important. Also of interest is how load impacts vary across customer segments, both those that were incorporated into the pilot design and sampling plan (e.g., impacts for CARE/FERA and non-CARE/FERA customers and for seniors and others in the hot climate zone) as well as segments that weren't built into the pilot plan but that can be identified through surveys or from IOU databases.

The approach used to estimate load impacts for the eight rate treatments spread across the three IOUs and for each customer segment that was oversampled rigorously adheres to the RCT design, which ensures that the impacts are internally valid. Internal validity means that the treatments being studied (e.g., TOU rates) are the cause of any observed difference in loads by rate period between the treatment and control conditions.

The analysis method used is referred to as difference-in-differences (DiD) analysis. This method estimates impacts by subtracting treatment customers' loads from control customers' loads in each hour or rate period after the treatments are in place and subtracts from this value the difference in loads between treatment and control customers for the same rate period in the pretreatment period. With random assignment to treatment and control conditions, this straightforward analysis ensures that any estimated impacts are internally valid. Subtracting any difference between treatment and control customers prior to the treatment going into effect adjusts for any difference between the two groups that might occur due to random chance.

The DiD analysis can be done by hand using simple averages or by using regression analysis. Customer fixed effects regression analysis allows each customer's mean usage to be modeled separately, which reduces the standard error of the impact estimates without changing their magnitude. Additionally, standard regression software allows for the calculation of standard errors, confidence intervals, and significance tests for load impact estimates that correctly account for the correlation in customer loads over time.[17] Implementing a DiD through simple arithmetic would yield the same point estimate but it would not generate confidence intervals. A typical regression specification for estimating impacts using an RCT design is shown in equation 3.1-1:

[17] More accurately, they account for the correlation in regression errors within customers over time.

$$kW_{i,t} = \alpha_i + \gamma\text{post}_t + \beta(\text{treatpost})_{i,t} + \ v_i + \ \varepsilon_{i,t} \qquad \text{Equation 3.1-1}$$

In Equation 3-1, the variable $kW_{i,t}$ equals electricity usage during the time period of interest, which might be each hour of the day, peak or off-peak rate periods, daily usage or some other period. The index i refers to customers and the index t refers to the time period of interest. The estimating database would contain electricity usage data during both the pretreatment and post-treatment periods for both treatment and control group customers. The variable post is equal to 1 for days after the TOU rate has been implemented and a value of 0 for days during the pretreatment period. The treatpost term is the interaction of treat and post and its coefficient β is a differences-in-differences estimator of the treatment effect that makes use of the "pretreatment" data. The primary parameter of interest is β, which provides the estimated demand impact of TOU during the relevant period. The parameter a_i is equal to mean usage for each customer for the relevant time period (e.g., hourly, peak period, etc.). The v_i term is the customer fixed effects variable that controls for unobserved factors that are time-invariant and unique to each customer. In the evaluation, Equation 1 was estimated using ordinary least squares regression (or weighted least squares in situations where oversampled cells are combined with random samples so that the estimated impacts represent the relevant populations) with clustered robust standard errors to account for serial correlation that is likely to be present in the data.18

Customer attrition is an important factor to address in the load impact analysis. Customer attrition stems from three factors; customers who move (referred to as churn); customers who become ineligible after enrolling in the pilot; and customers who drop off the pilot because they are unhappy being on the TOU rate. Customer churn and changes in eligibility should stay the same for both treatment and control customers. As such, dropping customers from both treatment and control groups due to churn and changes in eligibility do not introduce selection effects. That is, dropping these customers maintains the integrity of the RCT design. On the other hand, dropout rates will differ between treatment and control customers since, aside from completing a few surveys, there is no real reason for a control customer to drop off the pilot. As such, dropping these customers from the estimating sample will introduce a selection bias into the estimated impacts if they are analyzed as an RCT.

In order to address the differential opt-out rates between the treatment and control group, the load impact analysis was conducted as if the experiment was based on a Randomized Encouragement Design (RED). With a RED design, the behavior of two randomly-chosen groups of customers who were subjected to different levels of encouragement to take up a treatment is observed. In a typical RED design, the treatment customers are encouraged to enroll in a pilot, and only a certain percentage of customers actually sign up. In this case, all of the treatment group customers were enrolled on a TOU rate, but some chose to drop out after some period of time. In both cases, the end result is that a portion of customers originally assigned to the treatment group do not actually receive the treatment in some periods. However, in order to maintain the initial randomization and internal validity of the experimental design, all customers assigned to the treatment group must be retained as treatment

[18] Serial correlation certainly exists in the variable of interest (*treatpost*) and is very likely to be present in the dependent variable (period average load). If unaddressed, serial correlation will lead to standard errors that are systematically too small. This results in overstating the precision of the impact estimate and misleading inference. To adjust for serial correlation, we follow the best practices described by Bertrand, et al. (2002), Wooldridge (2003), and Cameron (2010).

customers for purposes of the analysis. This ensures that the treatment and control groups still have the same expected characteristics prior to the experiment and allows for estimation of the effect of the treatment on customers who were affected by the encouragement, as summarized below.

One fundamental difference between the analyses used for RCTs and for REDs is that with RCTs all customers in the treatment group are enrolled and therefore are assumed to be affected by the treatment, and none in the control group are affected. In contrast, for REDs, the treatment group consists of all customers who received some form of encouragement toward a treatment (in this case customers who were enrolled on a TOU rate) and the control group consists of customers who received less encouragement or no encouragement (in this case these are the control group customers who were not enrolled on a TOU rate). This means the RED treatment group will potentially contain some customers who are assumed to be unaffected by the treatment because they declined or in this case opted-out of the treatment. This introduces the potential for confusion in terminology when discussing REDs because it is often convenient to consider the treatment group of an experiment to be the group of all customers who are directly affected by the treatment of interest (e.g., all customers who actually enrolled in the TOU pilot).

For a RED there are two treatments of interest, each vital to producing the final treatment impact estimate. First, there is the encouragement treatment, which gives a RED its name. In this case, that treatment consists of a customer being enrolled on a TOU rate. Second, there is the impact of the treatment itself. That is, the impact for those who do not opt-out (i.e. accept the treatment).

The same regression specification shown in Equation 3.1-1 for an RCT design can be used to estimate the first stage impact, which estimates the impact of the encouragement.[19] The estimating database includes all customers who were offered the treatment, whether or not they accepted it—meaning it includes those who actually opt-out at some point.[20] It also includes the control group. The impact in this case represents the average for all customers that received an offer (were enrolled onto a TOU rate), not the average for customers who accepted the offer (customers who stayed on the TOU rate). This initial load impact estimate is often referred to as the intention-to-treat (ITT) effect. Under the reasonable assumption that those who opt-out revert to their pretreatment behavior once they return to the OAT, the intention-to-treat estimate can be transformed into the effect of the treatment on those who stay compliers by dividing the intention-to-treat estimate by the fraction of the population enrolled on the pricing plan in that period. This scaled up effect is often referred to as the local average treatment effect (LATE) or, alternatively, the treatment effect on the treated.

The model shown in Equation 3.1-1 is a simple and transparent specification that produces unbiased impact estimates with precise standard errors. It does not incorporate variables such as weather, time,

[19] Through the research plan review process Nexant received a suggestion that rather than using the RED analysis approach as described above, "opt-outs could be included in the analysis dataset if the variable *treatpost* was given a value of 0 once a customer had exited the pilot". It was suggested that this would "eliminate the issue of participants self-selecting out of the treatment group (they remain as part of the analysis), but allow the β from Equation 1 to model what we've intuitively come to expect in terms of the impact of the TOU rates". Nexant conducted some simulation analysis comparing the two approaches and found the differences in estimates to be small. This analysis as well as the reasons for staying with the approach outlined here are summarized in Appendix Volume 1 (Section 5.3)

[20] As indicated above, movers will be removed from the estimation database for both treatment and control customers.

day of week, customer segment, or other factors that can influence hourly loads. Adding additional variables like these can reduce variation in loads over time, thus increasing the precision of the estimated impacts. Doing so can also allow for determining whether impacts vary across customer characteristics by using interaction terms and observing whether the estimated coefficients are statistically significant. Finally, such models can be used to predict what impacts would be for other populations or other conditions than those experienced during the pilot. In spite of these potential advantages, this approach was not taken for the following reasons.

- **Lack of transparency:** The simple DiD model summarized in Equation 3.1-1 is very easy to understand and quite transparent compared with a model that incorporates multiple interaction terms. Given the keen interest of many stakeholders in the results from these pilots, we believe the transparency and simplicity of the proposed model is important.
- **Sample size determination was based on the same simple model:** As such, given that the target sample sizes were met, the target level of precision can be achieved without adding variables to the model to try and improve precision. While greater precision is always desirable, the potential errors that could be introduced by specification error (see next bullet) must be considered.
- **Potential specification error:** Introducing additional terms in the model in order to improve precision can lead to specification error and potential bias. For example, if the relationship between interaction terms and load is non-linear but a linear specification is used, the estimated coefficients would be biased and potentially misleading, especially across values at the extremes of the distribution.
- **The correlation between impacts and customer characteristics can be determined differently while maintaining transparency and avoiding specification error:** This can be done by partitioning the data for treatment and control customers into segments (e.g., a/c owners, usage stratum, pretreatment load shapes, etc.) and then using the simple DiD regression to the segmented data (assuming the segments of interest are large enough).

The load impact estimates reported here conform to the requirements for ex post evaluation of non-event based demand response resources as indicated in California's Demand Response Load Impact Protocols.[21] These protocols require that load impacts in each hour be developed for the average weekday and monthly system peak days for each month of the year. Although not explicitly required by the protocols, load impacts for the average weekend day are also developed for each month of the year given that the TOU rates are also effective on the weekends. As this is an ex post evaluation, average weekday impacts are based on the observed customer load pooled across the weekdays in each month, and similarly for weekend days. Monthly system peak day impacts are estimated based on loads that occur on the historical monthly system peak days. Weather normalized results, such as those conducted for demand response ex ante load impacts, are not currently in scope for this evaluation. Load impacts are presented in both nominal (kWh) and proportional (%) terms.

Figure 3.1-1 displays an image from an Excel spreadsheet containing the output that is produced for each IOU, rate treatment, customer segment, climate region, day type, and month covered by this interim analysis. These Excel spreadsheets are available upon request through the CPUC. Pull down

[21] http://www.calmac.org/events/FinalDecision_AttachementA.pdf

menus in the upper left hand corner of the spreadsheet allow users to select different customer segments, climate regions, day types (e.g., weekdays, weekends, monthly peak day) and time period (individual months or the average of July, August and September). In this written report, tables and graphs are presented that report estimated load impacts by treatment, rate period, customer segment, and day type for the summer period.

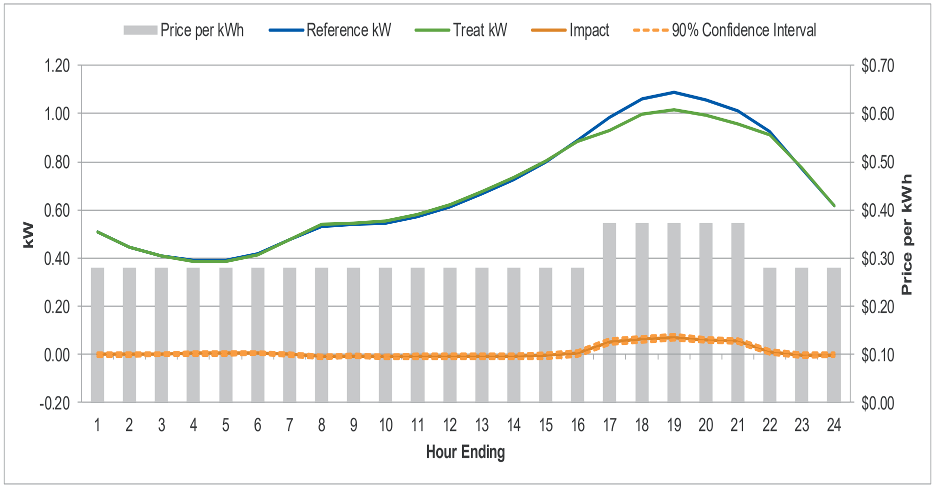
As discussed in Section 2.1, the experimental design and sampling were constructed so that load impacts and other metrics can be reported for selected customer segments and climate regions. For the segments around which the pilots were designed, load impacts are estimated using the model represented in Equation 3.1-1 for the data partitioned by segment (for both treatment and control customers). These estimates are internally valid by virtue of the RCT/RED design and DiD analysis.

There is also interest in knowing whether load impacts might vary across numerous other customer segments. Characteristics of potential interest might include psychological personas, load shape (e.g., peaky versus non-peaky loads), usage stratum (e.g., high and low usage customers), whether or not a customer was a structural benefiter or non-benefiter, whether or not a customer owns central air conditioning, senior households in cooler climate regions, customers who do and don’t experience economic index based on survey questions, highly satisfied or less satisfied customers and others. Whether or not a DiD RCT analysis can be used to produce unbiased, internally valid load impact estimates for these ex post customer segments depends on several factors. A discussion of the conditions under which such analysis is valid is contained in Appendix Volume 1, Section 5.3.3. Analysis for segments other than those for which the pilot was designed is not provided in this interim report.

Figure 3.1-1: Average Hourly Load Impact Estimates for PG&E's TOU Pilot Rate 1

Segment	All
Rate	Rate 1
Month	July, August, September 2016
Day Type	Average Weekday
Treated Customers	6,428

Period	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval	
Peak	1.04	0.98	0.06	5.8%	0.06	0.06
Partial Peak	N/A	N/A	N/A	N/A	N/A	N/A
Off Peak	0.59	0.59	0.00	-0.4%	0.00	0.00
Super Off Peak	N/A	N/A	N/A	N/A	N/A	N/A
Daily kWh	16.43	16.17	0.26	1.6%	0.22	0.30



Hour Ending	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval		Price	Period
1	0.51	0.51	0.00	-0.1%	-0.01	0.01	$0.28	Off Peak
2	0.45	0.45	0.00	-0.3%	-0.01	0.00	$0.28	Off Peak
3	0.41	0.41	0.00	0.0%	-0.01	0.01	$0.28	Off Peak
4	0.39	0.39	0.00	0.8%	0.00	0.01	$0.28	Off Peak
5	0.39	0.39	0.00	0.8%	0.00	0.01	$0.28	Off Peak
6	0.42	0.41	0.00	1.1%	0.00	0.01	$0.28	Off Peak
7	0.48	0.48	0.00	-0.2%	-0.01	0.01	$0.28	Off Peak
8	0.53	0.54	-0.01	-1.6%	-0.02	0.00	$0.28	Off Peak
9	0.54	0.54	-0.01	-1.2%	-0.01	0.00	$0.28	Off Peak
10	0.55	0.56	-0.01	-1.7%	-0.02	0.00	$0.28	Off Peak
11	0.57	0.58	-0.01	-1.5%	-0.02	0.00	$0.28	Off Peak
12	0.61	0.62	-0.01	-1.3%	-0.02	0.00	$0.28	Off Peak
13	0.67	0.67	-0.01	-1.0%	-0.02	0.00	$0.28	Off Peak
14	0.73	0.73	-0.01	-0.9%	-0.02	0.00	$0.28	Off Peak
15	0.80	0.80	-0.01	-0.7%	-0.02	0.00	$0.28	Off Peak
16	0.89	0.89	0.00	0.4%	-0.01	0.01	$0.28	Off Peak
17	0.98	0.93	0.05	5.2%	0.04	0.06	$0.37	Peak
18	1.06	1.00	0.06	6.0%	0.05	0.07	$0.37	Peak
19	1.09	1.02	0.07	6.4%	0.06	0.08	$0.37	Peak
20	1.05	0.99	0.06	5.7%	0.05	0.07	$0.37	Peak
21	1.01	0.96	0.06	5.5%	0.05	0.07	$0.37	Peak
22	0.92	0.91	0.01	1.3%	0.00	0.02	$0.28	Off Peak
23	0.77	0.77	0.00	-0.5%	-0.01	0.00	$0.28	Off Peak
24	0.62	0.62	0.00	-0.2%	-0.01	0.01	$0.28	Off Peak
Daily kWh	**16.43**	**16.17**	**0.26**	**1.6%**	**0.22**	**0.30**	**N/A**	**N/A**

3.2 Bill Impact Analysis

The impact of TOU rates on customers' bills is an important metric of interest to multiple stakeholders. A key design requirement for the TOU pilots and one of the primary objectives delineated in the Advice Letters and the Commission resolutions is to estimate bill impacts based on both pre- and post-treatment usage for a variety of customer segments. In hot climate regions, these segments include: seniors; CARE/FERA customers; households with incomes less than 100% of Federal Poverty Guidelines (FPG); and households with incomes between 100% and 200% of FPG. The bill impacts of TOU rates on CARE/FERA and non-CARE/FERA households in the moderate and cool climate regions is also of interest.

From a policy standpoint, what is of primary interest is how much individual customers' bills change as a result of being placed on a TOU rate after they adjust their behavior (or choose not to) in response to the time-varying price signals associated with the rate. However, it is not valid to compare an individual's bill before and after they are placed on a TOU rate because there are myriad reasons why such bills might change that have nothing to do with the new rate. A specific household might have gained or lost a household member, had a teenager go away to (or return from) college, made an addition to the house, purchased an electric vehicle, changed one or more appliances, or made any of a number of other changes that could cause very significant changes to usage and bills that have nothing to do with the rate change. As such, a key challenge is determining how best to answer the key policy questions associated with bill impacts without relying on "before-and-after" comparisons of bills for individual customers.

The basic approach used to examine the distribution of bill impacts for both treatment and control customers based on both pre- and post-treatment usage. By estimating bill impacts based on pretreatment usage, it is possible to identify the percent of customers in segments of interest that are structural benefiters and non-benefiters. It is also possible to determine, for example, the percent of customers in each segment that would see bill increases of, say, 10% or more or $20 dollars or more, if they didn't change their usage in response to the new rate. However, as indicated above, comparing this distribution based on pretreatment usage with a similar distribution or metric based on post-treatment usage for participants does not produce a valid estimate of the impact of a price-induced change in behavior on bill impacts because some or all of the observed change could result from some exogenous factors, such as differences in weather or a slowdown in the economy, or a change in the number of people in the household. Put another way, if we found that 25% of customers would see bill impacts greater than $20 based on pretreatment usage but only 20% would see a bill impact of $20 or more based on post-treatment usage, we wouldn't know if some of that observed reduction in the percent of customers experiencing high bill impacts resulted from a cooler than normal summer period with less load used during high priced periods.

To address this issue, we compare the change in the bill distribution and other metrics for treatment and control customers to determine how much of the observed change in the distribution is driven by price-induced behavior change and how much is driven by exogenous factors. Suppose, for example, we found that the percent of control group customers experiencing a bill impact greater than $20 was the same if calculated based on usage in both the pre- and post-treatment periods. Given this, we could say with confidence that the drop from 25% to 20% in the percent of customers in the treatment group experiencing bill impacts above $20 was due to a change in behavior for these customers in response to the TOU pricing and not due to some exogenous factor. Alternatively, if we found that the percent of control customers experiencing a bill increase based on post-treatment usage was down from 25% to 23%, then we could attribute 3 percentage points (60%) of the observed 5 percentage point change in the percent of treatment customers experiencing a $20 or more bill impact to a change in usage behavior and the remaining 2 percentage points (40%) to some exogenous factor such as weather. Conceptually, this approach is equivalent to a difference-in-differences calculation. Bill impacts based on the DiD approach as defined above were estimated for a set of metrics including an estimation of the average bill impact due to changes in usage, estimation of the total bill impact due to differences in the tariffs (holding usage constant) and behavior change, and the change in the distribution of bill impacts due to behavior change.

The calculation of bill impacts is quite straightforward. The primary challenge in this instance is to determine the best way to present the analysis so that it clearly answers the policy questions of interest. Based on iterative discussions with stakeholders, the following four analyses were conducted:

- **Structural benefiter/non-benefiter analysis based on pretreatment usage-** Displaying the proportions of structural benefiters and non-benefiters for each rate and relevant customer segment based on pretreatment data on an annual and summer season basis;
- **Estimation of the average bill impact due to changes in usage-** Displaying the average bill impact resulting from changes in behavior in response to the new price signals for each rate and relevant customer segment (after controlling for exogenous factors);
- **Estimation of the total bill impact due to differences in the tariffs (holding usage constant) and behavior change-** Displaying the bill impact for each rate and relevant customer segment due to structural differences in the rate mitigated by changes in behavior;
- **Change in the distribution of bill impacts due to behavior change-** Displaying the distribution curves of bill impacts (percentage of customers with bill impacts within $10 incremental bins) with and without behavior change in the same graph to illustrate if the distribution for participants shifted to the left or changed shape compared with the distribution for control customers without behavior change.

The following subsections provide detailed descriptions of the analysis methods implemented in each of the four billing impact analyses. Given the number of terms and variation in the equations used for each analysis, a common set of abbreviations used below are defined in Table 3.2-1.

Table 3.2-1: Terms Used in Billing Analysis Equations

Abbreviation	Term / Definition
PRE	Pre-Treatment Period –The period of time prior to enrollment on the TOU rate
POST	Post-Treatment Period – The period of time after enrollment on the TOU rate
OAT	Otherwise Applicable Tariff – The rate a customer would be on if they weren't enrolled on the TOU rate
TOU	Time-of-use Rate – The TOU rate for the Pilot
TREAT	Treatment Group – Customers on the TOU rate
CTRL	Control Group – Customers on the OAT rate
CUST	Customers

3.2.1 Structural Benefiter/Non-Benefiter Analysis Based on Pretreatment Usage

The structural benefiter analysis was conducted for the summer and annual time periods using pretreatment data for the treatment group for each rate and relevant customer segment. Annual impacts are based on hourly load data from May 2015 through April 2016 for all three utilities. This time period was selected to ensure that customer energy use was as close to the present time as possible, but wasn't significantly influenced by the utilities' communications with customers about the pilot. Summer impacts are based on June 2015 through September 2015 for PG&E and SCE, and May 2015 through October 2015 for SDG&E due to their longer summer period.

Average monthly bills are estimated for each treatment group customer on the OAT and TOU rate using the hourly load data. Prior to estimating any structural bill impacts, the monthly bills generated from the hourly load data were compared to the actual bills generated by the utilities for validation. After working with the utilities to understand any discrepancies, all rates for all utilities ultimately passed the validation test. The difference between the TOU rate and the OAT rate determined if a customer was a structural benefiter or non-benefiter, as shown in Equation 3.2-1.

Equation 3.2-1: Structural Benefiter / Non-Benefiter

(PRE, TREAT, TOU)[22] – (PRE, TREAT, OAT)

On some rates a significant portion of the customers exhibited differences that were close to zero. As such, it could appear that a large share of customers were structural benefiters or non-benefiters even when bill impacts for a large number of customers are quite small. To address this, a neutral category of

[22] Each parenthetical term in the equation contains three acronyms which were defined in Table 3-2. The first acronym refers to the time period (i.e. pre- or post-enrollment), the second to the customer group (control or treatment), and the third to the rate (OAT or TOU). For example, (PRE, TREAT, TOU) refers to the bill amount based on pretreatment usage for treatment customers using the TOU tariff.

+/- $3 per month was defined. The neutral category helps ensure that the assignment to the structural benefiter or non-benefiter category is more meaningful and not overly influenced by customers who would experience a difference in bills of only a few dollars.

Similar to the load impact analysis, in some instances, customers are allowed to be represented in multiple segments. For example, a senior customer on CARE in the hot climate region is allowed to represent CARE customers and senior customers. This is accomplished using a weighting scheme where each segment's proportion within the general population is known. If a segment happens to be over-sampled, its weight is scaled accordingly so that in the final calculations, it was properly represented. The weights used for each segment and treatment cell are shown in Sections 4.2, 5.2 and 6.2 for PG&E, SCE, and SDG&E, respectively.

The final results from the structural benefiter / non-benefiter analysis are presented in column graphs and shown as percentages for the summer season and on an annual basis. For each rate and relevant segment, the percentage of customers who are non-benefiters, neutral (+/- $3), or benefiters based on their average monthly bills for the time period of interest are shown as individual columns. The three columns within each rate and segment combination total 100%, thus showing the distribution of structural benefiters and non-benefiters for each rate and segment of interest.

3.2.2 Estimation of the Average Bill Impact Due to Behavior Change

The average bill impact due to customers changing their behavior in response to the TOU rates is estimated by first calculating bills for both the treatment and control group under the TOU rate during the pre-and post-treatment periods. A difference-in-differences (DiD) fixed effects model, similar to that used for estimating load impacts, is then used to estimate the average bill impact for the rate and segment of interest. The DiD analysis can be expressed by Equation 3.2-2.[23]

Equation 3.2-2: Average Bill Impact Due to Changes in Usage

[(POST, CTRL, TOU) - (POST, TREAT, TOU)] - [(PRE, CTRL, TOU) - (PRE, TREAT, TOU)]

In simplified terms, the estimated value equals the difference between the control group and the treatment group bills calculated on the TOU rate using post-treatment usage minus any pre-existing differences between the control and treatment group bills based on pretreatment usage. The control group bill calculated on the TOU rate represents the bill that would be expected if a customer was billed on the TOU rate, but didn't change their energy use behavior. The bill for the treatment group customers on the TOU rate reflects any behavioral changes in response to being on the TOU rate. By subtracting the treatment group's average bill from the control group's average bill—and removing any pre-existing differences—we are able estimate the average bill impact attributable to the treatment group's change in behavior resulting from exposure to the pilot rate, after controlling for exogenous factors. A positive impact indicates that customers successfully reduced their bills relative to the control group who did not respond to a TOU rate.

[23] In practice this is estimated via an econometric model, and some of the terms drop out. However, this equation is provided in order to present the concept of the calculations that are involved with the analysis. The outcome of this equation and the econometric model are identical, but the econometric model also produces standard errors which are used to determine if the results are statistically significant.

Bill impacts are presented on a column graph and shown as dollar impacts for the average summer monthly bill across July, August, and September for PG&E and SCE[24]; October is included for SDG&E due to their longer summer season. Impacts are organized by rate, climate region, and segment. The bill impact in percentage terms that corresponds to the dollar amount is also reported. It should also be noted that small bill impacts do not necessarily indicate that customers did not change their behavior. Bill impacts depend on the combination of changes in usage in each rate period. Customer may reduce use during the peak period but increase it in the off-peak period not just due to load shifting but also due to increased end-use activity. Depending on the relative magnitude of these changes and the rate differentials, significant behavior changes could lead to minimal changes in the total bill.

3.2.3 Estimation of the Total Bill Impact Due to Differences in the Tariffs (Holding Usage Constant) and Behavior Change

Total bill impacts experienced by customers on a TOU rate can be decomposed into two components: the structural impact, and the behavioral impact. The structural impact represents the change in customer bills based solely on the change in the underlying structure and prices for the rate. In this case, it is the change from the OAT to the time-differentiated TOU pilot rates. The behavioral impact represents how the customer changed their energy usage in response to the new pricing structure of the rate—which includes higher prices in the afternoon and evening and lower prices at other times of the day. During the summer period, most customers experienced a structural increase in their bills due to transitioning to the TOU rate. However, customers also had an opportunity to offset that increase by changing their energy use behavior in response to the new price signals. As noted above, it is the combination of the structural and behavioral impacts that produces the total bill impact experienced by the average study participant.

The estimation of the total bill impact requires the calculation of three components:

- **No Change in Behavior or Tariff [1]:** Estimate bills for control group customers based on post-treatment usage and the OAT and adjust for any small pretreatment difference in bills between control and treatment customers.

Equation 3.2-3: No Change in Behavior or Tariff

(POST, CTRL, OAT) - [(PRE, CTRL, OAT) – (PRE, TREAT, OAT)]

  - This represents what the treatment group bills would have been in the post-treatment period if they were on the OAT and had not changed their behavior.
  - It adjusts for exogenous factors that might affect bills such as differences in weather, economic conditions, or the like.

- **No Change in Behavior, Change in Tariff [2]:** Estimate bills for control customers based on the TOU tariff using post-treatment usage and adjust for any small pretreatment differences in bills between control and treatment customers.

[24] July is omitted for SCE Rate 3 customers due to the timing of customers being transitioned onto the rate during that month.

Equation 3.2-4: No Change in Behavior, Change in Tariff

(POST, CTRL, TOU) - [(PRE, CTRL, TOU) – (PRE, TREAT, TOU)]

- This represents what the treatment group bills would have been in the post-treatment period if they were on the TOU rate and had not changed their behavior.

- **Change in Behavior and in Tariff [3]:** Estimate bills for treatment customers based on the TOU tariff using post-treatment usage.

Equation 3.2-5: Change in Behavior and in Tariff

(POST, TREAT, TOU)

- This represents what the treatment group bills were in the post-treatment period on the TOU rate with a change in behavior

Based on the components defined above, the following metrics are calculated:

- The difference between **[1]** and **[2]** is the structural bill impact;
- The difference between **[1]** and **[3]** is the bill impact due to structural differences in the rates, but mitigated by changes in behavior;
- The difference between **[2]** and **[3]** is the amount customers were able reduce their bills by changing their behavior.

The results from this analysis are presented as the average summer monthly bills for July, August, and September for PG&E and SCE[25] —October is included for SDG&E due to their longer summer season—for [1], [2], and [3] as defined above. Presenting the total expected bill amount helps to provide context for the magnitude of the differences. In this exercise, one of the major factors is the relationship between the structural bill impacts, and how customers were able to respond. This relationship is represented by the "percentage of structural loss mitigated by the change in behavior". Put differently, this percentage represents how much of the bill increase from the TOU rate the customers are able to offset. Results are reported by rate, climate region, and segment; similar to the other bill impact analysis sections.

3.2.4 Change in the Distribution of Bill Impacts Due to Behavior Change

The fourth analysis presents the distribution of bill impacts for customers with and without behavioral change, and is designed to show how the distribution shifts in when customers respond to the rate by changing behavior. Similar to the other analyses, impact distributions are based on the average summer monthly bills for July, August, and September for PG&E and SCE[25] and October is included for SDG&E due to their longer summer season. The distributions are developed by estimating the percentage of customers who fall into bill impact ranges or bins, organized in $10 increments.[26] The underlying calculations used to develop the distributions are based on a DiD approach that compares the bills for

[25] July is omitted for SCE Rate 3 customers due to the timing of customers being transitioned onto the rate during that month.

[26] It should be noted that there is uncertainty associated with this distribution because calculations are not made at the individual customer level. There is also uncertainty associated with this calculation because the pilot itself is a sample and not the entire population.

treatment and control customers using both pre- and post-treatment usage. This analysis involves the following steps.

Equation 3.2-6: Steps for Calculating Change in Distribution of Bill Impacts[27]

- **Develop bill distributions:** For each range from $X to $Y in $10 increments, the percentage of customers experiencing bill impacts is calculated with and without a behavior change.
  - With change in behavior:
    - (POST, TREAT, $X, $Y)
  - No change in behavior:
    - (POST, CTRL[28], $X, $Y)- **[**(PRE, CTRL, $X, $Y) - (PRE, TREAT, $X, $Y)**]**
- **Underlying calculations:** (by bins or range from $X to $Y)
  - (PRE, CTRL, $X, $Y) = % of segment where:
    $X < [(PRE, CTRL, TOU) - (PRE, CTRL, OAT)] < $Y
  - (PRE, TREAT, $X, $Y) = % of segment where:
    $X < [(PRE, TREAT, TOU) - (PRE, TREAT, OAT)] < $Y
  - (POST, CTRL, $X, $Y) = % of segment where:
    $X < [(POST, CTRL, TOU) - (POST, CTRL, OAT)] < $Y
  - (POST, TREAT, $X, $Y) = % of segment where:
    $X < [(POST, TREAT, TOU) - (POST, TREAT, OAT)] < $Y.

Structural bill impacts are estimated for two cases, with and without behavior change, using the four terms defined above. Customers are segmented into bill impact bins. The percentage of customers in each $10 increment (with and without behavior change) is used to produce the two distributions of bill impacts.

The two distributions are presented on a line graph, with the height of the line at any given $10 increment representing the percentage of customers experiencing a bill impact of the corresponding dollar amount. An example is provided in Figure 3.2-1. In this case, the bill impact is measured as the difference between the TOU bill and the OAT bill. For example, if the point on the line graph in the $21 to $30 range is at 25% for the group without behavior change, it indicates that 25% of customers in the group could expect to see an increase of between $21 and $30 per month on their bill if they switched from the OAT to a TOU rate and didn't change their behavior. If the line for the group with behavior change is to the left of the line representing the group with no change in behavior, it shows that at least some customers were able to lower their bills by modifying their energy use. It is important to note that customers could move up or down through the incremental impact bins, and could potentially move

[27] It should be noted that the estimate is based on a difference in differences calculation done arithmetically (as opposed to a regression analysis) and, therefore, confidence intervals cannot be estimated. However, that doesn't mean that there isn't uncertainty involved in the estimate because the reference load itself is an estimate. Therefore the "true" impact could be smaller or larger than what's actually being reported.

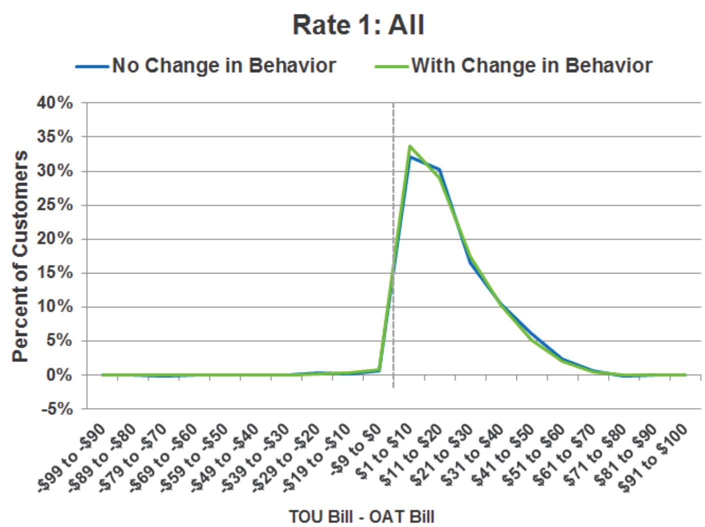
[28] The calculations for estimating bill impacts for the control group are based on the bills for individual customers, not an estimated reference load as seen in the load impacts section. This allows customers to be slotted into each of the dollar segments. After the difference in difference is calculated, there are no longer any individual customer data points.

more than one bin—meaning that a customer could potentially experience a bill increase due to their behavioral response, or they could jump down several bins and go from a $21 to $30 per month bill impact down to $1 to $10 impact, for example.

Given customers can shift anywhere along the curve on the graph, the key take away from this analysis is to observe the changes in the shape of the distribution of the line representing the group who changed their behavior, relative to the line representing no change in behavior. The interpretation of the changing shape of the distributions will be discussed in more detail in the results sections where actual results are presented.

Figure 3.2-1: PG&E Rate 1 Change in the Distribution of Bill Impacts Due to Behavior Change

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0%	0%
-$89 to -$80	0%	0%
-$79 to -$70	0%	0%
-$69 to -$60	0%	0%
-$59 to -$50	0%	0%
-$49 to -$40	0%	0%
-$39 to -$30	0%	0%
-$29 to -$20	0%	0%
-$19 to -$10	0%	0%
-$9 to $0	1%	1%
$1 to $10	32%	34%
$11 to $20	30%	29%
$21 to $30	17%	17%
$31 to $40	10%	10%
$41 to $50	6%	5%
$51 to $60	2%	2%
$61 to $70	1%	1%
$71 to $80	0%	0%
$81 to $90	0%	0%
$91 to $100	0%	0%



3.3 Survey Design and Analysis

In addition to estimating load and bill impacts, key objectives for the TOU pilots included research questions that could only be addressed through customer surveys. An integral part of pilot design was to conduct two surveys, one at the end of the first summer and the other at the end of the first full year on the TOU rates. A substantial portion of the "pay-to-play" incentives used to recruit customers into the study were tied to completion of the surveys to obtain high response rates for both treatment and control customers, which is essential to obtaining valid insights regarding some of the key research issues of interest. The remainder of this section provides an overview of the key research questions being studied through the initial survey, survey design and implementation, analytical methods that were applied to obtain key research findings, and other implementation and methodological issues useful for understanding and interpreting the survey findings presented in Sections 4 through 6. The survey was conducted and analyzed by Research Into Action (RIA).

3.3.1 Survey Design

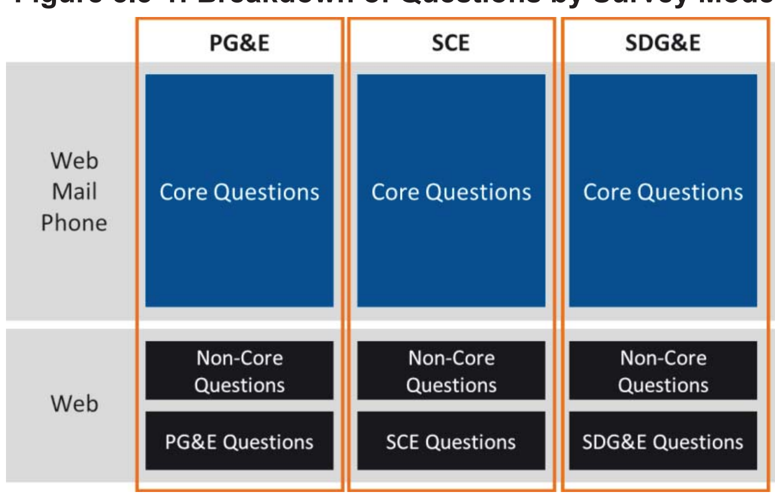
RIA, in collaboration with the TOU working group, developed a 20-minute survey to answer the following key research questions:

- What motivated respondents to participate in the study?
- How satisfied are respondents with their study rate and their utility?
- Do respondents understand key elements of how their study rate works?
- Did customers experience issues with paying their bills because of their study rate?
- Did their study rate increase economic or health hardship?
- What actions did they take to shift use on their study rate?
- Did respondents use study websites, apps, or tools to help manage their electricity use?

The 2016 survey specifically assessed differences in responses between those customers on the control rate (OAT) and those on the TOU rates for the summer months of the pilot. In addition to addressing the key research questions listed above, the survey included questions on demographics, housing characteristics, and attitudes toward and awareness of energy efficiency and demand response to help explain the survey findings. See Appendix Volume II for the survey guide and mapping of survey questions to the key research questions.

To manage survey length and respondent burden, the number of questions for mail and phone respondents was limited (see Figure 3.3-1). To determine which questions to leave out of the mail and phone survey, the survey questions were divided into “core” and “non-core” questions. Core questions contained all questions necessary to address regulatory requirements, including all hardship questions, welcome kit messaging questions, rate and utility satisfaction, motivations for participation, understanding of the rate, and actions taken in response to the rate. Non-core items included IOU-specific questions, website and smartphone application questions, and smart thermostat use questions. All core questions were included in each survey mode and non-core questions were added to the web survey. Because 81% of survey responses were completed via the web, the non-core questions were answered by the majority of respondents.

Figure 3.3-1: Breakdown of Questions by Survey Mode



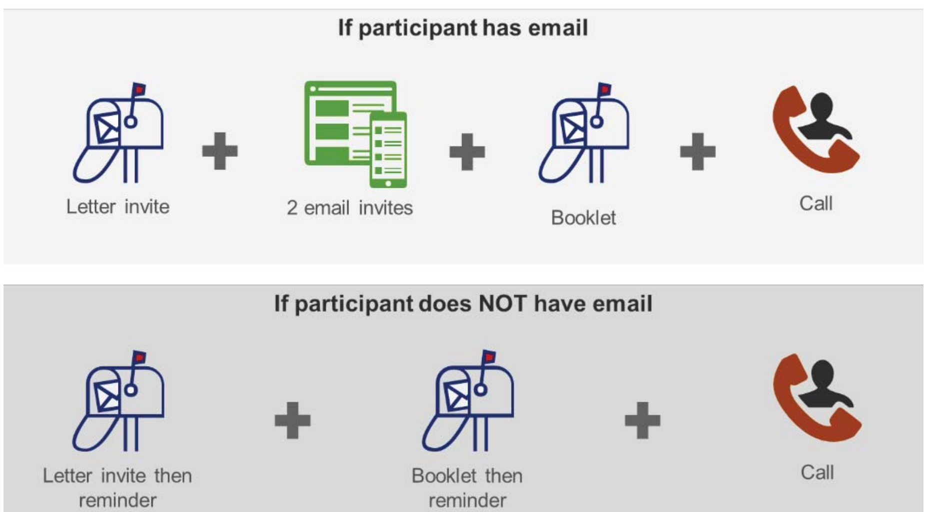
3.3.2 Survey implementation

An email, mail, and phone (EMP) mixed-mode survey approach was used for all segments in the pilot to achieve a high response rate from pilot participants.[29] An attempt was made to reach a complete census of all pilot participants. Pilot participants with email addresses received a mail invitation letter with a web link, then two email invitations. Non-responders received a mailed questionnaire and a phone call. Pilot participants without email addresses received a mail invitation letter with web link, followed by an additional invitation. Non-responders received a mailed questionnaire, a follow-up postcard reminder, and, finally, a phone call (Figure 3.3-2). All participants who did not respond via email or mail were called. See Appendix Volume II for examples of invitation letters and survey booklets.

High Response Rates Ensure Valid Results

A mixed-mode (email, mail, and phone) survey methodology was employed to help ensure high response rates and minimize response bias. This, combined with the incentives paid for survey completion, produced response rates by segment ranging from a low of 66% to a high of 96%. Importantly, response rates were very similar between control and treatment groups, which ensures the internal validity of key findings based on comparisons across groups.

Figure 3.3-2: EMP Process for 2016 Survey



Washington State's Social and Economic Sciences Research Center (SESRC) fielded the survey between October and December 2016. An overall response rate of 82% and a 94% cooperation rate were obtained across the three IOUs. Table 3.3-1 shows a detailed disposition table with counts and rates for each IOU and for the three IOUs combined. The response rates were sufficiently high to minimize non-response bias. In addition, most respondents to the survey (88% to 95%) reported that their name is on the bill they receive from their IOU.

[29] Survey implementation was based on Dillman's Tailored Design Method. Dillman, Don A., Smyth, Jolene D., Christian, Leah Melani. 2014. Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method, 4th edition. John Wiley: Hoboken, NJ.

Table 3.3-1: Disposition Table for 2016 Survey[30]

Disposition Code	PG&E	SCE	SDG&E	Total
Completes				
Phone completes	843	553	195	1,591
Mail completes	2,613	2,594	1,485	6,692
Web completes	12,731	12,740	10,804	36,275
Phone partial completes	168	88	42	298
Web partial completes	234	206	228	668
Eligible - Not Surveyed				
Refusal	338	195	82	615
Non-contact	429	376	154	959
Answering machine	1,874	2,057	940	4,871
Deceased respondent	10	6	5	21
Physically or mentally unable	12	5	8	25
Language problem	422	667	236	1,325
Unknown Eligibility - Not Surveyed				
Always busy	41	32	20	93
No answer	197	178	66	441
Call blocking	53	72	23	148
USPS: Returned to sender	64	14	13	91
Not Eligible - Not Surveyed				
Number not working, disconnected, changed	348	286	414	1,048
Other	52	39	17	108
Total Counts				
Total phone numbers used	20,429	20,108	14,732	55,269
Complete Interviews	16,187	15,887	12,484	44,558
Partial Interviews	402	294	270	966
Refusal and break off	338	195	82	615
Non-contact	2,303	2,433	1,094	5,830
Other	444	678	249	1,371
Response Rates				
Response Rate - Completes only	81%	80%	87%	82%
Response Rate - Full and partial completes	83%	82%	89%	84%
Cooperation Rates				
Cooperation rate - All respondents	93%	93%	95%	94%
Cooperation rate - All eligible	98%	99%	99%	99%

[30] The American Association for Public Opinion Research (AAPOR) standard disposition definitions was used for this disposition table. http://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions20169theditionfinal.pdf

3.3.3 Survey Data Validation Checks

To ensure that the internal validity of the RCT remained intact, response rates between the control and TOU rate groups were compared for each customer segment. Segment response rates varied from a low of 66% to a high of 96%. Lower-income, hard to reach populations had lower response rates; however, all response rates were sufficiently high to minimize non-response bias. Further, there are few differences in the response rates between participants in the control condition and those in the treatment condition, with differences in response rates between RCT groups ranging from 1% to a maximum of 6%. Because of the large sample sizes in the segments, several comparisons between response rates across RCT groups are statistically significant;[31] however, these differences may not be meaningful.

Response Rates for the PG&E Pilot: Table 3.3-2 shows the survey response rates for PG&E. Response rates ranged from a low of 66% for respondents with incomes below 100% of the federal poverty guide (FPG) in the hot climate region assigned to Rate 1 to a high of 92% for Non-CARE/FERA customers in several rate groups. When comparing response rates between control and TOU rate treatment groups in the hot region, three segments exhibited significant differences: those with incomes above 200% of FPG, seniors, and non-CARE/FERA customers. Although these differences are statistically significant, the response rates for these segments are high – 80% and above - and differences between response rates are 3% or less.

Table 3.3-2: PG&E Response Rates by Segment and RCT Group[1]

PG&E	Control	Rate 1	Rate 2	Rate 3	Overall	Sparkline	Largest ▲
Hot							
All	82%	80%	81%	80%	81%		2% *
Non-CARE/FERA	90%	87%	88%	87%	88%		3% *
CARE/FERA	76%	75%	73%	73%	75%		3%
Below 100% FPG	67%	66%	68%	67%	67%		2%
100 to 200% FPG	82%	78%	78%	78%	80%		4%
Seniors	84%	81%	82%	81%	82%		3% *
Moderate							
All	81%	79%	78%	81%	80%		3%
Non-CARE/FERA	92%	88%	88%	88%	89%		4%
CARE/FERA	71%	69%	68%	74%	71%		6%
Cool							
All	85%	82%	84%	80%	83%		4%
Non-CARE/FERA	92%	90%	92%	89%	91%		4%
CARE/FERA	76%	72%	74%	71%	73%		5%
All Climate Zones							
Overall	83%	80%	81%	81%	81%		2%

[1] Asterisks (*) indicate a significant difference in the response rate across RCT groups for that segment.

[31] Chi-square tests were used to test the number of respondents versus non-respondents across RCT groups by segment. Those flagged as significant indicate a chi-square significant at the 95% confidence level.

Response Rates for the SCE Pilot: Table 3.3-3 shows the survey response rates for SCE. Response rates ranged from a low of 66% for respondents with incomes below 100% of the FPG in the hot climate region assigned to Rate 3 to a high of 92% for non-CARE/FERA customers assigned to Control in the moderate climate region, and Control and Rate 2 in the cool climate region. Two segments showed significant differences in response rates (seniors and CARE/FERA segments) in the hot region when comparing response rates between control and rate treatment groups. While statistically significant, response rates for these segments are high (70% and above) and differences between response rates are 6% or less.

Table 3.3-3: SCE Response Rates by Segment and RCT Group[1]

SCE	Control	Rate 1	Rate 2	Rate 3	Overall	Sparkline	Largest ▲
Hot							
All	82%	84%	79%	80%	81%		5% *
Non-CARE/FERA	88%	90%	87%	87%	88%		3%
CARE/FERA	76%	75%	71%	73%	74%		5% *
Below 100% FPG	71%	69%	67%	66%	69%		4%
100 to 200% FPG	83%	80%	78%	80%	80%		5%
Seniors	85%	87%	81%	83%	84%		6% *
Moderate							
All	82%	79%	79%	81%	80%		3%
Non-CARE/FERA	88%	88%	87%	91%	89%		4%
CARE/FERA	75%	71%	70%	70%	72%		5%
Cool							
All	82%	79%	80%	79%	80%		3%
Non-CARE/FERA	90%	89%	88%	89%	89%		2%
CARE/FERA	73%	67%	71%	68%	70%		6%
All Climate Zones							
Overall	82%	81%	79%	80%	80%		3% *

[1] Asterisks (*) indicate a significant difference in the response rate across RCT groups for that segment.

Response Rates for the SDG&E Pilot: Table 3.3-4 shows the survey response rates for SDG&E. Response rates ranged from a low of 77% for CARE/FERA respondents to a high of 96% for non-CARE/FERA respondents in the cool region. One segment showed a significant difference in response rates – CARE/FERA customers in the cool region when comparing response rates between control and TOU treatment groups. While statistically significant, response rates for these segments are high – 75% and above - and differences between response rates was 5%.

Table 3.3-4: SDG&E Response Rates by Segment and RCT Group[1]

SDG&E	Control	Rate 1	Rate 2	Total	Overall	Largest ▲
Hot						
All			91%	91%		0%
Moderate						
All	87%	86%	85%	86%		1%
Non-CARE/FERA	93%	93%	93%	93%		0%
CARE/FERA	80%	78%	77%	78%		2%
Cool						
All	88%	87%	86%	87%		2%
Non-CARE/FERA	94%	96%	95%	95%		2%
CARE/FERA	82%	78%	77%	79%		5% *
All Climate Zones						
Overall	87%	87%	86%	87%		1%

[1] Asterisks (*) indicate a significant difference in the response rate across RCT groups for that segment.

For another survey validation check, response rates were compared across survey modes (i.e., web, mail, or phone) for each IOU sample. Three comparisons were made for each survey question (web vs. mail, web vs. phone, and mail vs. phone) using regression models controlling for RCT group, climate region, CARE/FERA enrollment, FPG, household income, level of education, race, and age. Across all IOUs, web and mail survey respondents were more likely to choose “Don’t know” and to skip questions compared to phone respondents. Phone respondents were more likely to choose extreme answers on scale questions (i.e., choosing 9 or 10 on a 0-10 scale) compared to web and mail respondents. These findings align with previous research showing that respondents to interviewer-administered surveys (e.g., phone) are less likely to admit they don’t know an answer to a question, are less likely to skip questions, and are likely to give higher or lower ratings on scale questions compared to respondents to self-administered surveys (e.g., web or mail).[32] The differences across survey mode are small and do not impact the overall validity of the survey results.

[32] Dillman, Smyth, & Christian (2014). *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method, 4th ed.* Hoboken, NJ: John Wiley & Sons Inc.; Krosnick & Presser (2010). “Question and Questionnaire Design,” in *Handbook of Survey Research*, Marsden & Wright (eds.). Bingley, UK: Emerald Group Publishing Ltd, pgs. 263-314.

3.3.4 Data cleaning

To clean the survey data, respondents who answered seven or fewer (5.4% or less) of the 129 survey items asked of all respondents (n=259 of 45,524, or 0.6%) were removed from the dataset. The team also removed the respondents who provided the same answer for each item (i.e., straight-lining) in all three of the multi-item questions that had more than four items on the list (n=77 of 45,524, or 0.2%).

Also removed from the dataset were:

- Respondents who straight-lined a multi-item question with four or more items;
- Respondents who selected all items in a 'select-all-that-apply' question in which not all answer categories are mutually exclusive; and
- Outliers to the survey questions about year of birth and number of household members.

Finally, 'Don't Know' responses for many survey items were recoded using the following rules:

- 'Don't Know' responses were excluded from all the rating questions and some of the demographic questions, like race, housing type, number of bedrooms.
- 'Don't Know responses were coded as 'No' for most of the recall questions, like recall participation and welcome packet, and some of the characteristics questions, like type of cooling equipment in the home.
- 'Don't Know' responses were kept for questions in which it is a meaningful response, like the test questions, reasons IOUs are changing to TOU rates, and the economic and health hardship/status questions.

3.3.5 Estimating Household Income and CARE/FERA eligibility

This section describes the steps taken to estimate customers who are currently not participating in IOU CARE/FERA programs, but are still eligible to participate based upon their income and household size. The following steps were taken to identify additional CARE/FERA eligible participants:

1. Gathered income data for as many survey respondents as possible
2. Imputed income data using prior enrollment or IOU purchased data if necessary
3. Used household size responses from the survey paired with income data from the survey or the imputed income data to identify respondents eligible but not currently participating in the CARE/FERA program.

Estimating Household Income

Table 3.3-5 shows the frequency of responses for household income from the 2016 survey.

Table 3.3-5: Household Income Categories from 2016 Survey

Household Income Categories	Count	Percent
Less than $12,000	3,736	8%
$12,000 to less than $17,000	3,609	8%
$17,000 to less than $21,000	2,669	6%
$21,000 to less than $25,000	2,908	6%
$25,000 to less than $29,000	2,186	5%
$29,000 to less than $33,000	2,303	5%
$33,000 to less than $37,000	1,770	4%
$37,000 to less than $41,000	1,762	4%
$41,000 to less than $50,000	3,313	7%
$50,000 to less than $100,000	8,973	20%
$100,000 or more	8,300	18%
Total survey responses to income question	*41,529*	*92%*
Don't know	2,386	5%
No answer	1,273	3%
Total left to impute	*3,659*	*8%*
Grand total survey responses in dataset	**45,188**	**100%**

Across all three IOUs, 8% of respondents did not provide a viable response (5% chose “don’t know” and 3% did not answer). To minimize the number of missing and don’t know responses in the analyses, income data was imputed from either the enrollment survey or purchased IOU data. Both supplementary data sources included two types of income data: one containing six income categories and one containing eleven categories. Table 3.3-6 displays the improvements in missing income data following each imputation step.

Table 3.3-6: Improvements in Missing Income Data Following Imputation

	Percent missing
Raw survey responses	8.10%
Following first imputation (11 category enrollment survey data)	4.38%
Following second imputation (11 category IOU data)	3.09%
Following third imputation (6 category enrollment survey data)	3.07%
Following final imputation (6 category IOU data)	3.05%

The eleven-category variables match the categories shown in Table 3.3-5, and were prioritized for imputing income data. However, for the 3.1% of respondents that still lacked income data following this initial imputation, the six-category data was used to impute household income. Since the six-category data did not perfectly match one of the categories in the survey, the midpoint of the values in each category was mapped into the corresponding category in the survey question (Table 3.3-7). This second round of imputation picked up an additional 0.2% of respondents, ultimately providing 97% of survey respondents with income data.

Table 3.3-7: Household Income Imputation Map

Six-Category Household Income Items	Midpoint (if categories differed)	Value Imputed to 11-Category Household Income
Less than $12,000	->	Less than $12,000
$12,000 to < $25,000	$18,500	$17,000 to < $21,000
$25,000 to < $37,000	$31,000	$29,000 to < $33,000
$37,000 to < $50,000	$43,500	$41,000 to < $50,000
$50,000 to < $100,000	->	$50,000 to < $100,000
$100,000 or more	->	$100,000 or more

Estimating CARE/FERA Eligibility

CARE/FERA eligibility is based on both household size and income, as shown in Table 3.3-8. The maximum household income to household size requirements publicly available on each IOU's website were used.

Table 3.3-8: CARE/FERA Eligibility Requirements

Number of Persons in Household	Maximum Household Income	
	CARE	FERA
1 to 2	Up to $32,040	Not Eligible
3	Up to $40,320	$40,321 - $50,400
4	Up to $48,600	$48,601 - $60,750
5	Up to $56,880	$56,881 - $71,100
6	Up to $65,160	$65,161 - $81,450
7	Up to $73,460	$73,461 - $91,825
8	Up to $81,780	$81,781 - $102,225
Each additional person	$8,320	$8,320 - $10,400

Source: https://www.sce.com/wps/portal/home/residential/assistance/care-fera/

Using household size survey data and the income data described earlier, CARE and FERA eligibility was estimated by mapping the respective income qualification guidelines to the closest corresponding income bracket from the survey options, as summarized in Table 3.3-9.

Table 3.3-9: CARE and FERA Eligibility

Number in Household	CARE Income Requirement	FERA Income Requirement
1 to 2	$29,000 to less than $33,000	--
3	$37,000 to less than $41,000	$41,000 to less than $50,000
4	$41,000 to less than $50,000	$50,000 to less than $100,000
5+	$50,000 to less than $100,000	

The results indicate an estimated 57% of respondents were eligible for CARE or FERA. Due to missing income or household size survey data, CARE/FERA eligibility for 3% of the sample could not be estimated. To identify the number of non-participating but eligible CARE/FERA respondents present in the data, the overlap between those currently participating in CARE/FERA programs and those estimated to be eligible to do so was calculated. As shown in Table 3.3-10 , 27% of non-CARE/FERA customers in the sample were eligible for CARE/FERA. To test the validity of the eligibility estimates, the ratio of those determined to be eligible to participate to those currently participating in CARE/FERA was calculated. Ideally, 100% of current CARE/FERA participants would be determined to be eligible. In fact, 94% of respondents flagged as CARE/FERA participants by the IOUs were also flagged as CARE/FERA eligible using survey data, a substantial amount of overlap. Possible explanations for the 6% error rate include:

- CARE/FERA income qualification guidelines slightly differed from the income brackets used in the survey.[33]
- The status of some CARE/FERA customers may have changed over the six-month period between pilot enrollment and when customers took the survey.

Table 3.3-10: CARE/FERA Enrollment vs Eligibility[1]

Current CARE/FERA status	Eligible for CARE/FERA	
	Count	Percent
Not participating	6,809	27%
Participating	18,772	73%
Total	25,581	100%

[1] Reported values are unweighted and aggregated across all IOUs.

[33] The maximum income data is "$100,000 or more" and CARE eligibility for 11 household members is $106,740. This limits the ability accurately compute eligibility for CARE/FERA households with more than 10 members.

3.3.6 Section 745 Analytical Methods

Reasoning for Metric Development

The following sections describe the steps used to develop Economic and Health indices that help to capture these complex concepts. Using psychometric theory, the most relevant metrics from the opt-in survey data were identified to inform what effect TOU rates might have on the economic or health outcomes of participants. Since both economic and health outcomes are complex and potentially incorporate multiple behaviors, the aim was to create two separate indices that merge related questions reflecting economic outcomes in one index and health outcomes in another. This process makes assessing differences between groups simpler and more valid since the goal is to evaluate the larger concepts of “economic difficulty” or “health difficulty”. Due to the complexity of these concepts, evaluating a series of individual questions can provide misleading and sometimes contradictory outcomes. Given the questions in the survey, different approaches were taken for each index.

1. The economic index was formed using Exploratory Factor Analyses (EFA) to explore the underlying connections between questions targeted at economic and financial issues -- including an index created by the Consumer Financial Protection Bureau -- and questions obtained from other research conducted in California.[34] The EFA identified items that correlated with one another, and demonstrated coverage of several underlying aspects of the “economic difficulties” concept. It was validated and confirmed that this scale measured economic difficulty (as discussed further below).
2. The health index contains a single question, the number of times a customer sought medical attention because it was too hot in their home.[35] Responses to household characteristics questions were used to identify customers for which this question was most relevant (e.g., customers who have air conditioning and who have a disability that requires their home to be cool). Rather than creating a scale, as was done for economic difficulty, the related questions were used to identify the sub-sample where the question is relevant.[36]

The next two sub-sections describe, in detail, the process used to create the economic and health indices.

Economic Index Development

One of the primary purposes of this study is to assess whether TOU rates cause unreasonable economic hardship for particularly vulnerable households, such as seniors or low income customers living in hot climate regions. To do this, it was necessary to create a valid, reliable economic index metric using established methods. Table 3.3-11 summarizes the steps generally used when developing a new metric and the methods used here for that step. More detail on steps three through six is provided below.

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[34] These questions were extensively developed and discussed in close collaboration with the TOU Working Group to ensure they would adequately measure economic hardship.

[35] This survey question was similarly developed in collaboration with the TOU Working Group to ensure that it would generate the information necessary to evaluate the impact of TOU rates on health and safety during the summer.

[36] The 2017 survey will focus some additional space to create a more statistically versatile health index, but the current health index identifies groups with increased health effects due to TOU rates sufficiently well to inform 745c decision.

Table 3.3-11: Steps to Create a Valid and Reliable Scale[37]

Established Method	Methods used
Step 1: Generate Items	Combination of new and established items in survey
Step 2: Gather Data	Survey implementation (October to December)
Step 3: Reduce Data to a Model	Exploratory factor analysis and Cronbach's alpha
Step 4: Confirm Model	Confirmatory factor analysis
Step 5: Assess Validity	Confirmatory factor analysis
Step 6: Replicate Findings	Dataset splitting and rerunning steps 3, 4, and 5

Steps 1 and 2 – Generate items and gather data: To generate items, survey questions were designed to assess multiple aspects of economic difficulty, such as a person's concern for being able to pay their bills, the methods used to pay bills, and the difficulty customers had paying their bills during the summer. Questions were also included from previously validated metrics of financial health, such as the Consumer Financial Protection Bureau (CFPB). The abbreviated CFPB index question used in the customer survey is comprised of five Likert scale items.38 For the first three items, respondents are asked how each describes their situation using a scale including "not at all," "very little," "somewhat," "very well," and "completely." For the last two items, respondents are asked how often each applies to them using a scale including "never," "rarely," "sometimes," "often," and "always." The CFPB items are:

- Because of my money situation, I feel like I will never that the things I want in life.
- I am just getting by financially.
- I am concerned that the money I have won't last.
- I have money left over at the end of the month.
- My finances control my life.

Using newly developed questions in concert with previously validated ones helped ensure that both traditional views on financial health and elements of financial hardship specific to rate design were covered. The survey from was conducted during October, November and December 2016 and data was obtained from 44,558 pilot participants.

Step 3 – Reduce data to a model: To prepare the data for step 3, all questions in the survey related to economic or financial status were identified and interval-level indices were created out of ordinal or categorical survey items as described below:

- Calculated the CFPB financial well-being index using five Likert scale items. Scores ranged from 19 to 90, with a score of 90 corresponding to a very financially secure respondent.

[37] Adapted from Hinkin, T. R. (1998). A brief tutorial on the development of measures for use in survey questionnaires. *Organizational Research Methods*, 2*(1)*, 104-121. DOI: 10.1177/109442819800100106.

[38] The Consumer Financial Protection Bureau's methods for the abbreviated version of their "Financial Well-Being Scale" were followed. See the following documentation for full methodological details: http://files.consumerfinance.gov/f/201512_cfpb_financial-well-being-user-guide-scale.pdf

- Summed the response values for three 0 to 10 Likert scale items related to how the respondent's rate plan works for them.[39] Scores range from 0 to 30, with 30 interpreted as high agreement that the rate works well for the respondent.
- Summed the response values for the number of times respondents had trouble paying both their electricity bill and other important household bills.[40] Scores range from 0 to 6, with a score of 6 corresponding to six or more times the respondent had trouble paying their important household bills.
- Summed the number of different methods a respondent used to pay their household bills outside of using their current monthly income. Scores range from 0 to 10, with a score of 10 interpreted as the respondent using ten alternative methods (e.g., borrowing money from a friend) to pay their bills.
- Kept one stand-alone 0 to 10 Likert scale item indicating concern about paying bills as-is, with a 10 meaning a respondent is very concerned about paying their bills.

The transformed data was analyzed using exploratory factor analysis (EFA).[41] EFA methods serve two purposes: 1) as a data reduction method to identify items that are not useful; and 2) as a tool to reveal underlying, or "latent", patterns in the survey data. EFAs are ideal for exploring potential metrics because the method groups ("loads") related items together into "factors".

Because the range of possible values on the items used in the EFAs varied considerably, respondent values for these variables were standardized into z-scores, in which a score of zero reflects the sample mean and a score of one is one standard deviation away from the mean. By standardizing responses, it is possible to compare responses across items and understand that a z-score response of 3.2 is much more extreme than a response of 0.74.

Throughout this process, statistical models were estimated using 30% and 50% of the full dataset of respondents. This was done for two reasons: 1) to ensure that the same factors loaded on different sized random subsamples of the data (vs. the full dataset) and 2) to reduce the excessive statistical power stemming from the very large sample sizes obtained through the survey.

Because EFA is an exploratory method, initial models were run that included potentially relevant survey items that were not included in the final model. The final model included four items as shown in Table 3.3-12 and explains 67% of the variance in answer choices.[42]

[39] Cronbach's alpha = .91. Cronbach's alpha measures the internal consistency of the source variables included in the index.

[40] Cronbach's alpha = .84.

[41] To create a metric useful across California, survey responses were pooled across IOUs, climate zones, segments, and RCT groups.

[42] 67% of the variance explained means that these four items explain 67% of the variability in answer choices used in the model. Typically, the variance explained from models using survey results range from 20% to 40%. A model that explains 67% of the variability in answer choices suggests a very good fitting model.

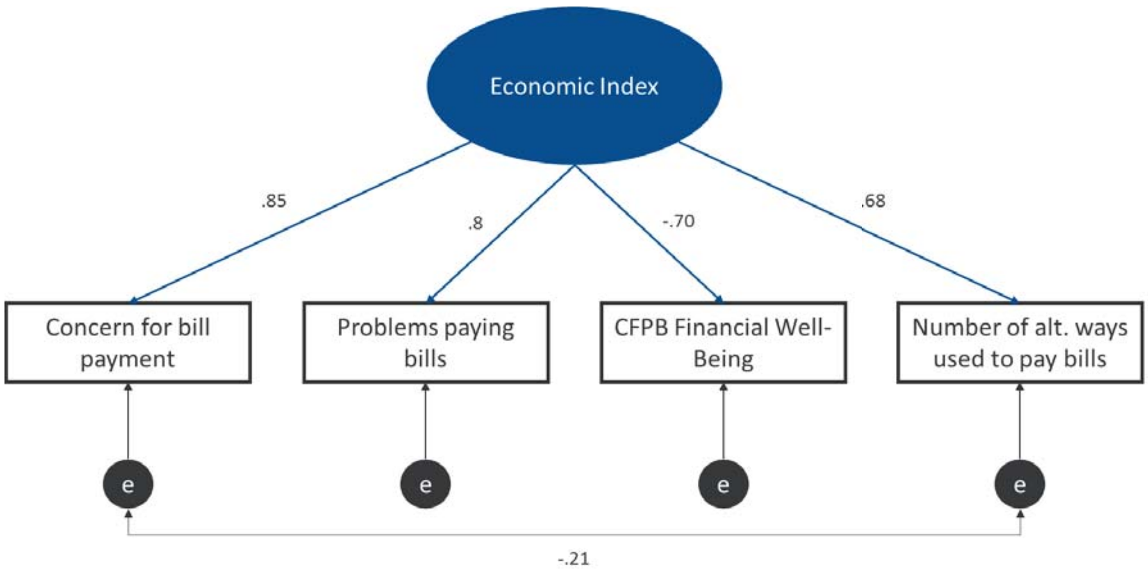
Table 3.3-12: EFA Results[1]

Item	Factor Loading	KMO Stat	% Variance Explained
Concern for bill payment	0.869	0.8	67%
Problems paying bills	0.847		
CFPB Financial well-being	-0.669	**Goodness of Fit**	
# of alt. ways used to pay bills	0.569	χ^2=50.8, df=2, p<0.001	

[1] A Maximum Likelihood extraction method was used.

Steps 4 and 5 – Confirm and validate the model: Confirmatory factor analysis (CFA) was used to confirm and validate the EFA results. Figure 3.3-3 shows the path diagram depicting the four items identified in step 3 and the correlation between the inputs and the latent "Economic Index" variable. The statistics confirm that the model fits the data well.[43]

Figure 3.3-3: Confirmatory Factor Analysis Output



To assess convergent validity, the Average Variance Extracted (AVE) was calculated, by averaging the squared factor loadings. The above model results in an AVE score of 0.58. A value above .5 is acceptable. To assess reliability of the items in the model, Cronbach's alpha and Composite Reliability (CR) scores were calculated. The resulting Cronbach's alpha of .84 and CR of .84 indicate a good measure of internal consistency between the four items the EFA identified as potential inputs to the economic index metric.

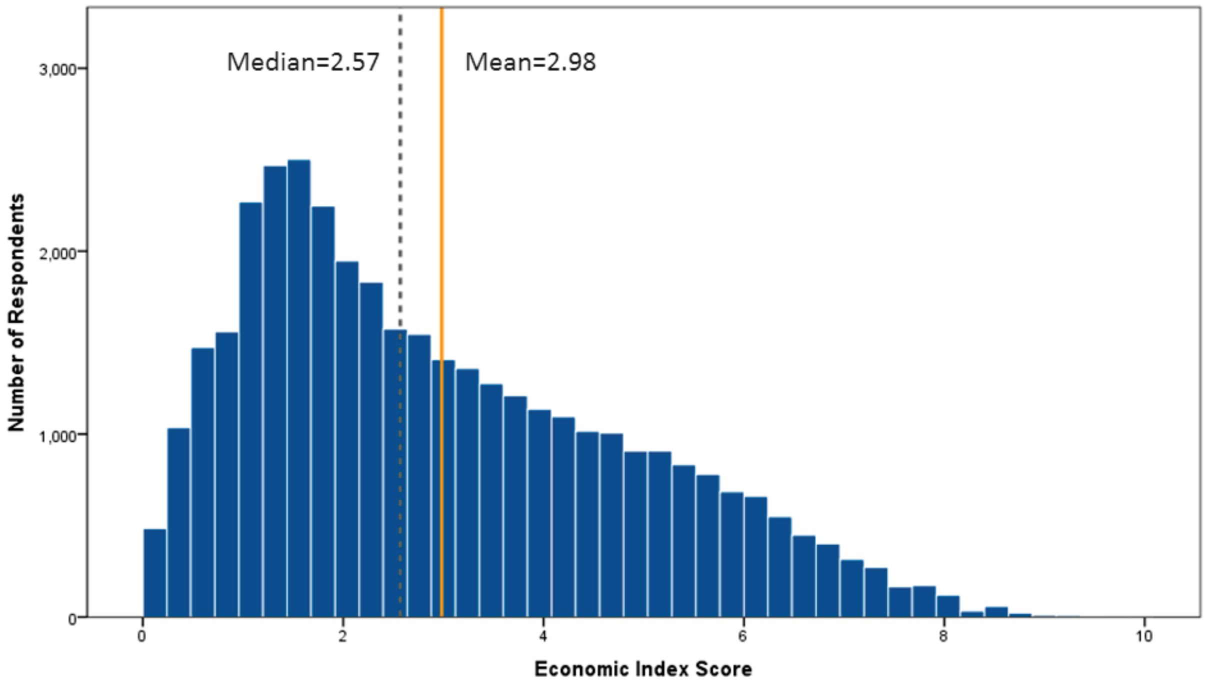
To calculate the final economic index scores, the four items were combined into one metric. For this multi-step process, the z-scored values from the financial well-being index were inverted to match the direction of the other three variables to be included in the index (where higher scores mean higher economic difficulty). Values from these four items were then added into an initial score. To make the metric more transparent, the metric was normalized such that a score of zero means the absence of economic difficulty and 10 means complete economic difficulty as measured by the survey. The following formula was used for normalizing the economic index metric:

[43] χ^2=1.29, df=1, p=0.165 (a non-significant chi-square indicates a good model fit), RMSEA=0.007 (an RMSEA of less than 0.01 also indicates a good fit), CFI = almost 1 (a CFI over .95 indicates good fit).

$$Economic\ Harship\ Score = \frac{(Initial\ Index\ Score + Min\ Observed\ Index\ Score)}{(Max\ Observed\ Index\ Score + Min\ Observed\ Index\ Score)} * 10$$

Figure 3.3-4 shows the distribution of economic index scores for all 2016 survey respondents.

Figure 3.3-4: Histogram of Economic index scores for All 2016 Survey Respondents



Most respondents (84%) provided responses to all questions necessary to calculate the economic index. Non-CARE/FERA customers had higher response rates than CARE/FERA or other targeted segments, but overall the question-level response rates were very high across all segments (Table 3.3-13).

Table 3.3-13: Response Rates for Economic Index Score Questions by Segment

Climate	Segment	% Responding to All Hardship Questions
Total		84%
Hot	Non-CARE/FERA	88%
	CARE/FERA	77%
	CARE/FERA - on or eligible	79%
	Below 100% FPG	78%
	100 to 200% FPG	78%
	Seniors	80%
Moderate	Non-CARE/FERA	88%
	CARE/FERA	78%
	CARE/FERA - on or eligible	79%
Cool	Non-CARE/FERA	89%
	CARE/FERA	79%
	CARE/FERA - on or eligible	80%

Step 6 - Replicate findings: Throughout steps 3 through 5, models were run using a separate subset of the data to replicate findings in real time. This was possible because the sample of data collected for this evaluation was large enough to allow for partitioning the data while still maintaining a large amount of statistical power.

Health Index Development

One of the primary purposes of this study is to assess whether TOU rates increase health-related incidents (resulting from reduced air conditioning use) for particularly vulnerable households, such as seniors or low income customers living in hot climate regions. To test this hypothesis, information on health-related incidents was gathered by asking respondents to report the number of times since June 2016 that they sought medical attention because it was too hot in their homes. Table 3.3-14 summarizes the responses to this question for the full survey sample.

Table 3.3-14: Number of Times Needed Medical Attention Due to Excessive Heat[1]

Response Option	Count	Percent
Never	40,663	92.7%
One	1,065	2.4%
Two	599	1.4%
Three	345	0.8%
Four	211	0.5%
Five	233	0.5%
Six	185	0.4%
Seven	163	0.4%
Eight	136	0.3%
Nine	78	0.2%
Ten	69	0.2%
More than ten times	99	0.2%
Total	43,846	100%

[1] Question asked in survey: Since June 2016, how often, if ever, did you or any members of your household need medical attention because it was too hot inside your home? Please select only one

Given the small number of respondents that chose an option other than "never", an index was constructed indicating whether the respondent's household had at least one medical event due to excessive heat, which served as the dependent variable for the analysis of health issues (Table 3.3-15).

Table 3.3-15: Proportion of Sample with at least One Heat-Induced Medical Event, by IOU[1]

	PG&E		SCE		SDG&E	
	Count	Percent	Count	Percent	Count	Percent
No medical events	14,968	94%	14,413	92%	11,282	92%
At least one medical event	967	6%	1,190	8%	1,026	8%
Total	15,935	100%	15,603	100%	12,308	100%

[1] The data were intentionally not weighted during index development to keep indices relevant for the sample measured.

The health analysis was guided by the following two questions in accordance with P.U. Code 745(c)(2):

- Do senior citizens in hot climate regions experience unreasonable hardship related to health and safety resulting from reduced air conditioning use?

- Do customers eligible for CARE/FERA (economically vulnerable customers) in hot climate regions experience unreasonable hardship related to health and safety resulting from reduced air conditioning use?

To answer these research questions, responses to the health metric for customers that met the following criteria were analyzed:

- Reported having some type of air conditioning at home.[44]
- Noted they had a disability that required their home to be cooled.

By limiting the analysis of the health index to customers with air conditioning and those who noted they had a disability that required their home to be cooled, the ability to observe health effects caused by TOU rates is maximized. For example, Table 3.3-16 shows the number and percent of customers citing they had at least one medical event over the summer. The orange shading indicates the group of customers identified as most relevant to assess health effects due to TOU rates. While customers without air conditioning in their home but with a disability that requires cooling also have a higher proportion of medical events across RCT groups, they are less likely to be affected by TOU rates.

Table 3.3-16: Health Index by AC in Home and Whether Customer Has Disability Requiring Cooling[1]

		No AC in Home				AC in Home			
		No Disability that Reqs Cooling		Has Disability that Reqs Cooling		No Disability that Reqs Cooling		Has Disability that Reqs Cooling	
IOU	Health Index	N	%	N	%	N	%	N	%
PG&E	No medical events	4,301	97%	253	81%	8,077	97%	1,429	80%
	At least one medical event	128	3%	60	19%	284	3%	352	20%
	Total	4,429	100%	313	100%	8,361	100%	1,781	100%
SCE	No medical events	1,435	95%	116	69%	10,068	96%	1,944	80%
	At least one medical event	75	5%	52	31%	419	4%	487	20%
	Total	1,510	100%	168	100%	10,487	100%	2,431	100%
SDG&E	No medical events	2,940	95%	196	64%	6,733	96%	888	74%
	At least one medical event	154	5%	108	36%	299	4%	320	26%
	Total	3,094	100%	304	100%	7,032	100%	1,208	100%

[1] The data were intentionally not weighted during index development to keep indices relevant for the sample measured.

To statistically investigate whether TOU rates caused health difficulty due to reduced air conditioning use, two-proportion z-tests were used to determine if the treatment and control groups differed significantly in the proportion that had at least one medical event due to excessive heat in their home.

3.3.7 Question-Level Analytical Methods

Different statistical tests were used to analyze different types of survey questions. For "yes-no" questions, a z-test for proportions was used to determine differences across RCT groups. For 0-to-10 Likert scale questions, t-tests were used to determine differences across RCT groups (e.g. mean ratings between control respondents and rate 1 respondents). For Likert questions that used fewer levels of rating, such as "never", "sometimes", "always", chi-square statistics were used to compare the number

[44] These included ducted air conditioning, room air conditioning, or heat pumps.

of respondents in each “level” across RCT groups. For all analyses, table notes are provided to indicate the statistical test and alpha level that applies. Statistical details are provided in IOU-level electronic Appendices E-Table 4.5-1, E-Table 5.5-1, and E-Table 6.5-1.

In addition, many of the survey questions are about the respondent who completed the survey (respondent-specific) while other questions are about the whole household (household-specific).[45] For example, the satisfaction rating questions are respondent-specific and the health index questions are household-specific. In the discussion of the survey results, it is noted if the results are reported for the whole household or only the respondent. Respondent-specific results do not provide the ability to infer if the results apply to the whole household. For example, the questions about understanding TOU rates are respondent-specific and it cannot be determined if other household members have a different level of understanding than the respondent.

3.3.8 Caution on Sample Sizes and Statistical Significance

For individual question analyses, please interpret statistically significant results with caution. There are many respondents in each cell of this study and many questions yielded statistically significant results that are not meaningful. For example, statistically significant differences were found between average ratings of 6.7 and 6.1 for a control versus rate group t-test. A difference of 0.6 on an 11-point rating scale is not meaningful.

> **Statistically Significant Differences May Not be Meaningful Differences**
>
> The large survey sample sizes obtained for this evaluation provide an unusually high degree of statistical power. As such, even quite small differences in two values may be found to be statistically significant. However, such differences may have little practical significance.

Further, in the analysis across IOUs, climate region, and segments, more than 5,500 tables were generated and over 13,500 statistical tests were conducted. An alpha level of 0.05 was used to assess statistical significance, and results in about a five percent error rate when “differences” are identified between groups. So many statistical tests, and so many respondents, mean some reported differences that, while statistically significant in the sample, are not significant in the real world. It is recommended to look at overall patterns across rate groups and segments to identify meaningful differences that are caused by TOU rates.

3.3.9 Understanding the Economic Index Metric

To facilitate understanding of the economic index scores, a series of Classification and Regression Tree (CART) analyses were done to show how the economic index metric corresponds with respondents’ demographics and the original component questions. Because the economic index is a new metric, CART analysis can be used to show average scores broken down by more concrete questions like income and presence of children in the home. Respondent scores ranged from a low of zero to a high of 10, which are the minimum and maximum scores anyone can get with this metric.

[45] Between 88% and 95% of respondents reported that their name is on the bill they receive from their IOU.

Table 3.3-17[46] shows the relationship between the economic index metric and its component questions. The average group index scores observed here range from a low of 0.86 to a high of 7.15, suggesting the component items optimally differentiate economic index scores. The CART output also shows that the number of times respondents had difficulty paying their bills and their concern rating about paying bills help to differentiate index scores the most. Cutting back on essentials also served to distinguish subsets of respondents with higher than average economic index scores. Further, for respondents with very high economic index scores, whether a respondent left bills unpaid at the end of the month helped to further differentiate respondents' scores. Consequently, respondents who had difficulty paying their bills three or more times since June 2016, worried about paying their bills, and had to leave bills unpaid at the end of the month have the highest economic index scores.

Table 3.3-18 shows the relationship between key demographic questions and the economic index metric. Customers who make less money, have a medical condition, or have children are more likely to have higher economic index scores than respondents who make more money, have a higher education, or do not have children living with them. The group with the highest average score in this analysis consists of respondents who make between $17,000 and $25,000 dollars a year, have a medical condition that requires them to be home during the day, and who have one or more children living at home (average index score of 5.26 compared to the grand mean of 2.99).

[46] These tables are descriptive only. Statistical comparisons for TOU rate and control groups for each IOU are provided in Sections 4, 5 and 6.

Table 3.3-17: CART Breakdown of the Economic Index by Component Questions

Parent	Split Values	Avg. Econ Score	Graph
	Grand Mean	2.99	
No Difficulty paying bills	--	1.81	
	Did not cut back on essentials	1.53	
	Just getting by = Not at all agree	0.86	
	Just getting by = Very little	2.09	
	Just getting by = Somewhat; Very well	1.54	
	Just getting by = Completely	2.60	
	Cut back on essentials	2.94	
	Worry about paying bills - Not at all	2.26	
	Worry about paying bills - 1	2.50	
	Worry about paying bills - 2, 3	2.86	
	Worry about paying bills - 4, 5	3.44	
	Worry about paying bills - 6, 7	3.81	
	Worry about paying bills - > 7	4.41	
Difficulty paying bills - ONCE	--	3.47	
	Worry about paying bills - Not at all	2.26	
	Did not cut back on essentials	2.00	
	Cut back on essentials	2.84	
	Worry about paying bills - 1	2.69	
	Worry about paying bills - 2, 3	3.03	
	Did not cut back on essentials	2.66	
	Cut back on essentials	3.44	
	Worry about paying bills - 4, 5	3.58	
	Did not cut back on essentials	3.16	
	Cut back on essentials	3.94	
	Worry about paying bills - 6, 7	4.12	
	Did not cut back on essentials	3.70	
	Cut back on essentials	4.37	
	Worry about paying bills - 8, 9	4.62	
	Worry about paying bills - 10	5.15	

Parent	Split Values	Avg. Econ Score	Graph
Difficulty paying bills - TWO times	--	4.38	
	Worry about paying bills - Not at all	2.81	
	Worry about paying bills - 1	3.29	
	Worry about paying bills - 2, 3	3.76	
	Did not cut back on essentials	3.27	
	Cut back on essentials	4.08	
	Worry about paying bills - 4, 5	4.23	
	Did not cut back on essentials	3.86	
	Cut back on essentials	4.50	
	Worry about paying bills - 6, 7	4.66	
	Did not cut back on essentials	4.12	
	Cut back on essentials	4.93	
	Worry about paying bills - 8, 9	5.13	
	Did not cut back on essentials	4.72	
	Cut back on essentials	5.35	
	Worry about paying bills - 10	5.61	
	Did not cut back on essentials	5.11	
	Cut back on essentials	6.00	
Difficulty paying bills - THREE or more times	--	5.68	
	Worry about paying bills - 0, 1	3.75	
	Did not cut back on essentials	3.38	
	Cut back on essentials	4.09	
	Worry about paying bills - 2, 3	4.35	
	Reduced electricity use	4.60	
	Did not reduce electricity use	4.17	
	Worry about paying bills - 4, 5	4.90	
	To pay bills - Did NOT use credit card	4.66	
	To pay bills - Used credit card	5.49	
	Worry about paying bills - 6, 7	5.49	
	Did not cut back on essentials	5.00	
	Cut back on essentials	5.74	
	Worry about paying bills - 8, 9	5.98	
	To pay bills - Able to pay HH bills	5.54	
	To pay bills - Left bills HH unpaid	6.64	
	Worry about paying bills - 10	6.66	
	To pay bills - Able to pay HH bills	6.12	
	To pay bills - Left bills HH unpaid	7.15	

Table 3.3-18: CART Breakdown of Economic Index by Key Demographics

Income	Variable	Avg. Econ Score	Graph
Grand Mean		2.99	
Less than $12K	--	4.63	
	Medical cond. that needs cooling	5.04	
	Receives disability payments	5.17	
	Does NOT get disability payments	4.93	
	No medical cond. that needs cooling	4.40	
	No children under 6	4.28	
	One or more children under 6	5.17	
$12K to less than $17K	--	4.10	
	No children under 18	3.90	
	Medical cond. that needs cooling	4.40	
	No medical cond. that needs	3.71	
	One or more children under 18	4.70	
$17K to less than $25K	--	3.97	
	No medical cond. requiring being home	3.73	
	No children under 6	3.60	
	One or more children under 6	4.49	
	Medical cond. requiring being home	4.47	
	No children under 18	4.26	
	One or more children under 18	5.26	
$25K to less than $29K	--	3.60	
	No children under 18	3.33	
	No room AC	3.26	
	Has room AC	3.53	
	One or more children under 18	4.30	
$29K to less than $41K	--	3.56	
	No children under 18	3.27	
	Rents house	3.74	
	Owns house	2.99	
	One or more children under 18	4.27	
	Medical cond. that needs cooling	4.96	
	No medical cond. that needs cooling	4.09	

Income	Variable	Avg. Econ Score	Graph
Grand Mean		2.99	
$41K to less than $50K	--	3.11	
	No children under 18	2.83	
	Rents house	3.10	
	Owns house	2.70	
	One or more children under 18	3.96	
	Rents house	4.34	
	Owns house	3.54	
$50K to less than $100K	--	2.46	
	No children under 18	2.19	
	Medical cond. that needs cooling	2.92	
	No medical cond. that needs cooling	2.09	
	One or more children under 18	3.41	
	No medical cond. requiring being home	3.29	
	Medical cond. requiring being home	3.87	
$100K or more	--	1.54	
	No children under 18	1.45	
	Not employed full time	1.29	
	Employed full time	1.54	
	One or more children under 18	1.83	
	Technical, Four-year, High school	1.90	
	Graduate or professional degree	1.66	
	Some college, no degree; Two-year	2.20	
Not provided	--	2.58	
	Rents house	3.43	
	No medical cond. requiring being home	3.24	
	Medical cond. requiring being home	3.85	
	Owns house	2.19	
	Medical cond. that needs cooling	2.88	
	No medical cond. that needs cooling	2.03	

Figure 3.3-5 shows an example set of responses to the questions included in the economic index for a score of 2.48 – a typical non-CARE/FERA score.

Figure 3.3-5: Response Example for Low Economic Index Score (Typical of a Non-CARE/FERA response)

Economic Index Score	2.48

Since June 2016, how well does this statement describe you and your situation? Please select one for each statement.	Response
Because of my money situation, I feel like I will never have the things I want in life	Very little
I am just getting by financially	Very little
I am concerned that the money I have won't last	Very little

How often does this statement apply to you?	Response
I have money left over at the end of the month	Often
My finances control my life	Rarely

Enter your age (Below age 62 will yeild slightly higher scores)	48

How did your household afford to pay electricity bills and/or other basic needs this summer?	Put 1 for each used
Use your household's savings or other investments	
Cut back on non-essential spending for things your household wants	
Reduce your household energy usage	1
Borrow money from family, friends, or peers	
Borrow money using a short term loan	
Use a credit card that you can't pay off right away	
Leave rent/mortgage unpaid	
Leave some household bills unpaid past the due date	
Received emergency assistance from [IOU NAME]	
Received emergency assistance from other city or regional programs	

Since June 2016, how many times, if at all, has your household had difficulty paying your bills?	Response
Electricity bill	None
Bills for other basic needs such as food, housing, medicine, and other important bills	None

Item (0 = not at all agree, 10 = completely agree)	Enter 0 to 10
I often worry whether there is enough money to pay my electricity bill.	6

Figure 3.3-6 below shows an example set of responses to the questions included in the economic index for a score of 4.17 – a typical CARE/FERA score.

Figure 3.3-6: Response Example for High Economic Index Score (Typical of a CARE/FERA response)

Economic Index Score	4.17

Since June 2016, how well does this statement describe you and your situation? Please select one for each statement.	Response
Because of my money situation, I feel like I will never have the things I want in life	Somewhat
I am just getting by financially	Somewhat
I am concerned that the money I have won't last	Somewhat

How often does this statement apply to you?	Response
I have money left over at the end of the month	Rarely
My finances control my life	Often

Enter your age (Below age 62 will yeild slightly higher scores)	48

How did your household afford to pay electricity bills and/or other basic needs this summer?	Put 1 for each used
Use your household's savings or other investments	
Cut back on non-essential spending for things your household wants	1
Reduce your household energy usage	1
Borrow money from family, friends, or peers	
Borrow money using a short term loan	
Use a credit card that you can't pay off right away	
Leave rent/mortgage unpaid	
Leave some household bills unpaid past the due date	
Received emergency assistance from [IOU NAME]	
Received emergency assistance from other city or regional programs	

Since June 2016, how many times, if at all, has your household had difficulty paying your bills?	Response
Electricity bill	1 time
Bills for other basic needs such as food, housing, medicine, and other important bills	None

Item (0 = not at all agree, 10 = completely agree)	Enter 0 to 10
I often worry whether there is enough money to pay my electricity bill.	8

4 PG&E Evaluation

This report section summarizes the design, implementation, and evaluation of the PG&E pilot. It begins with a summary of the rate and other treatments that were tested in the pilot. This is followed by a brief overview of the pilot implementation process, which includes a discussion of enrollment rates and customer attrition. Section 4.3 presents the load impact estimates for each rate and complementary treatment and Section 4.4 summarizes the bill impacts. Section 4.5 presents the survey results, including key findings regarding hardship for selected customer segments. The final section contains a high level summary and synthesis of the survey and impact findings.

4.1 Pilot Treatments

PG&E filed its Advice Letter (AL) 4764-E on December 24, 2015 describing its plan to implement opt-in TOU pilots as required under Decision 15-07-001. The Commission approved PG&E's AL with some modifications on February 25, 2016 (Resolution 4762-E). PG&E's pilot plan involves testing three TOU rate plans, which vary with respect to the number of rate periods and the prices in each period, as summarized in Table 4.1-1 and Figures 4.1-1 through 4.1-3.

Emphasis on Evening Peak Periods

All three of PG&E's pilot tariffs have peak periods that include the prime evening hours from 6 to 9 PM.

Table 4.1-1: Summary of PG&E's TOU Rates

Rate Description		Rate 1	Rate 2	Rate 3
Rate Periods	Summer	2	3	2
	Winter	2	2	2
	Spring	N/A	N/A	3
Highest Price Differential (¢)	Summer	10.3	14.9	28.6
	Winter	1.9	2.6	1.9
	Spring	N/A	N/A	18.0
Peak Period		4-9 PM	6-9 PM	4-9 PM
Duration of Peak		5 Hours	3 Hours	5 Hours
Super Off-Peak?		No	No	Yes
Super On-Peak?		No	No	No

Figure 4.1-1: TOU Pilot Rate 1 (Hour Ending)[47]

Tariff	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Off-Peak (31.67¢)																Peak (41.97¢)							
	Winter	Off-Peak (27.1¢)																Peak (28.98¢)							
	Spring	Off-Peak (27.1¢)																Peak (28.98¢)							
Weekend	Summer	Off-Peak (31.67¢)																							
	Winter	Off-Peak (27.1¢)																							
	Spring	Off-Peak (27.1¢)																							

Figure 4.1-2: TOU Pilot Rate 2 (Hour Ending)

Tariff	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Off Peak (29.59¢)																Partial Peak (39.27¢)		Peak (44.48¢)					
	Winter	Off Peak (26.99¢)																		Peak (29.6¢)					
	Spring	Off Peak (26.99¢)																		Peak (29.6¢)					
Weekend	Summer	Off Peak (29.59¢)																Partial Peak (39.27¢)		Peak (44.48¢)					
	Winter	Off Peak (26.99¢)																		Peak (29.6¢)					
	Spring	Off Peak (26.99¢)																		Peak (29.6¢)					

Figure 4.1-3: TOU Pilot Rate 3 (Hour Ending)

Tariff	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Off-Peak (28.59¢)																Peak (57.19¢)							
	Winter	Off-Peak (27.08¢)																Peak (28.97¢)							
	Spring	Off Peak (26.74¢)										Super Off-Peak (18.02¢)						Peak (36.05¢)							
Weekend	Summer	Off-Peak (28.59¢)																							
	Winter	Off-Peak (27.08¢)																							
	Spring	Off Peak (26.74¢)										Super Off-Peak (18.02¢)													

Prices in the figures do not reflect the baseline credit of 11.71¢/kWh. This credit is applied to usage up to 100% of the baseline quantity in each climate region. The baseline credit significantly reduces average prices, especially for lower usage customers.

Rate 1 is a simple, two-period rate with weekday peak period from 4 to 9 PM all year long and off-peak prices in effect on all other weekday hours and for all hours on weekends. The tier-2, peak-to-off-peak price ratio in the summer is roughly 1.3 to 1 and is very modest in the winter (non-summer months).

Rate 2 is slightly more complex than Rate 1 as it adds a summer "Partial-Peak" period covering the two hours immediately preceding and the one hour immediately following the three-hour Peak period that runs from 6:00 to 9:00 PM on weekdays and weekends. In order to offset the additional complexity incurred with a third TOU period, PG&E kept the same prices in effect on both weekdays and weekends.

[47] The prices included in these figures are taken from PG&E's filing and are subject to adjustments that may occur for PG&E's Rate 1 over the course of the pilot.

Rate 3 is more complex than Rates 1 and 2. It includes TOU pricing in the spring (from March until May) that differs from pricing in the winter in order to allow for lower prices during low-cost hours from 10:00 am until 4:00 PM to be charged in a “Super-Off-Peak” period. The “Super-Off-Peak” period coincides with the period CAISO identifies as being at high risk for excess supply in the future. Rate 3 has the same design as Rate 1 for the summer and winter seasons, with peak times from 4:00 to 9:00 PM and all other hours being off-peak. In the spring, the peak hours are also the same as Rate 1, but the remaining hours are divided into off-peak and super-off-peak periods.

In addition to the rate treatments summarized above, PG&E also offered a smartphone app to approximately half of all pilot participants on one of the three rate plans (control group not included). The HomeBeat app by Bidgely provides a means to visualize electricity usage data. In order to encourage energy reductions, the app conveys a variety of useful information to TOU participants, including: pricing information; TOU-specific performance feedback; bill projections, and energy saving tips informed by user specific end use load disaggregation, in order to encourage energy savings.

The objective of this treatment is to assess the impact that the application has on customer acceptance, engagement, satisfaction, and understanding of TOU rates and also to estimate load impacts of the smartphone app if a sufficient number of pilot participants chose to use it. PG&E implemented the study by randomly assigning customers into two groups, and offering the app to only one of the two groups. Roughly 300 customers out of 7,016 who were invited to download the app successfully did so, completed registration and connected the app to their accounts.

4.2 Implementation Summary

The sampling plan for PG&E’s hot climate zone oversampled selected customer segments such as low income and senior households and oversampled CARE/FERA customers in climate regions designated as hot, moderate, and cool. Table 4.2-1 summarizes the target enrollment for various treatments and customer segments that was designed to meet the requirements in PG&E Resolution E-4762. PG&E’s Rate 1 was the pilot tariff designated for oversampling in the hot climate zone for purposes of assessing hardship for seniors and low income households. The sampling strategy in the hot climate region involved a combination of recruitment from the general population as well as segment specific targeting of seniors and low income customers based on information contained in PG&E’s Experian database. Recruiting customers according to the plan in Table 4.2-1—and using the Experian data and assumptions about the incidence rate of customers that meet the various income and age characteristics defined in the resolution—would result in a distribution of enrolled customers by microsegment in the hot climate region as shown in the column labeled “Count” in Table 4.2-2. The right hand column in the table shows the required sample sizes for each segment from the Resolution. As seen, this would result in enrollment that exceeds the required sample sizes in all cases. CARE/FERA customers were oversampled in all climate regions.

Table 4.2-1: PG&E Sampling Plan

Climate Zone	Segment	Random Sample				Targeted		
		Rate 1	Rate 2	Rate 3	Control	Rate 1	Control	Total
Hot	CARE/FERA	725	600	600	725	1,000	1,000	4,650
	Non-CARE/FERA	1,150	600	600	1,150	500	500	4,500
	Total	1,875	1,200	1,200	1,875	1,500	1,500	9,150
Moderate	CARE/FERA	600	600	600	600	—	—	2,400
	Non-CARE/FERA	600	600	600	600	—	—	2,400
	Total	1,200	1,200	1,200	1,200	—	—	4,800
Cool	CARE/FERA	600	600	600	600	—	—	2,400
	Non-CARE/FERA	600	600	600	600	—	—	2,400
	Total	1,200	1,200	1,200	1,200	—	—	4,800
All	CARE/FERA	1,925	1,800	1,800	1,925	1,000	1,000	9,450
	Non-CARE/FERA	2,350	1,800	1,800	2,350	500	500	9,300
	Total	4,275	3,600	3,600	4,275	1,500	1,500	18,750

Table 4.2-2: Distribution of Enrolled Customers on Rate 1 in PG&E's Hot Climate Zone by Customer Segment

Customer Segment	Count	Requirement
Seniors < 100% FPG	335	313
Seniors > 100% FPG	1,132	313
CARE/FERA < 100% FPG	507	313
CARE/FERA > 100% FPG	1,218	313
100–200% FPG	790	313
Seniors	1,466	625
CARE/FERA	1,725	625
< 100% FPG	633	625
100–200% FPG	790	625

Prior to pulling the recruitment sample, selected customers were screened out from participating in the pilot. A detailed accounting of all exclusion criteria is contained in Section 3.1 of Appendix Volume 1. After applying all exclusions, PG&E had an eligible population of roughly 3.6 million customers.

4.2.1 Customer Recruitment

In order to determine the size of the recruitment sample needed to meet the enrollment targets summarized above, and to assess the costs of various recruitment options, PG&E conducted a pre-test in January 2016. The pretest varied the delivery mode (FedEx versus USPS), the total incentives paid out and the timing of the incentive amounts (e.g., more upfront versus more tied to survey completion). Eight different combinations of delivery mode and incentive combinations were tested on a sample of 1,970 customers. Response rates varied from a low of roughly 3% to a high of 13% with the average response rate across all eight options equaling roughly 8%. While response rates for FedEx were more than twice those for USPS, the cost was more than 10 times higher. As such, USPS delivery was chosen for pilot recruitment. Based in part on its own pretest results as well as those of the other two IOUs, PG&E decided to offer a $200 enrollment incentive for the pay-to-play recruitment, with $75 paid after enrollment, $50 for completion of the first survey in Fall 2016 and $75 for completion of the second survey in Summer 2017.

Based on input from the pretests, PG&E decided to mail out roughly 350,000 invitation letters over a four-day period starting on April 1, 2016. The solicitation emphasized the importance of the study, the financial incentive participants would receive, what was expected from participants and what they could expect over the course of the pilot, and the fact that participation was risk free due to bill protection. It also set a cutoff date for enrollment of April 22. TOU rates were described in very general terms but the specific rates included in the pilot were not described in detail as customers were to be randomly assigned to the rate options after agreeing to be in the study.

The engagement letter provided a toll free phone number, a link to the PG&E TOU website, as well as a postage paid enrollment card/form that customers could fill out and return to PG&E. The enrollment form acted as a survey aimed at gathering important data regarding income, senior status, email addresses, and a few other variables. Customers for whom PG&E had email addresses (approximately 1/3 of the sample) also received an email solicitation in about a week after the letter was sent. The recruitment email conveyed the same messaging as the solicitation letter, and included a link to the PG&E TOU website, as well as a Pilot hotline for enrollment.

Table 4.2.1-1 shows the number of customers that received solicitations in each segment, the number who accepted the offer, and the acceptance rate. The overall acceptance rate for the non-app treatment groups was 7%. Acceptance rates for the tariff treatment varied from a low of 5% for non-targeted, non-CARE individuals in hot climate region, to a high of 11% for CARE individuals in cool climate region. Importantly, the acceptance rates across groups are not directly comparable. For some sub-segments that were under the target level by the April 22 close date, PG&E allowed enrollment to extend beyond that date while cutting off those that exceeded the enrollment target. For one group, non-CARE customers in the moderate climate zone, recruitment was far enough below the target level that PG&E conducted outbound calling to meet the enrollment requirements. As such, the acceptance rates for each group reflect a combination of different time periods and, in one case, a mixed mode recruitment process near the end of the recruitment period. Given this, one cannot draw conclusions about how acceptance rates differ across segments by simply comparing the rates in Table 4.2-3.

Table 4.2-3: PG&E Offers and Acceptances by Partition and Strata

Category	Hot Climate Region			
	Non-Targeted		Targeted	
	CARE	Non-CARE	CARE	Non-CARE
Offers	66,534	87,890	49,999	25,000
Acceptances	4,393	4,144	4,442	1,815
Acceptance Rate	7%	5%	9%	7%

Category	Moderate Climate Region		Cool Climate Region		Pretest	Total
	CARE	Non-CARE	CARE	Non-CARE		
Offers	30,164	30,601	30,119	30,413	1,972	350,720
Acceptances	2,866	2,434	3,204	2,644	191	25,942
Acceptance rate	10%	8%	11%	9%	10%	7%

In July 2016, roughly 50% of all customers who were enrolled on pilot rates received an invitation to download the HomeBeat app by Bidgely. The invitation outlined the app's functionality, step-by-step instructions for download, as well as contact information for Bidgely and the TOU study phone line. The invitation was sent by both email and mail, with very similar designs. As previously mentioned, acceptance rates for the smart phone app were quite low.

4.2.2 Rate Assignment and Enrollment

Not all customers who agreed to participate in the pilot were actually placed on a TOU tariff or assigned to the control group. There were several reasons why customers were not placed on one of the rate treatments or assigned to the control group. First, their eligibility might have changed between the time they were selected into the recruitment sample and when they accepted the offer, or between the time they were assigned to a treatment condition and when enrollment was scheduled to occur, which was on the first billing cycle date to occur after June 1. For example, a customer might have closed their account, become a net metered customer, or enrolled into the medical baseline program during this period, all of which would lead to being declared ineligible for the study.

Another reason why some customers who accepted the offer were not enrolled was due to over recruitment. As indicated in Table 4.2-1, PG&E targeted to enroll 18,750 customers, but almost 26,000 customers accepted the pilot offer. In most strata, save for Non-CARE individuals in the moderate climate region (which had a lower acceptance rate and proved difficult to meet the target), PG&E accepted more than the target level of enrollees. Overall, PG&E accepted almost 21,000 customers into the pilot and turned away 4,600 customers due to over enrollment. Both those declined due to over enrollment or due to a change in eligibility were sent a decline notice and offered a 4-pack of LED light bulbs as recompense.

Table 4.2-4 shows the progression of customers from acceptance to enrollment. Once ineligible customers were eliminated and those who were declined due to over recruitment were purged from the sample, the remaining customers were randomly assigned to treatment or control conditions. Another change that occurred during this process was that some customers were reassigned to segments based on data gathered through the enrollment survey. The original sample for targeted segments such as seniors above and below the poverty level was based on information on income and the age of the PG&E accountholder contained in PG&E's Experian database. However, data on these variables was collected from the vast majority of participants at the time of enrollment. As such, the enrollment survey data was used first to classify customers, with the Experian data only used in the rare instances when the respondent did not provide demographic data in their enrollment survey. In addition, customers were reclassified using an alternative definition of senior households from the one used to draw the original sample. The original sample was based on a definition of seniors tied to the age of the customer of record on the account. Subsequently, the Commission directed the IOUs to define senior households as any household where one or more people were aged 65 or older. This change increased the number of senior households in the sample by about 10 percent.

Table 4.2-4: Distribution of PG&E Customers from Acceptance to Enrollment

Category	Hot Climate Zones, CARE Customers	Hot Climate Zones, Non-CARE Customers	Hot Targeted Climate Zones, CARE Customers	Hot Targeted Climate Zones, Non-CARE Customers	Moderate Climate Zones, CARE Customers	Moderate Climate Zones, Non-CARE Customers	Cool Climate Zones, CARE Customers	Cool Climate Zones, Non-CARE Customers	Total
Offers	66,534	87,890	49,999	25,000	30,164	30,601	30,119	30,413	350,720
Acceptances	4,393	4,144	4,442	1,815	2,866	2,434	3,204	2,644	25,942
Acceptance rate	7%	5%	9%	7%	10%	8%	11%	9%	7%
Ineligible Prior to Rate Assignment	53	50	35	8	21	31	23	27	248
Moved	43	36	20	7	19	29	17	25	196
Medical	0	0	0	0	0	0	0	0	0
NEM	0	0	0	0	0	0	0	0	0
Participation in Rate Program	3	8	6	0	0	1	5	1	24
Other	7	6	9	1	2	1	1	1	28
Opt-Out Prior to Rate Assignment	1	2	0	0	0	0	1	0	4
Random Over Enrollment Declines	1,316	319	1,486	662	192	28	643	44	4,690
Assignments	3,023	3,773	2,921	1,145	2,653	2,375	2,537	2,573	21,000
Customers Assigned to a Pilot Rate	3,023	3,773	2,921	1,145	2,653	2,375	2,537	2,573	21,000
Rate 1	827	1,239	1,461	573	664	595	635	644	6,638
Rate 2	685	648	0	0	664	594	634	643	3,868
Rate 3	685	648	0	0	663	593	634	643	3,866
Control	826	1,238	1,460	572	662	593	634	643	6,628
Target enrollment	2,650	3,500	2,000	1,000	2,400	2,400	2,400	2,400	18,750
% of Target achieved	114%	108%	146%	115%	111%	99%	106%	107%	112%
Customers Sent to Rate Transition Process	3,007	3,746	2,909	1,138	2,645	2,370	2,528	2,566	20,909
Customers Successfully Transitioned to a Pilot Rate	2,952	3,692	2,897	1,130	2,626	2,356	2,514	2,546	20,713

Once the cell assignments were made, customers were notified of their acceptance into the pilot through the Welcome Package that was sent to customers. Study participants began receiving Welcome Kits in mid-May, 2016 dependent on their individual treatment status. The treatment groups (designated as, Time-of-day Study 4 to 9 pm, Time-of-day Study 6 to 9 pm and Time-of-day Study Three Seasons for Rates 1, 2 and 3 respectively) received similar welcome kits outlining the entire study timeframe, incentive requirements and schedules and bill protection and providing a telephone number and treatment specific website for any inquiries. The welcome kits effectively illustrated Peak, Partial Peak, Off-Peak, and Super Off-Peak periods using study-specific infographics, color-coded clocks, and seasonal timelines. The welcome kits outlined an effective strategy for study participants to lower or maintain their electricity bills by shifting usage from peak to off-peak times.

The control group also received a Welcome Kit explaining that they were to remain on their current monthly rate plan throughout the study. The mailer included an outline of the entire study timeframe, incentive requirements and schedules, as well as a telephone line for study inquires. Energy conservation tips were also included in the mailer alongside a website link for further information.

4.2.3 Customer Attrition

Table 4.2-5 shows customer attrition from the pilot between when customers were assigned to a rate in May and December 31, 2016. Attrition over that period was the result of changes in eligibility, customers closing their account due to moving (e.g., customer churn), and customers actively choosing to opt out of the pilot. Attrition is divided into three periods: the time between rate assignment/ notification and when customers were submitted for a rate change; the time during the rate transition process; and the time between transfer onto the rate and December 31.

Opt-Out Rates Were Quite Low

Only about 2% of customers dropped off the pilot rates over the roughly six month period from enrollment in June through the end of December. Opt-out rates were slightly higher in the hot climate region compared with the moderate and cool regions, and slightly higher for non-CARE/FERA customers than for CARE/FERA customers, but all differences across regions and customer segments are small. There is no meaningful difference in the opt-out rates across the three pilot tariffs.

Over this period, 2,417 customers left the pilot due either to ineligibility, moving or proactively dropping out. Of this total, roughly 44% left because they moved location. Given that this period of time covered roughly seven months (mid-May through December), this equates to approximately 152 customers moving each month, or an annual churn rate of 1,824, or less than 10%. This is significantly less than the assumed churn rate underlying the sampling plan, which was in the 15% to 20% range.

Out of the total attrition of 2,417, 2,178 (or 90%) occurred after customers were enrolled onto the rate. Drop outs occurring over the roughly six month period following transition onto a rate (or control) equaled 398, or 2.1% of the 18,583 customers who were enrolled onto a rate or placed into the control group. Almost twice that number (788) became ineligible during that same period. The vast majority of these were customers who switched their service to one of several Community Choice Aggregators (CCAs) that are active in PG&E's service territory. Losses to CCAs are concentrated in PG&E's moderate and cool regions and are expected to continue over the course of the pilot. These losses may lead to sample sizes during the second summer of the study that dip below the minimum planning target in the moderate and cool regions but are not expected to significantly impact the hot climate region test cells.

Table 4.2-5: PG&E Customer Attrition

Attrition Reason	Hot Climate Zones, CARE Customers	Hot Climate Zones, Non-CARE Customers	Hot Climate Zones, Non-Senior CARE Customers below FPL	Hot Climate Zones, Non-Senior CARE Customers above FPL	Hot Climate Zones, Seniors below FPL	Hot Climate Zones, Seniors above FPL	Moderate Climate Zones, CARE Customers	Moderate Climate Zones, Non-CARE Customers	Cool Climate Zones, CARE Customers	Cool Climate Zones, Non-CARE Customers	None	Total
Customers assigned to rate treatment or control	3,023	3,773	398	306	745	2,580	2,653	2,375	2,537	2,573	37	21,000
Customers transitioned to pilot rate (or control custome	2,951	3,692	390	302	735	2,547	2,616	2,352	2,503	2,538	35	20,661
Customers enrolled as of 12-31-2016	2,621	3,394	332	264	678	2,423	2,278	2,038	2,337	2,190	28	18,583
Ineligible Post-Rate Assignment	**68**	**44**	**7**	**3**	**18**	**30**	**212**	**175**	**69**	**223**	**3**	**852**
Ineligibles, Prior to Rate Change Process	3	1	0	0	0	1	0	1	0	0	1	7
Ineligibles, During Rate Change Process	11	10	1	0	4	4	6	7	6	10	0	59
Ineligibles, Post-Rate Change	54	33	7	3	14	25	206	167	63	214	2	788
Moved Post-Rate assignment	**251**	**177**	**51**	**33**	**36**	**70**	**130**	**101**	**110**	**107**	**4**	**1,070**
Moves, Prior to Rate Change Process	4	5	2	0	0	0	3	0	5	1	0	20
Moves, During Rate Change Process	12	9	0	2	0	3	12	5	7	8	0	58
Moves, Post-Rate Change	235	163	49	31	36	67	115	96	98	98	4	992
Opt-Out Post-Rate Assignment	**83**	**158**	**8**	**6**	**13**	**57**	**33**	**61**	**21**	**53**	**2**	**495**
Opt-Outs, Prior to Rate Change Process	9	21	1	0	2	11	5	4	4	6	1	64
Opt-Outs, During Rate Change Process	4	17	1	0	0	5	1	2	1	2	0	33
Opt-Outs, Post-Rate Change	70	120	6	6	11	41	27	55	16	45	1	398
Total	**402**	**379**	**66**	**42**	**67**	**157**	**375**	**337**	**200**	**383**	**9**	**2,417**
Attrition rate	13%	10%	17%	14%	9%	6%	14%	14%	8%	15%	24%	12%

Figures 4.2-1 through 4.2-3 show the cumulative opt-out rates over time for each test cell and climate region. The cumulative number of opt-outs is highest in the hot region, second highest in the moderate region and lowest in the cool region. The number of control customers dropping out is very low in all climate regions. The cumulative opt-out rate in the moderate and cool regions is below 2% for all customer segments and rates. In the hot region, the opt-out rate exceeds 2% for four customer-segment/rate combinations, all of them involving non-CARE/FERA customers. Almost 4.5% of non-CARE/FERA customers on Rate 3 in the hot climate region have dropped out of the study. Overall, opt out rates were slightly higher for non-CARE/FERA customers than for CARE/FERA customers. While there is evidence of an upturn in the opt-out rates starting in late July, after the first bills were sent out, there is also evidence of a significant leveling off near the beginning of October, when customers were transitioned to the winter rate period.

Figure 4.2-1: PG&E Opt Outs by Month – Hot Climate Region

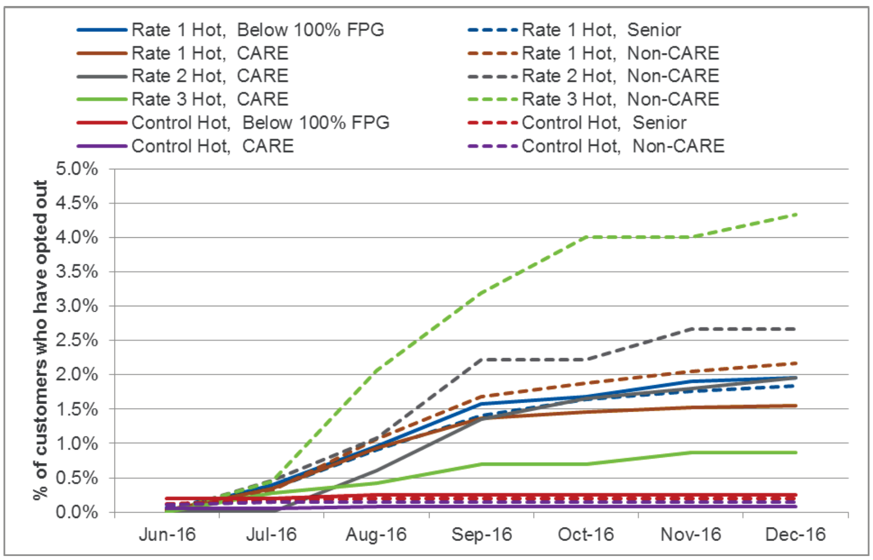


Figure 4.2-2: PG&E Opt Outs by Month – Moderate Climate Region

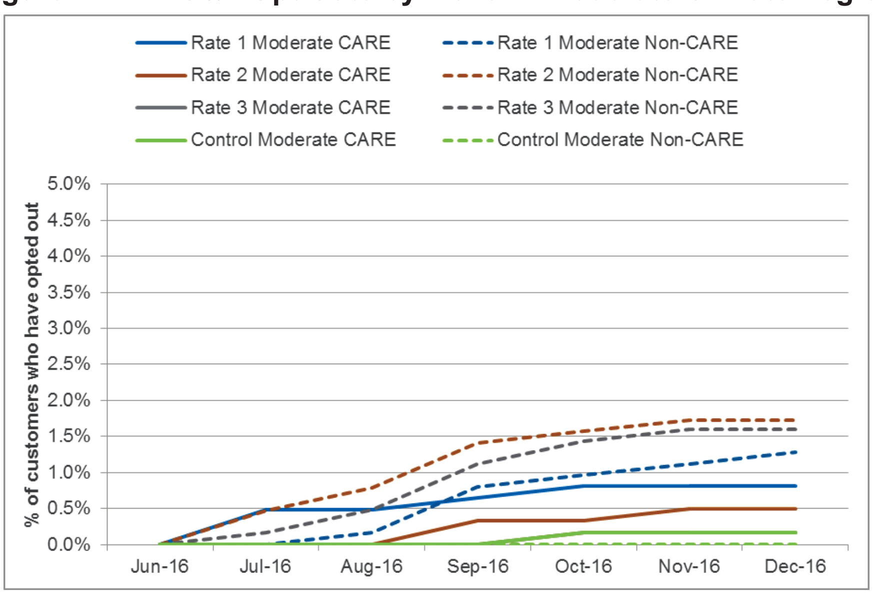


Figure 4.2-3: PG&E Opt Outs by Month – Cool Climate Region

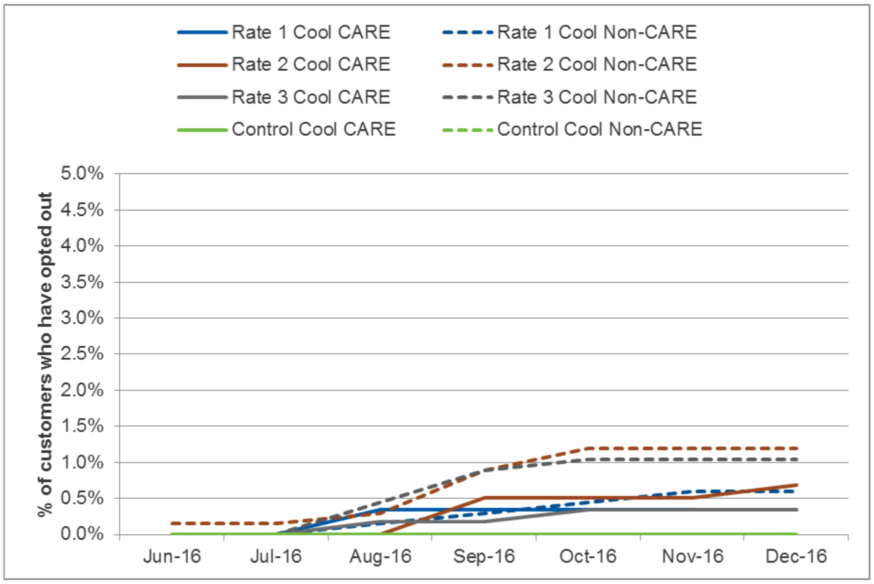
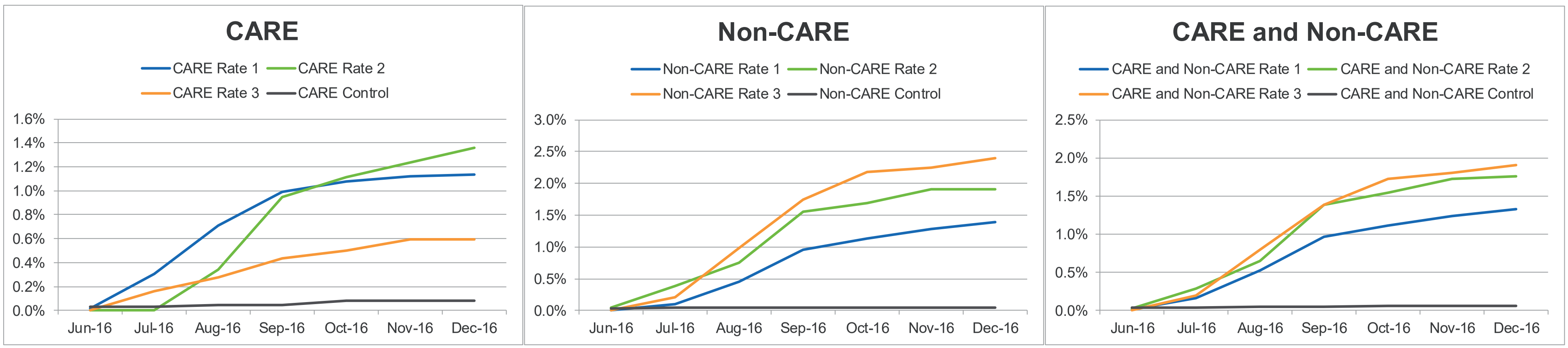


Figure 4.2-4 shows the cumulative percent of customers that opted out of each tariff for the CARE/FERA, non-CARE/FERA segments and for the total population across PG&E's service territory as a whole. As seen, the cumulative percent of customers opting out was quite low for all rates and segments. The lowest cumulative percent opt out was for CARE/FARE customers on Rate 3 and the highest was for Non-CARE/FERA customers on Rate 3. For the service territory as a whole, there is no meaningful difference in the cumulative percent of opt outs across the three rates.

Figure 4.2-4: Opt Outs by Rate and Customer Segment for the PG&E Service Territory



Figures 4.2-5 through 4.2-7 show the overall attrition rate over time for each climate region, customer segment, and TOU rate. As seen in Figure 4.2-4, the cumulative attrition is quite constant over time in the hot region, with the final attrition rate ranging from a low of roughly 4% for the non-CARE/FERA control group and a high of nearly 12% for CARE/FERA customers on Rate 3. The attrition in the moderate and cool climate regions have a very different shape over time, with a significant increase in attrition starting in August in the moderate region and in September in the cool region. These higher rates coincide with more active transitions of customers to CCAs during those periods.

Figure 4.2-5: PG&E Attrition by Month – Hot Climate Region

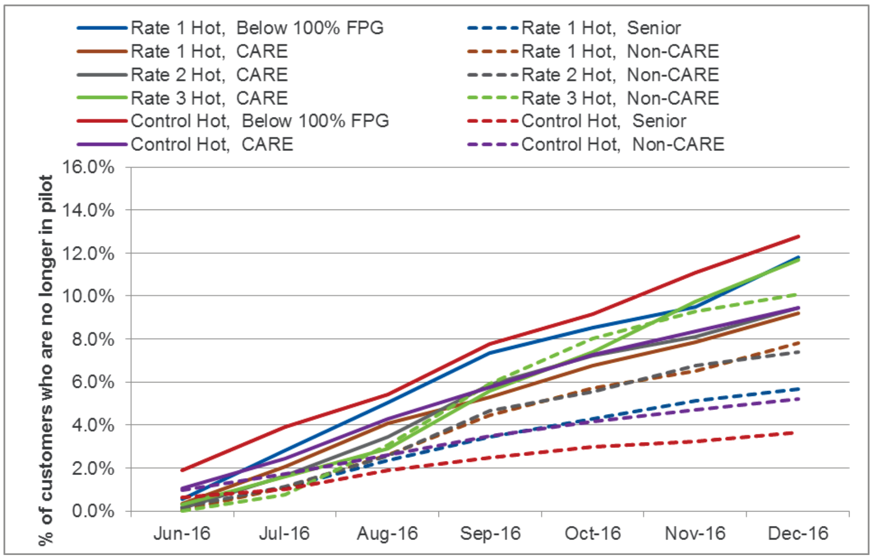


Figure 4.2-6: PG&E Attrition by Month – Moderate Climate Region

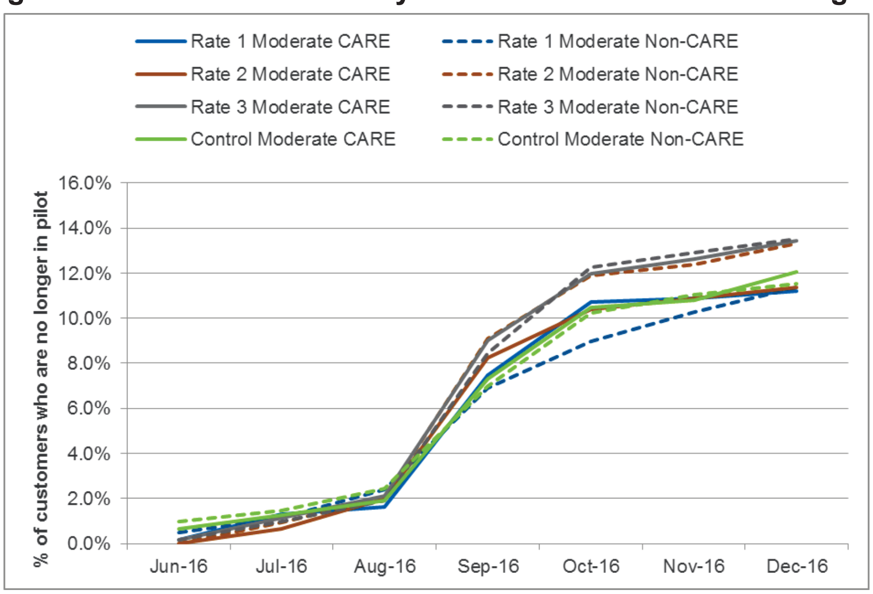
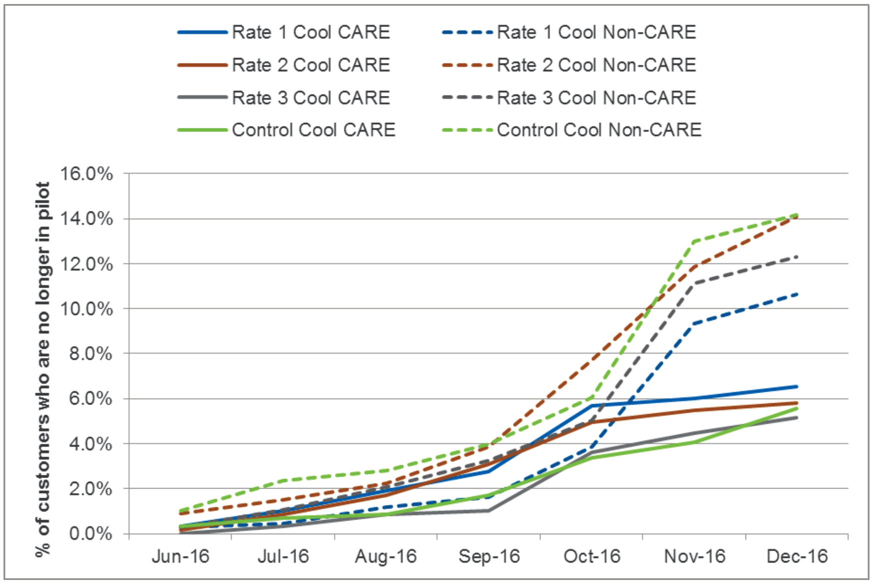


Figure 4.2-7: PG&E Attrition by Month – Cool Climate Region



4.2.4 Education and Outreach Material

Study participants received Education and Outreach materials tailored to their individual treatment. The treatment groups (Three Seasons, 4 to 9 pm, and 6 to 9 pm) received similar outreach materials that reiterated the energy reduction tips, incentive requirements & schedules, peak and off-peak period definitions, and general usage shifting strategy that was presented in the Welcome Kits. Customers in each treatment group received outreach material entitled “Careful Consideration” and “Predict and Control” depending on their customer segment. The materials differed in their message regarding the participant’s attitude toward the study. The Careful Consideration material was entitled “This summer, become a part of California’s cleaner energy future” whereas the Predict and Control material was entitled “This summer, you have the control to shift your electricity usage and manage bills”. The tone of the Careful Consideration leads the reader to believe they are involved in a larger effort to reduce emissions, whereas the Predict and Control material evokes a very practical or utilitarian message.

4.2.5 Operational Challenges and Lessons Learned

PG&E’s experience implementing the Residential Opt-in TOU pilot has generated a number of insights that may inform future pilots or the future transition of larger customer groups onto TOU rates. This subsection summarizes key lessons learned from the pilot thus far. The insights are divided into four sections: 1) general lessons learned that apply to all stages of pilot implementation, 2) lessons learned from the Planning and Initiation phase, 3) lessons learned from the Recruitment phase, and 4) lessons learned from the Operations phase.

General

Lessons learned:

- Clearly defined pilot **objectives** helped minimize scope creep.
- Close and disciplined **coordination** within PG&E helped enable an on-time and on-scope pilot launch

- **Tight timelines** sometimes led to target completion dates for some milestones that were too optimistic.
- **Collaboration across the three IOUs** enabled the sharing of lessons learned in real-time, which proved useful throughout the implementation process.

Objectives: The objectives of the Opt-in TOU pilot were clearly defined from the beginning, and it was a product of extensive collaboration among multiple stakeholders prior to the start of pilot implementation. The objectives, which are outlined in detail in the Nexant Time-of-Use Pricing Opt-in Pilot Plan,[48] were a useful reference point that has helped govern the entire implementation process, from planning through operations. PG&E feels these objectives played a key role in keeping the pilot focused and limiting scope creep.

Coordination: Implementing a pilot the size of the Opt-in TOU Pilot, particularly within such a short time frame, required a significant amount of disciplined coordination among internal stakeholders from multiple lines of business. From the beginning of the implementation process, PG&E held weekly meetings with representatives from each key line of business to discuss progress toward key milestones, issues, and risks. These meetings were critical in facilitating coordination across work streams, as it allowed individual contributors to discuss interdependent deliverables in real-time.

Tight timelines: The project timeline was highly aggressive, with targets that were more optimistic than is typically expected for projects of similar scope and magnitude. While PG&E was able to meet the aggressive timeline and ensure a smooth customer experience, the project schedule led to elevated risks, inefficient processes (favoring on-time completion at the expense of more thoughtful planning), and little room for error. A more realistic timeline would have resulted in less manual work and stronger reporting systems.

Collaboration: PG&E has also benefited from close collaboration with SCE and SDG&E. PG&E found it useful to maintain a regular cadence of cross-IOU meetings to raise issues and develop or share solutions given that the other two IOUs were also implementing pilots of similar scope on a similar schedule. Even greater collaboration across IOUs, specifically within particular work streams, from the start of the project would have been beneficial.

Planning and Initiation Phase

Lessons learned:

- The **pilot recruitment "pre-test"** generated extremely valuable insights that helped inform the broader recruitment campaign.
- **Process maps** helped establish a common understanding of the Opt-in Pilot's key operational processes and facilitated the close coordination of activities across lines of business. However, due to timing and resource constraints, some of the processes were developed and socialized later during the project lifecycle than planned. More extensive and comprehensive process mapping during the early stages would have been useful to reduce the amount of troubleshooting during the operations phase.
- Each piece of **marketing collateral required several versions**, adding substantial complexity to the initiation process.

[48] George, S., Sullivan, M., Potter, J., & Savage, A. (2015). Time-of-Use Pricing Opt-in Pilot Plan. *Nexant, Inc.*

The planning and initiation phase began in January 2016, after PG&E filed its advice letter with the CPUC, and extended to the start of the pilot launch in June 2016. During this period, PG&E developed its marketing materials, launched a small recruitment "pre-test," established and tested the relevant IT and operational processes, and trained customer service representatives in the lead-up to the pilot launch.

A major component of the planning phase was the pilot recruitment "pre-test". The pre-test involved recruiting an initial small batch of customers onto the pilot ahead of the full recruitment campaign in order to test the impact of varying incentive amounts and pilot invitation delivery mechanisms on customer acceptance. PG&E sent pilot invitations to 1,970 customers, testing two incentive amounts ($175 and $250) and two delivery mechanisms (FedEx and USPS) within this population. Of the 168 initial acceptances, PG&E found that the higher incentive amount did not positively affect acceptance rates. While the FedEx invitations led to higher acceptance rates than USPS invitations (11.7% vs 5.5%), the difference was not large enough to warrant the higher cost of sending all invitations via FedEx. PG&E used the information from the pretest to settle upon a $200 incentive sent via USPS. The observed acceptance rates in the pre-test informed PG&E's plan to send pilot invitations to 348,750 customers in its full recruitment campaign in order to safely generate the minimum number of acceptances to fulfill the sampling requirements of the pilot design.

PG&E found that the pre-test was an extremely useful exercise that enabled PG&E to develop a cost-effective offer that would incentivize participation without overspending. The pre-test also generated acceptance rates that helped PG&E calibrate the recruitment effort to avoid recruiting too few customers (which would have affected PG&E's ability to launch on time with the minimum number as required by the pilot design) or too many customers (which would have led to more customers being rejected from the pilot in order to keep total costs down).

In preparation for the operations phase, PG&E developed several process maps to document the customer onboarding and support processes, including roles and hand-offs across PG&E's lines of business and key aspects of the customer journey. Overall, PG&E stakeholders expressed satisfaction with the process mapping efforts and final deliverables, which provided significant detail into the various operational steps and interdependencies, and facilitated coordination across lines of business. However, the complexity of some processes, particularly those related to IT systems and reporting requirements, were initially underestimated, leading to the need for real-time troubleshooting. In addition, due to the short implementation timeline, some processes were socialized to key staff with minimal time to prepare and troubleshoot. Having more time to develop these processes and integrate them into PG&E's standard training procedures would have led to a smoother pilot launch.

PG&E also found that the large number of versions for each piece of marketing collateral added a significant amount of time and complexity to the implementation process. With four treatment groups and the need to produce collateral in three languages, along with some marketing pieces that were tailored to specific persona groups, the number of versions multiplied quickly. Each unique piece of collateral went through PG&E's internal quality control and approval process and was separately tracked. This led to significant demands on internal resources and it is unclear whether the extra effort and expense brought commensurate benefit. PG&E will consider the impact of multiple collateral versions carefully in future, potentially much larger and more complex, customer transitions to TOU rates.

Recruitment Phase

Lessons Learned:

- Having a **single team** dedicated to customer recruitment and enrollment helped ensure that PG&E could recruit the required number of customers within the short timeframe available.
- Recruitment required more labor hours than initially expected, largely due to **customer questions** about the pilot's eligibility requirements and other aspects of the pilot.

Recruitment began during the week of March 27, 2016, with the first batch of 348,750 letters distributed to customers that week, and enrollments were accepted through the first week of May 2016. PG&E successfully recruited a sufficient number of customers into each of the segments defined in its initial sampling plan and ultimately accepted 21,001 customers into the pilot.

PG&E contracted with a third party consultant to serve as the first point of contact for all three enrollment channels: website, call center, and mail. This allowed for a well-coordinated and closely controlled recruitment process that could be initiated and wound down with relative speed and efficiency. PG&E received updated enrollment counts across all three channels daily, which enabled PG&E to closely monitor how quickly the customer segments were being filled. It also enabled PG&E to quickly close specific customer segments to new enrollment once the maximum numbers were reached. The arrangement also enabled data from the enrollment survey to be routed to a single database, which allowed for quick ad hoc analyses throughout the recruitment phase.

While the recruitment process went smoothly overall, the labor requirements to complete the recruitment exceeded PG&E's initial expectations. In particular, PG&E underestimated the amount of time that customer service representatives needed to spend on the phone with prospective pilot enrollees. A significant number of customers called in with questions about the seven eligibility requirements and other aspects of the pilot, such as bill protection after the first 12 months. While this led to some lag in enrolling customers, the issue was not severe enough to seriously affect the recruitment effort.

Operations Phase

- Many processes and tools developed for the Opt-in Pilot are not scalable to a broader rollout of residential TOU rates.
- The rollout of the end of summer survey was hampered by technical bandwidth issues, which affected the customer experience. Survey delivery should be spaced out to mitigate these risks in the future.
- The need to produce several unanticipated customer communication pieces exacerbated PG&E's resource constraints.
- The adoption rate of the **smartphone app** was much lower than anticipated.

Given the short amount of time PG&E had to prepare for the pilot, as well as its temporary nature with discrete start and end dates, it was not possible, or necessarily desirable, to fully develop and integrate pilot-specific processes and tools into PG&E's overall operational systems. Therefore several temporary operational processes and tools were developed to facilitate pilot operations.

For example, PG&E established temporary online microsites for pilot participants that were not integrated with its primary website and customer portal, www.pge.com. In addition, many billing operations processes, such as identifying customers that become ineligible to continue participating in the pilot (e.g. due to qualifying for a Medical Baseline Allowance or joining another PG&E program such as Solar Choice or SmartRate), had to be performed manually. To add to the complexity, the pilot's unique reporting requirements, such as the need to document when customers became ineligible and the reasons why, led to additional manual transactions, review, and troubleshooting. While PG&E's staff has been able to meet the pilot's business requirements given its size of 20,001 initial participants, a key lesson learned is that the vast majority of these processes will need to be automated when the number of customers transitioning to TOU increases by several orders of magnitude.

PG&E also found opportunities for improvement in the survey administration process. Pilot participants across all three IOUs received the end of summer 2016 survey at the same time, which overloaded the survey administrator's servers and affected customers' ability to complete the survey upon receipt of their invitation. The survey administrator also did not anticipate the volume of calls that the survey would generate. The IOUs underestimated customers' interest in and desire to complete the survey as soon as possible. Future surveys should be administered in waves to mitigate the risk of server issues.

Additionally, PG&E did not in its initial planning account for all of the customer communications that would be needed throughout the project lifecycle. For example, customers who were declined from the pilot due to oversubscription and customers made ineligible to continue participating (for example, after defaulting onto Community Choice Aggregation) needed to be contacted via mail. PG&E was able to produce the necessary marketing collateral to ensure a quality customer experience, but improved planning of all marketing-related deliverables throughout the pilot would have led to a more accurate accounting of marketing resource needs and less ad hoc implementation.

PG&E also found that adoption of the smartphone app has been low. Results from the most recent email marketing effort in January 2017 were disappointing with unique click-through rates of 1 – 1.8%, which underperforms averages for both industry and PG&E residential email click-through rates. In addition, registration of the app is a somewhat complicated process, which led to some attrition. A total of 600 users (out of about 6,000 who were offered the app) downloaded the app, and only about half of them completed the registration process. PG&E is considering that the app may be a niche offering for some customers but may not be a tool for assisting a majority of customers to succeed on a Time of Use rate.

4.3 Load Impacts

This section summarizes the load impact estimates for the three rate treatments tested by PG&E. The CPUC resolution approving PG&E's pilot requires that load impacts be estimated for the peak and off-peak periods and for daily energy use for the following rates, customer segments, and climate regions:

- Seniors, CARE/FERA customers, non-CARE/FERA customers and households with incomes below 100% of FPG in PG&E's hot climate region for Rate 1;
- For all three rates for all customers in PG&E's service territory as a whole and for all customers in PG&E's hot and moderate climate regions; and
- For CARE/FERA and non-CARE/FERA customers on each rate across PG&E's service territory as a whole.

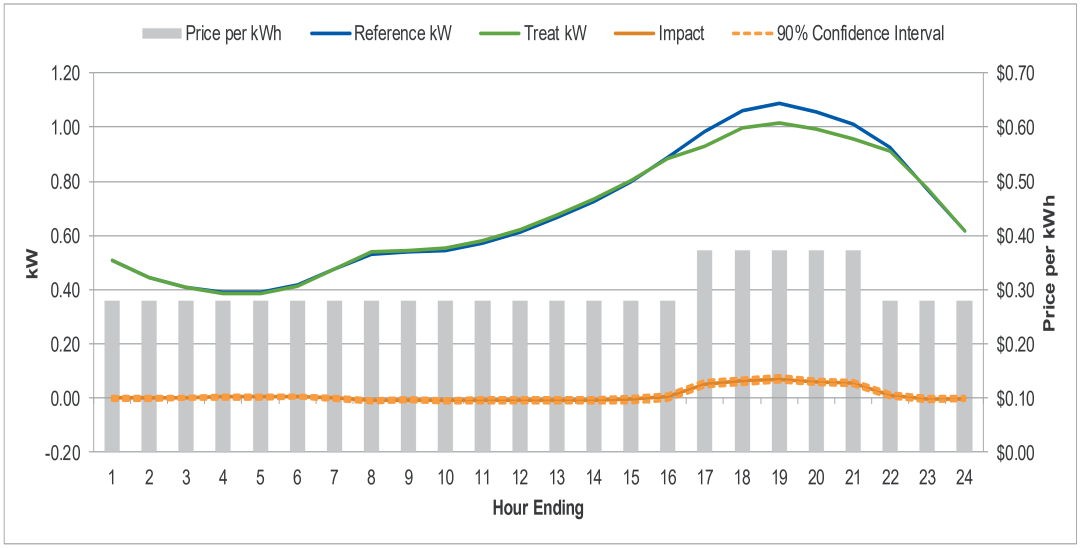
In addition to these required segments, Nexant estimated load impacts for CARE/FERA and non-CARE/FERA customers for each rate for each climate region. Load impacts are reported here for each rate period for the average weekday, average weekend and for the average monthly peak day for the summer months of July, August and September[49] for each rate, climate zone and customer segment summarized above. Underlying the values presented in the report are electronic tables that contain estimates for each hour of the day for each day type, segment and climate zone and for each month separately. These values are contained in Excel spreadsheets that are available upon request through the CPUC. Figure 4.3-1 shows an example of the content of these tables for PG&E Rate 1 for all eligible customers in the service territory. Pull down menus in the upper left hand corner allow users to select different customer segments, climate regions, day types (e.g., weekdays, weekends, monthly peak day) and time period (individual months or the average of July, August and September).

[49] Estimates were not produced for the month of June because enrollment changed dramatically from the beginning to the end of the month and the estimates would not be comparable to those for other months.

Figure 4.3-1: Example of Content of Electronic Tables Underlying Load Impacts Summarized in this Report (PG&E Rate 1, Average Summer Weekday, All Customers)

Segment	All
Rate	Rate 1
Month	July, August, September 2016
Day Type	Average Weekday
Treated Customers	6,428

Period	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval	
Peak	1.04	0.98	0.06	5.8%	0.06	0.06
Partial Peak	N/A	N/A	N/A	N/A	N/A	N/A
Off Peak	0.59	0.59	0.00	-0.4%	0.00	0.00
Super Off Peak	N/A	N/A	N/A	N/A	N/A	N/A
Daily kWh	16.43	16.17	0.26	1.6%	0.22	0.30



Hour Ending	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval		Price	Period
1	0.51	0.51	0.00	-0.1%	-0.01	0.01	$0.28	Off Peak
2	0.45	0.45	0.00	-0.3%	-0.01	0.00	$0.28	Off Peak
3	0.41	0.41	0.00	0.0%	-0.01	0.01	$0.28	Off Peak
4	0.39	0.39	0.00	0.8%	0.00	0.01	$0.28	Off Peak
5	0.39	0.39	0.00	0.8%	0.00	0.01	$0.28	Off Peak
6	0.42	0.41	0.00	1.1%	0.00	0.01	$0.28	Off Peak
7	0.48	0.48	0.00	-0.2%	-0.01	0.01	$0.28	Off Peak
8	0.53	0.54	-0.01	-1.6%	-0.02	0.00	$0.28	Off Peak
9	0.54	0.54	-0.01	-1.2%	-0.01	0.00	$0.28	Off Peak
10	0.55	0.56	-0.01	-1.7%	-0.02	0.00	$0.28	Off Peak
11	0.57	0.58	-0.01	-1.5%	-0.02	0.00	$0.28	Off Peak
12	0.61	0.62	-0.01	-1.3%	-0.02	0.00	$0.28	Off Peak
13	0.67	0.67	-0.01	-1.0%	-0.02	0.00	$0.28	Off Peak
14	0.73	0.73	-0.01	-0.9%	-0.02	0.00	$0.28	Off Peak
15	0.80	0.80	-0.01	-0.7%	-0.02	0.00	$0.28	Off Peak
16	0.89	0.89	0.00	0.4%	-0.01	0.01	$0.28	Off Peak
17	0.98	0.93	0.05	5.2%	0.04	0.06	$0.37	Peak
18	1.06	1.00	0.06	6.0%	0.05	0.07	$0.37	Peak
19	1.09	1.02	0.07	6.4%	0.06	0.08	$0.37	Peak
20	1.05	0.99	0.06	5.7%	0.05	0.07	$0.37	Peak
21	1.01	0.96	0.06	5.5%	0.05	0.07	$0.37	Peak
22	0.92	0.91	0.01	1.3%	0.00	0.02	$0.28	Off Peak
23	0.77	0.77	0.00	-0.5%	-0.01	0.00	$0.28	Off Peak
24	0.62	0.62	0.00	-0.2%	-0.01	0.01	$0.28	Off Peak
Daily kWh	16.43	16.17	0.26	1.6%	0.22	0.30	N/A	N/A

Table 4.3-1 shows the weights used when aggregating CARE/FERA and non-CARE/FERA customers within each climate region and when aggregating across climate regions to produce estimates at the service territory as a whole. The weights are based on the eligible population contained in each customer segment and climate region.

Table 4.3-1: Weights Used for Aggregating up to Climate Region and Service Territory

Segment		Eligible for Pilot Participation	Population Weight	Climate Region Weight
Hot	CARE	548,819	15.4%	39.2%
	Non-CARE	850,419	23.8%	60.8%
Moderate	CARE	220,803	6.2%	17.2%
	Non-CARE	1,059,794	29.7%	82.8%
Cool	CARE	192,156	5.4%	21.5%
	Non-CARE	700,745	19.6%	78.5%
Total		3,572,736	100.0%	n/a

Table 4.3-2 shows the weights that were used to aggregate up from the customer subpopulations to the CARE/FERA populations in the hot climate region for each group of customers assigned to rate and control conditions. These weights are based on the number of customers that were enrolled into the study from the general population recruitment category in the hot climate region. Since customers in the sub-segments (e.g., below 100% of FPG, 100 to 200% of FPG, seniors) contained in this general population group were not over or under sampled, the shares of each sub-segment in this group are conceptually analogous to the shares in the CARE/FERA and non-CARE/FERA segments contained in other climate regions.

The remainder of this section is organized by rate treatment – that is, load impacts are presented for each relevant customer segment and climate region for each of the three rates. Following the summary for each rate, load impacts are compared across rates. This comparison is made only for the hours within each peak period that are common across all three rates (6 to 9 PM). Because the rates differ with respect to the length and timing of peak and off-peak periods, differences in load impacts across rates for any particular rate period may be due not only to differences in prices within the rate period but also due to differences in the length or timing of the rate periods.

As discussed at the outset of Section 4, in addition to the three rate treatments, PG&E offered a smart phone app to a subset of roughly 7,000 customers. However, only a few hundred customers successfully downloaded the app. This small sample size does not support estimation of load impacts for this self-selected group of customers. Survey information on customer perceptions about the smart phone app is summarized in Section 4.5.2.

Table 4.3-2: Weights Used to Aggregate Sub-segments Into CARE/FERA and Non-CARE/FERA Segments in the Hot Climate Region

Assignment	FPG	Senior	CARE	Sample Proportion (SP)	Proportion in "General Population" (GP)	Weight (GP/SP)
Control	<100%	N	N	1.6%	2.3%	1.41
			Y	11.3%	14.6%	1.30
		Y	N	1.1%	1.1%	1.04
			Y	11.7%	6.3%	0.54
	100-200%	N	N	2.0%	3.3%	1.68
			Y	6.9%	10.2%	1.47
		Y	N	3.3%	3.3%	0.99
			Y	18.4%	7.7%	0.42
	>200%	N	N	13.9%	24.2%	1.74
			Y	2.3%	3.1%	1.33
		Y	N	23.4%	22.0%	0.94
			Y	4.1%	1.8%	0.45
Rate 1	<100%	N	N	1.4%	2.3%	1.69
			Y	11.5%	14.6%	1.27
		Y	N	1.3%	1.1%	0.90
			Y	11.6%	6.3%	0.54
	100-200%	N	N	1.9%	3.3%	1.80
			Y	7.6%	10.2%	1.35
		Y	N	4.2%	3.3%	0.78
			Y	17.8%	7.7%	0.43
	>200%	N	N	13.8%	24.2%	1.76
			Y	1.8%	3.1%	1.70
		Y	N	23.6%	22.0%	0.93
			Y	3.6%	1.8%	0.51

Assignment	FPG	Senior	CARE	Sample Proportion (SP)	Proportion in "General Population" (GP)	Weight (GP/SP)
Rate 2	<100%	N	N	1.8%	2.3%	1.29
			Y	16.8%	14.6%	0.87
		Y	N	0.5%	1.1%	2.09
			Y	6.9%	6.3%	0.91
	100-200%	N	N	3.2%	3.3%	1.03
			Y	11.9%	10.2%	0.86
		Y	N	2.9%	3.3%	1.11
			Y	9.1%	7.7%	0.84
	>200%	N	N	20.2%	24.2%	1.20
			Y	3.6%	3.1%	0.88
		Y	N	20.8%	22.0%	1.05
			Y	2.2%	1.8%	0.85
Rate 3	<100%	N	N	1.6%	2.3%	1.42
			Y	16.9%	14.6%	0.87
		Y	N	1.1%	1.1%	1.05
			Y	6.6%	6.3%	0.95
	100-200%	N	N	3.5%	3.3%	0.95
			Y	12.7%	10.2%	0.81
		Y	N	3.0%	3.3%	1.09
			Y	9.1%	7.7%	0.84
	>200%	N	N	20.8%	24.2%	1.16
			Y	3.1%	3.1%	1.02
		Y	N	19.6%	22.0%	1.12
			Y	2.0%	1.8%	0.92

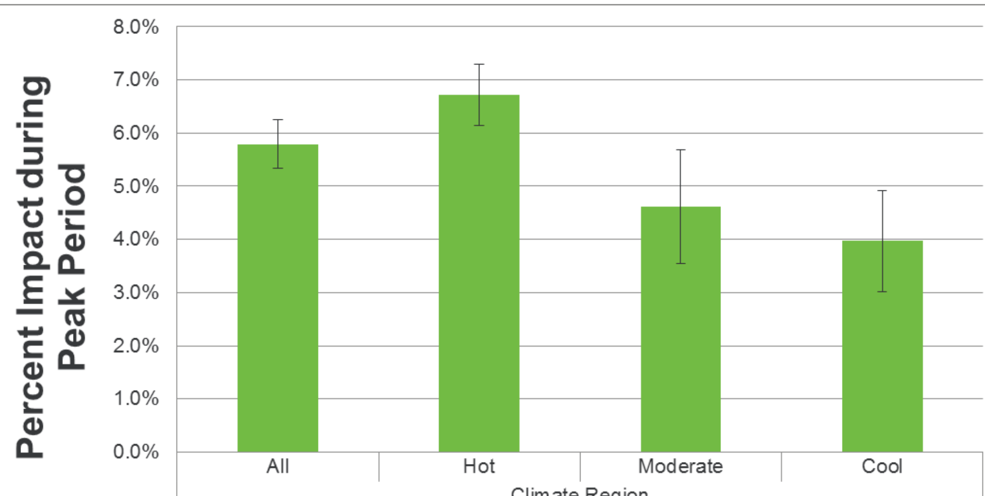
4.3.1 Rate 1

PG&E's Rate 1 is a two-period rate with a peak-period from 4 to 9 PM on weekdays. In summer, for electricity usage above the baseline quantity, prices equal roughly 42.0 ¢/kWh in the peak period and 31.7¢/kWh in the off-peak period. All usage on weekends is priced at the off-peak price. For usage below the baseline quantity, a credit of 11.7 ¢/kWh is applied.

> **Key Findings for PG&E Rate 1**
>
> On average, customers on Rate 1 reduced peak period usage by almost 6%. The average load reduction was highest in the hot climate region, second highest in the moderate region and lowest in the cool region. CARE/FERA customers had lower average load reductions than non-CARE/FERA customers. Senior households in the hot climate region had load reductions very similar to non-senior households. Load reductions for households with incomes below 100% of FPG in PG&E's hot climate region did not produce statistically significant reductions in peak period loads.

Figure 4.3-1 shows the average peak-period load reduction in percentage terms for Rate 1 for PG&E's service territory as a whole and for each climate region. Figure 4.3-2 shows the absolute load impacts for each region. The lines bisecting the top of each bar in the figures show the 90% confidence band for each estimate. If the confidence band includes 0, it means that the estimated load impacts are not statistically different from 0 at the 90% level of confidence. If the confidence bands for two bars do not overlap, it means that the observed difference in the load impacts across the two bars is statistically significant. If they do overlap, it does not necessarily mean that the difference is not statistically significant.[50] In these cases, t-tests were calculated to determine whether the difference is statistically significant.[51]

Figure 4.3-1: Average Percent Load Impacts for Peak Period for PG&E Rate 1[52] (Positive values represent load reductions)



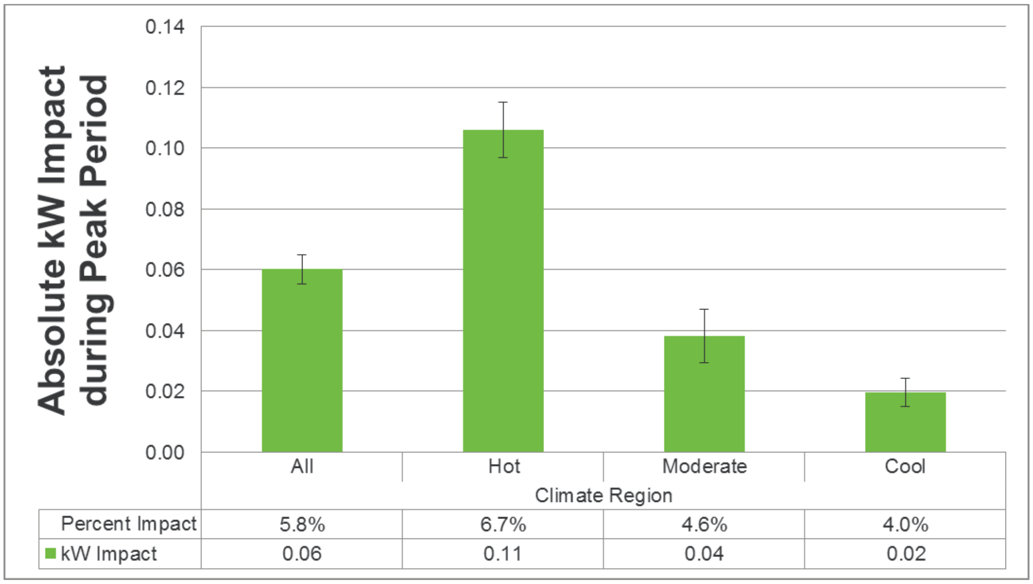
	All	Hot	Moderate	Cool
Percent Impact	5.8%	6.7%	4.6%	4.0%
kW Impact	0.06	0.11	0.04	0.02

[50] For further discussion of this topic, see https://www.cscu.cornell.edu/news/statnews/stnews73.pdf.

[51] The test was applied at the 90% confidence level which means that a t-value exceeding 1.65 indicates statistical significance.

[52] PG&E Rate 1 summer impacts represent July through September 2016.

Figure 4.3-2: Average Absolute Load Impacts for Peak Period for PG&E Rate 1 (Positive values represent load reductions)



As seen in the figures, all of the average peak-period load impacts for the service territory as a whole and for each climate region are statistically significant at the 90% level of confidence. On average, pilot participants across PG&E's service territory reduced peak-period electricity use by 5.8%, or 0.06 kW,[53] across the five-hour peak period from 4 to 9 PM. The average peak-period load reductions range from a high of 6.7% and 0.11 kW in the hot climate region to a low of 4.0% and 0.02 kW in the cool climate region. In the moderate climate region, load reductions equal 4.6%, or 0.04 kW. The variation in absolute impacts across climate regions is much greater than the variation in percent impacts due in large part to variation in electricity usage (e.g., the reference load) across regions and all differences across regions are statistically significant. For percentage impacts, the difference is statistically significant between the hot and moderate regions but not between the moderate and cool regions.

Table 4.3-3 shows the average percent and absolute load impacts for each rate period for weekdays and weekends and for the average monthly system peak day for the PG&E service territory as a whole and for the participant population in each climate region. The percent reduction equals the load impact in absolute terms (kW) divided by the reference load. Shaded cells in the table contain load impact estimates that are not statistically significant at the 90% confidence level. The percentage and absolute values in the first row of Table 4.3-3, which represent the load impacts in the peak period on the average weekday, equal the values shown in Figures 4.2-1 and 4.2-2, discussed above.

[53] The kW value represents the average kWh/hour across the five hour peak period. It is not an instantaneous measure of peak demand during the period. The value can be multiplied by the number of hours in the peak period to determine the total reduction in electricity use (kWh) that occurred over the period.

Table 4.3-3: Rate 1 Load Impacts by Rate Period and Day Type[54]
(Positive values represent load reductions, negative values represent load increases)

			Rate 1											
			All			Hot			Moderate			Cool		
Day Type	Period	Hours	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	1.04	0.06	5.8%	1.58	0.11	6.7%	0.83	0.04	4.6%	0.49	0.02	4.0%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.59	0.00	-0.4%	0.81	0.00	0.0%	0.51	0.00	-0.7%	0.36	0.00	-1.0%
	Day	**All Hours**	**0.68**	**0.01**	**1.6%**	**0.97**	**0.02**	**2.3%**	**0.58**	**0.01**	**0.9%**	**0.39**	**0.00**	**0.3%**
Average Weekend	Off Peak	All Hours	0.71	0.01	1.2%	1.02	0.02	1.9%	0.60	0.00	0.6%	0.40	0.00	-0.5%
	Day	**All Hours**	**0.71**	**0.01**	**1.2%**	**1.02**	**0.02**	**1.9%**	**0.60**	**0.00**	**0.6%**	**0.40**	**0.00**	**-0.5%**
Monthly System Peak Day	Peak	4 PM to 9 PM	1.36	0.10	7.5%	2.11	0.16	7.5%	1.14	0.11	9.5%	0.51	0.00	0.9%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.70	-0.01	-1.2%	1.01	-0.01	-1.0%	0.60	-0.01	-0.9%	0.36	-0.01	-3.3%
	Day	**All Hours**	**0.84**	**0.01**	**1.7%**	**1.24**	**0.03**	**2.1%**	**0.71**	**0.02**	**2.6%**	**0.39**	**-0.01**	**-2.2%**

[54] Shaded values are NOT statistically significant at the 90% level of confidence.

The reference loads shown in Table 4.3-3 represents estimates of what customers on the TOU rate would have used if they had not responded to the price signals contained in the TOU tariff. As seen in the table, average hourly usage during the peak period is roughly 1 kW for the service territory as a whole, and around 0.68 kW over the 24 hour average weekday. In the hot climate region, average usage in the peak period is more than 50% larger, at 1.58 kW. Average usage in the moderate region is 0.83 kW and in the cool region, at 0.49 kW, it is roughly one third what it is in the hot region.

When examining the change in usage across rate periods, it is important to keep in mind a reduction in peak-period usage could result from conservation (e.g., using air conditioning during the period without doing any pre-cooling or without experiencing a snapback effect after the end of the period) or from load shifting (doing laundry in the off-peak period rather than the peak period). An increase in off-peak usage could be the result of load shifting from the peak to the off-peak period, from increased energy use during the off-peak period unrelated to load shifting (e.g., less careful attention to lighting usage because rates are lower in the off-peak period), or both.

As seen in the Table 4.3-3, on the average weekday, there were small but statistically significant load increases in the off-peak period in the service territory as a whole and in the moderate and cool climate regions. In the hot region, there was no statistically significant change in average electricity use in the off-peak period.

A reduction in daily electricity use (depicted by positive values in the row labeled Day in the table) means that the combination of changes in use across all rate periods resulted in less electricity use for the day as a whole. As seen in Table 4.3-3, for the service territory as a whole, there was a 1.6% reduction in daily electricity use on the average weekday. In the hot climate region, the estimated conservation effect equals 2.3% while in the moderate region, it is 0.9%. In the cool climate region, the estimated reduction in electricity use is not statistically significant.

While the daily reduction in electricity use for Rate 1 is small in percentage and absolute terms, this average is spread over 24 hours each day, so the average reduction in electricity use on weekday equals roughly 0.26 kWh.[55] Over three months, this adds up to about 16 kWh per customer. If this average conservation effect was provided under default conditions and, say, 90% of the eligible population of roughly 3.5 million customers in PG&E's service territory remained on the rate, the total reduction in electricity use over the three-month period would equal more than 57 Gwh. This is quite significant. It is roughly half of the total reduction of 107 Gwh obtained for the entire year from roughly 1.5 million customers who received PG&E's Home Energy Reports program in 2014.[56]

On PG&E's Rate 1, off-peak prices are in effect all day on the weekend. In spite of these lower prices, for the service territory as a whole, the load impact estimate indicates that participants reduced electricity usage on the weekend relative to what they would have used on the OAT. Statistically significant conservation savings are also seen on the weekend in the hot and moderate climate regions.

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[55] The value in the table, 0.01 kW, is actually 0.011 kW. When multiplied by 24 hours, the estimate kWh reduction equals 0.26 kWh per day.

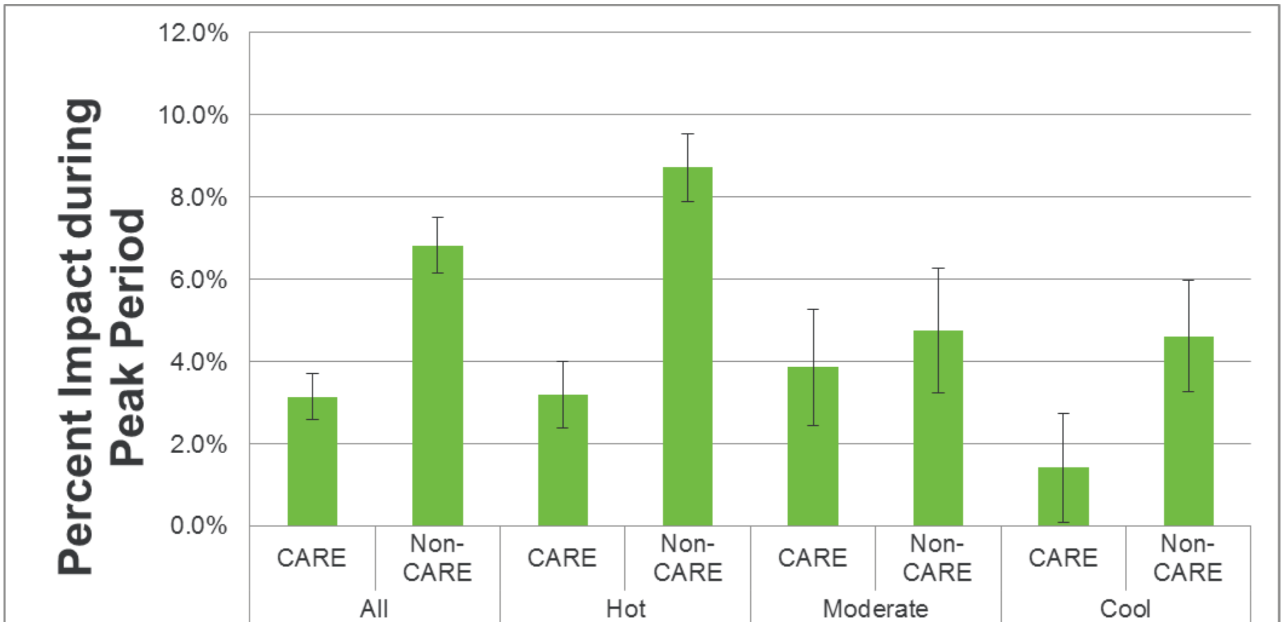
[56] Sullivan, M., & Savage, A. (2016) 2014 Energy Efficiency Savings Estimates, Pacific Gas and Electric Company, Home Energy Reports Program. *Nexant, Inc.*

The monthly system peak day estimates represent the average across the three weekdays, one each in July, August, and September, when PG&E's system peaked in 2016. This day type is a standard one for which impacts are estimated for all demand response programs and is included here so that results can be compared with other rate and demand response programs at PG&E. Reference loads are higher on these days than on the average weekday. For the service territory as a whole, the percent reduction in peak period loads, 7.5%, is greater than on the average weekday (5.8%) and the absolute load reduction, 0.10 kW, is significantly greater than on the average weekday (0.06 kW).

Figures 4.3-3 and 4.3-4, respectively, show the percentage and absolute peak period load impacts for Rate 1 for CARE/FERA and non-CARE/FERA customers for the service territory as a whole and for each climate region. For the service territory as a whole, and in the hot and cool climate regions, both the percent and absolute load impacts in the peak period are greater for non-CARE/FERA customers than for CARE/FERA customers, often significantly greater. For example, in the hot climate region, the average weekday peak period reduction is 8.7% and 0.14 kW for non-CARE/FERA customers whereas for CARE/FERA customers, the average reduction is 3.2% or 0.05 kW, which is only one third as much as for non-CARE/FERA customers. Load reductions in the cool climate region are significantly less than in the hot region for both segments and the difference between the two segments is also significant. Interestingly, in the moderate climate region, the difference between the two segments is small and is not statistically significant.

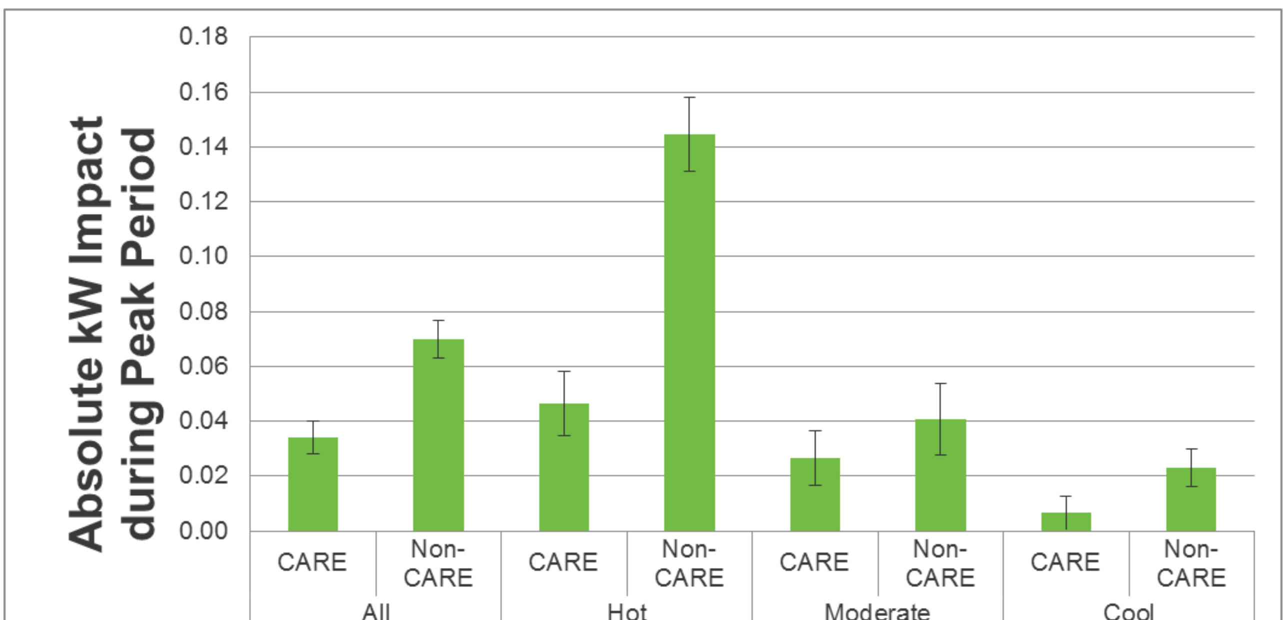
Differences between the hot and cool climate regions and CARE/FERA and non-CARE/FERA are typically driven by the differing levels of discretionary load. As shown in Table 4.5-57, in hot climate regions more customers have air conditioning compared to the cool regions. Air conditioning temperature is something relatively easy to adjust and relatively small adjustments can produce a significant difference in electricity usage. Customers in the cool regions who don't have air conditioning have fewer discretionary loads that can be adjusted to reduce energy usage. Similarly to the differences in discretionary load between the hot and cool climate regions, CARE/FERA customers with lower incomes typically have less discretionary load, and are less likely to have air conditioning within a given climate region, than non-CARE/FERA customers. While air conditioning ownership isn't the only factor influencing the findings, it is an important example of a key driver.

Figure 4.3-3: Average Percent Load Impacts for Peak Period for PG&E Rate 1 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)



	CARE (All)	Non-CARE (All)	CARE (Hot)	Non-CARE (Hot)	CARE (Moderate)	Non-CARE (Moderate)	CARE (Cool)	Non-CARE (Cool)
Percent Impact	3.1%	6.8%	3.2%	8.7%	3.9%	4.7%	1.4%	4.6%
kW Impact	0.03	0.07	0.05	0.14	0.03	0.04	0.01	0.02

Figure 4.3-4: Average Absolute Load Impacts for Peak Period for PG&E Rate 1 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)



	CARE (All)	Non-CARE (All)	CARE (Hot)	Non-CARE (Hot)	CARE (Moderate)	Non-CARE (Moderate)	CARE (Cool)	Non-CARE (Cool)
Percent Impact	3.1%	6.8%	3.2%	8.7%	3.9%	4.7%	1.4%	4.6%
kW Impact	0.03	0.07	0.05	0.14	0.03	0.04	0.01	0.02

Table 4.3-4 shows the estimated load impacts for each rate period and day type by climate zone and for the service territory as a whole for non-CARE/FERA customers and Table 4.3-5 shows the estimated values for CARE/FERA customers. It should be noted that, for the service territory as a whole, CARE/FERA customers have average peak-period loads that are slightly larger than non-CARE/FERA customers (1.08 for CARE/FERA and 1.02 for non-CARE/FERA) but within each climate region, CARE/FERA customers use less electricity during the peak-period than non-CARE/FERA customers. In the hot, moderate, and cool climate regions, non-CARE/FERA households use 14%, 25%, and 10% more electricity during the peak period, respectively, than do CARE/FERA households. Similar ratios exist for average weekday daily electricity use. This pattern across and within climate regions reflects the fact that in PG&E's service territory, a greater percent of CARE/FERA customers live in the hot climate region than in the moderate and cool region but within each region, a greater share of CARE/FERA customers may live in smaller houses and perhaps have a higher concentration of multi-family housing than non-CARE/FERA customers.

For the service territory as a whole, both customer segments reduced average daily usage on weekdays by more than 1%. On weekends, non-CARE/FERA customers reduced electricity use by 1.4% while CARE/FERA customers had a smaller reduction in electricity use (0.6%). In the hot climate region, non-CARE/FERA customers reduced electricity use on weekdays by 3%, nearly three times more than for CARE/FERA customers (0.9%). In the cool climate region, CARE/FERA customers had a small but statistically significant increase in daily electricity use on weekdays while non-CARE/FERA customers had a small, but statistically insignificant reduction in electricity use.

Table 4.3-4: Rate 1 Load Impacts by Rate Period and Day Type – Non-CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

Rate 1														
Day Type	Period	Hours	All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	1.02	0.07	6.8%	1.66	0.14	8.7%	0.86	0.04	4.7%	0.50	0.02	4.6%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.59	0.00	-0.6%	0.84	0.00	0.1%	0.53	-0.01	-1.4%	0.37	0.00	-0.8%
	Day	**All Hours**	**0.68**	**0.01**	**1.7%**	**1.01**	**0.03**	**3.0%**	**0.60**	**0.00**	**0.5%**	**0.40**	**0.00**	**0.6%**
Average Weekend	Off Peak	All Hours	0.71	0.01	1.4%	1.07	0.03	2.7%	0.62	0.00	0.3%	0.42	0.00	-0.2%
	Day	**All Hours**	**0.71**	**0.01**	**1.4%**	**1.07**	**0.03**	**2.7%**	**0.62**	**0.00**	**0.3%**	**0.42**	**0.00**	**-0.2%**
Monthly System Peak Day	Peak	4 PM to 9 PM	1.36	0.12	9.1%	2.27	0.22	9.6%	1.20	0.13	10.7%	0.51	0.00	0.4%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.70	-0.01	-1.6%	1.06	-0.01	-1.1%	0.62	-0.01	-1.3%	0.37	-0.01	-3.8%
	Day	**All Hours**	**0.84**	**0.02**	**2.0%**	**1.31**	**0.04**	**2.7%**	**0.74**	**0.02**	**2.7%**	**0.40**	**-0.01**	**-2.7%**

Table 4.3-5: Rate 1 Load Impacts by Rate Period and Day Type – CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 1											
			All, CARE			Hot, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	1.08	0.03	3.1%	1.46	0.05	3.2%	0.69	0.03	3.9%	0.46	0.01	1.4%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.60	0.00	0.3%	0.76	0.00	-0.2%	0.45	0.01	3.3%	0.33	-0.01	-1.6%
	Day	**All Hours**	**0.70**	**0.01**	**1.2%**	**0.90**	**0.01**	**0.9%**	**0.50**	**0.02**	**3.5%**	**0.36**	**0.00**	**-0.8%**
Average Weekend	Off Peak	All Hours	0.72	0.00	0.6%	0.94	0.00	0.5%	0.51	0.01	2.4%	0.36	-0.01	-1.8%
	Day	**All Hours**	**0.72**	**0.00**	**0.6%**	**0.94**	**0.00**	**0.5%**	**0.51**	**0.01**	**2.4%**	**0.36**	**-0.01**	**-1.8%**
Monthly System Peak Day	Peak	4 PM to 9 PM	1.36	0.04	3.3%	1.87	0.07	3.6%	0.85	0.02	1.9%	0.48	0.01	2.5%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.71	0.00	-0.4%	0.93	-0.01	-0.7%	0.50	0.01	1.7%	0.34	0.00	-1.4%
	Day	**All Hours**	**0.85**	**0.01**	**0.8%**	**1.13**	**0.01**	**0.8%**	**0.58**	**0.01**	**1.8%**	**0.36**	**0.00**	**-0.4%**

As discussed earlier in this section, certain groups were oversampled and assigned to Rate 1 in PG&E's service territory. The Commission's Resolution approving PG&E's pilots required that load impacts be estimated for Rate 1 in the hot climate region for senior households and for households with average incomes below 100% of FPG. Figure 4.3-5 shows the percent load reduction during the peak period on average weekdays for each of these customer segments and Figure 4.3-6 shows the load impacts in absolute terms. Table 4.3-6 shows the estimated values for other rate periods and day types for each segment and for the hot climate region as a whole.

A comparison of the values in Figures 4.3-5 and 4.3-6 with those for the hot region in Figures 4.3-1 and 4.3-2 shows that load impacts for senior households were very similar to the hot climate region, participant population as a whole in both percentage (7%) and absolute (0.10 kW) terms. The reference load for senior households (1.46 kW) is also similar to that of the general participant population in the hot climate region (1.58 kW). That is, senior households do not, on average, consume materially less electricity than the average customer in PG&E's hot climate region. Estimated load impacts in the off-peak period, which were not statistically different from 0, and a 2.3% reduction in daily energy use on weekdays indicates that senior households did more conservation than load shifting. This conservation effect carried over into the weekend, which showed a 1.7% load reduction on average over the summer. Peak-period load reductions on the average monthly system peak day were the same in percentage terms (7%) as on weekdays but were higher in absolute terms because average reference loads were higher on the monthly system peak days.

Peak period load impacts for senior households in the hot climate region on CARE/FERA rates equaled 4.6%, or 0.06 kW while non-CARE/FERA seniors had average load reductions of 8.1% and 0.13 kW. These values were also quite similar to the values for all CARE/FERA and non-CARE/FERA households in PG&E's hot climate region.

Figure 4.3-5: Average Percent Load Impacts in the Peak Period on Weekdays for PG&E Rate 1 for Senior Households and Households with Incomes Below 100% of FPG (Positive values represent load reductions)

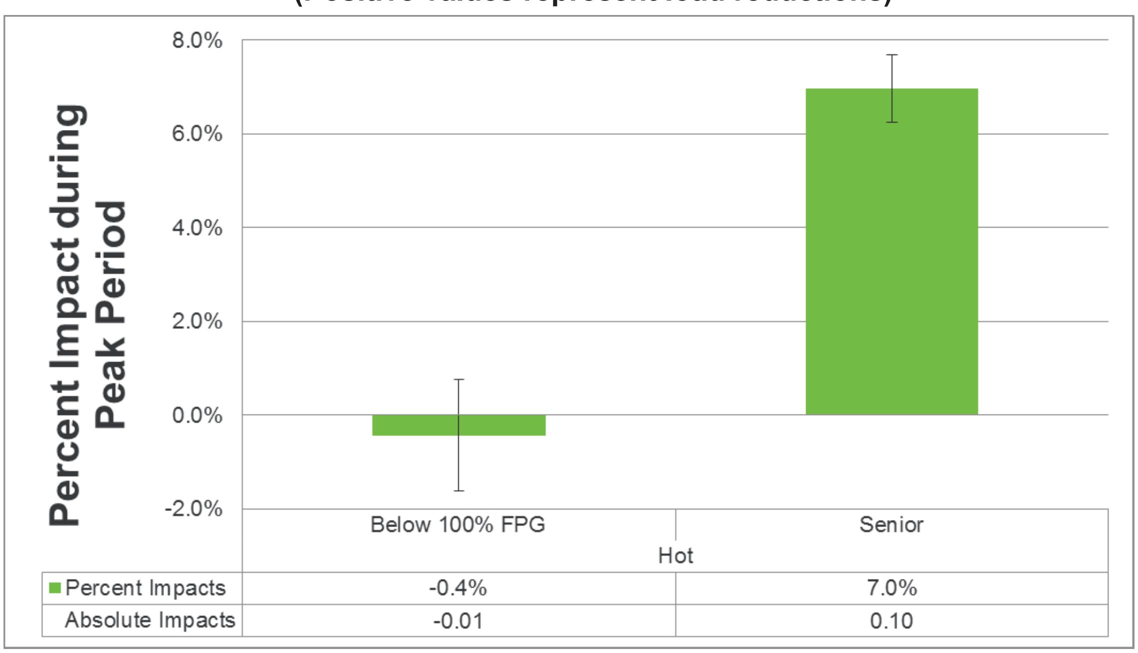
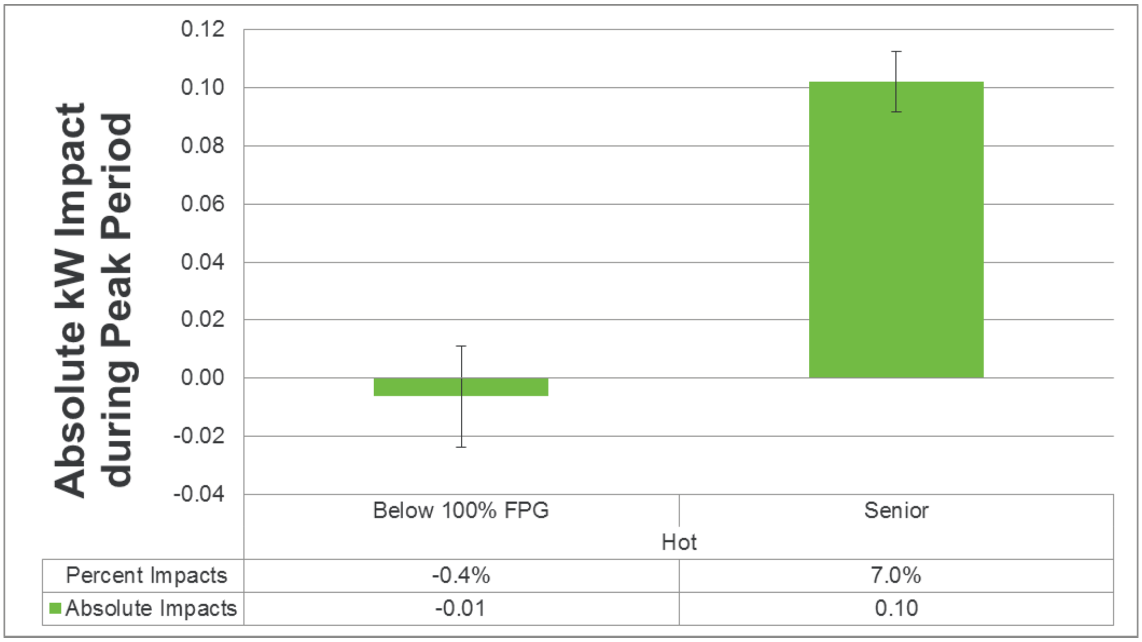


Figure 4.3-6: Average Absolute Load Impacts in the Peak Period on Weekdays for PG&E Rate 1 for Senior Households and Households with Incomes Below 100% of FPG (Positive values represent load reductions)



The load impacts for households with incomes less than or equal to 100% of FPG were quite different from those of senior households or the general population. These households did not reduce load at all during the peak period (the estimated values were not statistically different from 0). In fact, low income households increased usage significantly in the off-peak period on average weekdays, monthly system peak days and on the weekend. Daily electricity use increased by roughly 1.9% on weekdays and 1.6% weekends. It is also worth noting that reference loads for these households were nearly identical to loads for CARE/FERA customers in the hot climate region (as shown previously in Table 4.3-5) and were only about 7% lower than the overall population in the hot climate region. Put another way, low income households are not, on average, low users of electricity in PG&E's hot climate region but they are low responders to TOU price signals in this instance.[57]

[57] As seen in Section 5, results in SCE's service territory are quite different.

Table 4.3-6: Rate 1 Load Impacts by Rate Period and Day Type for PG&E for Senior Households and Households with Incomes Below 100% of FPG (Positive values represent load reductions)

Rate 1								
Day Type	Period	Hours	Hot, Below 100% FPG			Hot, Senior		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	1.47	-0.01	-0.4%	1.46	0.10	7.0%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.80	-0.02	-2.6%	0.74	0.00	-0.1%
	Day	**All Hours**	**0.94**	**-0.02**	**-1.9%**	**0.89**	**0.02**	**2.3%**
Average Weekend	Off Peak	All Hours	0.96	-0.02	-1.6%	0.92	0.02	1.7%
	Day	**All Hours**	**0.96**	**-0.02**	**-1.6%**	**0.92**	**0.02**	**1.7%**
Monthly System Peak Day	Peak	4 PM to 9 PM	1.88	-0.01	-0.6%	1.99	0.15	7.4%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.97	-0.04	-3.9%	0.94	0.00	-0.4%
	Day	**All Hours**	**1.16**	**-0.03**	**-2.8%**	**1.16**	**0.03**	**2.4%**

4.3.2 Rate 2

Key Findings for PG&E Rate 2

Rate 2 has a shorter peak period than Rate 1, with peak hours covering just the evening hours from 6 to 9 PM, but has a shoulder period from 4 to 6 PM and 9 to 10 PM. TOU rates are also in effect on weekends. The average peak period load reduction was 6.1% across the PG&E service territory and the pattern of load reductions across climate regions and between CARE/FERA and non-CARE/FERA customers was similar to Rate 1. Load reductions on weekends were similar to weekday reductions in all rate periods.

PG&E's Rate 2 differs from Rate 1 in several important ways. First, Rate 2 has three rate periods on weekdays in the summer, rather than two rate periods. Second, the Rate 2 peak period is a shorter, with a three-hour peak period covering only the evening hours from 6 to 9 PM compared with the five-hour peak period from 4 to 9 PM in Rate 1. Rate 2 has a partial peak period from 4 to 6 PM and from 9 to 10 PM. Finally, on weekends, the same three rate periods as on weekdays are in effect with Rate 2, whereas for Rate 1, all weekend hours are charged at the off-peak, weekday price. Rate 2 peak-period prices above the baseline usage amount are about 2.5 ¢/kWh higher than Rate 1 peak period prices and the off-peak price for Rate 2 is roughly 2.0 ¢/kWh lower. The shoulder period price for Rate 2 is 39.3 ¢/kWh.

Figures 4.3-7 and 4.3-8 show the percent and absolute load impacts for the weekday peak period for Rate 2 for PG&E's service territory as a whole and for each climate region. From a policy perspective, it is important to note that there are statistically significant and materially significant load reductions in the Rate 2 peak period, which coincides completely with evening hours from 6 to 9 PM. The magnitude and pattern of load reductions across climate regions are similar for Rate 2 compared with Rate 1. The average weekday peak-period load reduction for Rate 2 equals 6.1% and 0.06 kW. The estimated impacts in the hot region (6.8% and 0.11 kW) are nearly identical to the Rate 1 reductions as are the estimates for the cool region. In the moderate climate region, the percent reduction in the peak period on weekdays for Rate 2, 5.8%, is higher than the 4.6% reduction for Rate 1 but this difference is not statistically significant. The difference in absolute load reductions across hot, moderate, and cool climate regions is statistically significant in all cases. The difference in percentage impacts is statistically significant between the moderate and cool regions but not between the hot and moderate regions.

Table 4.3-7 contains load impact estimates for each rate period and day type for Rate 2. Importantly, peak-period load reductions are similar on weekends and weekdays. Peak-period reductions on the monthly system peak days are 50% larger in percentage terms and twice as large in absolute terms for the service territory as a whole. The biggest difference between average weekday and monthly peak day values occurs in the moderate climate region, where absolute load reductions nearly tripled on the monthly peak days compared with the average weekday.

For the service territory as a whole, load reductions during the partial peak period were roughly half as large as peak period load reductions on weekdays and weekends, and about 33% lower on the average monthly peak day. All day types show statistically significant increases in off-peak usage for Rate 2. These increases were much larger than for Rate 1, and the difference between the two rates is statistically significant, even though the hours covered by the off-peak period are quite similar for both rates. The change in daily electricity use is also quite different between Rates 1 and 2, with the conservation effect being much less for Rate 2 (0.4%) compared with Rate 1 (1.6%) on the average weekday.

Figure 4.3-7: Average Percent Load Impacts for Peak Period for PG&E Rate 2[58] (Positive values represent load reductions)

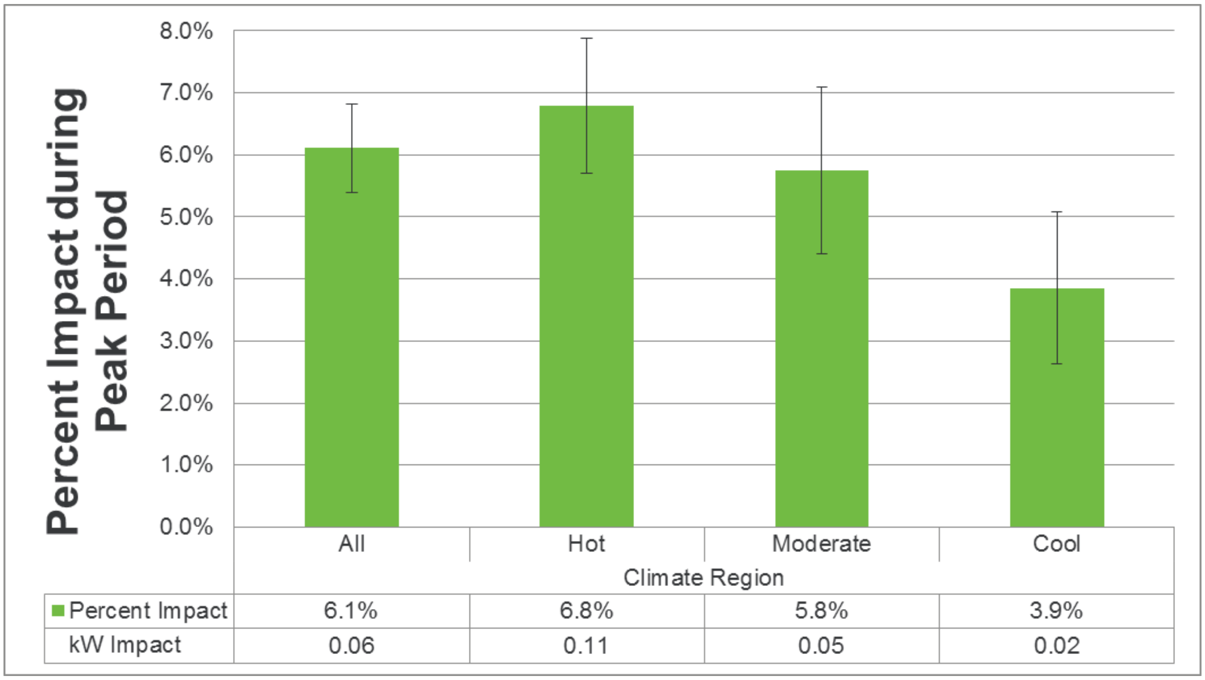
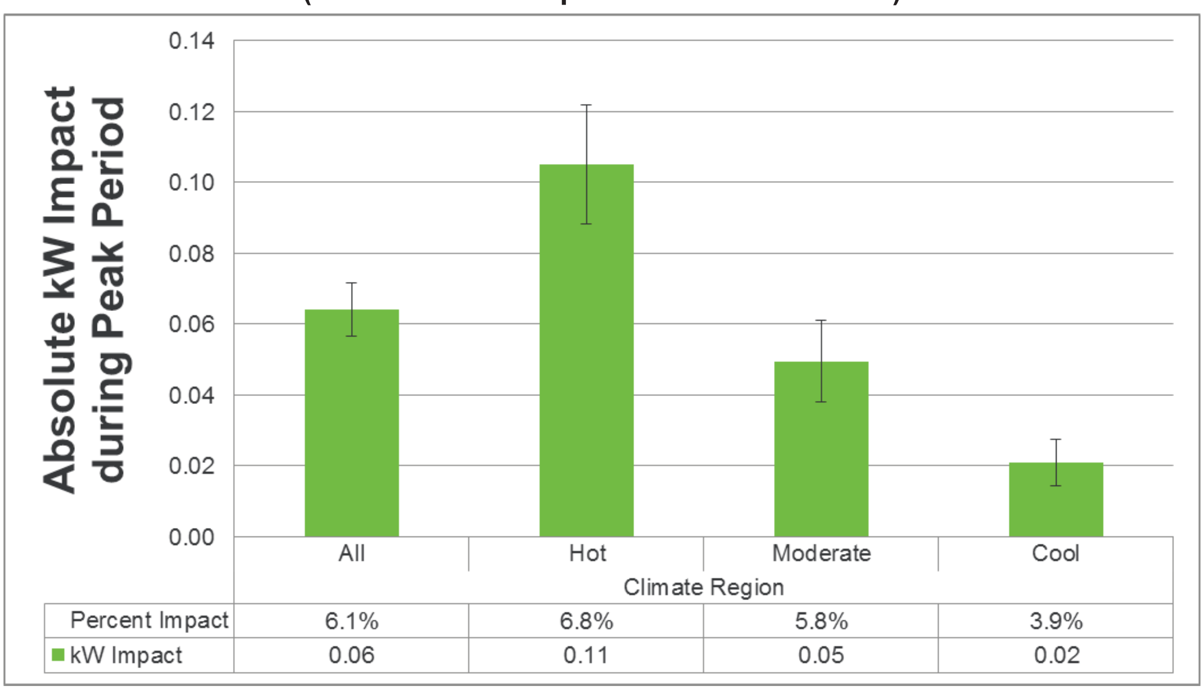


Figure 4.3-8: Average Absolute Load Impacts for Peak Period for PG&E Rate 2 (Positive values represent load reductions)



[58] PG&E Rate 2 summer impacts represent July through September 2016

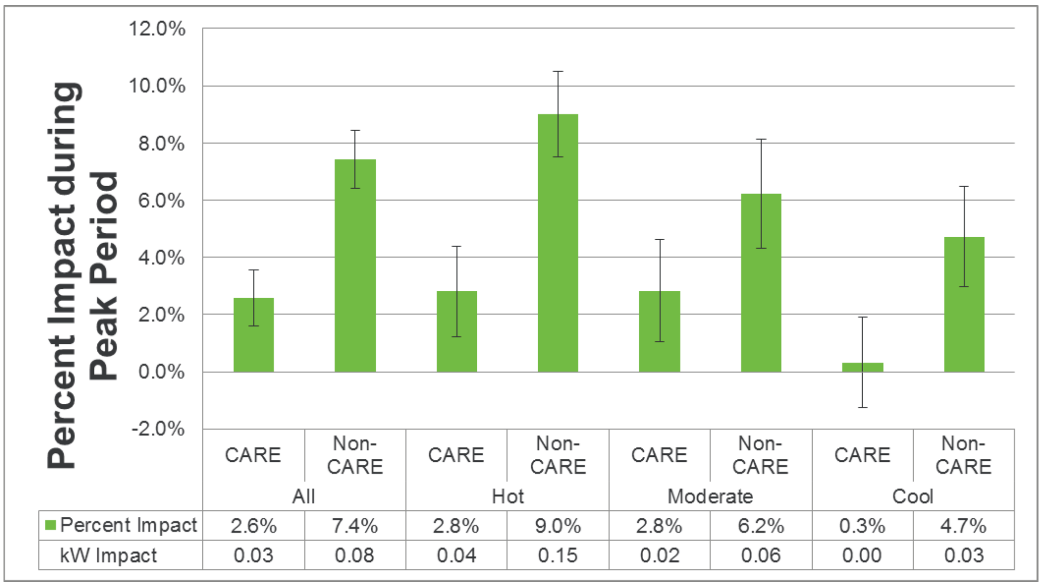
Table 4.3-7: Rate 2 Load Impacts by Rate Period and Day Type[59] (Positive values represent load reductions, negative values represent load increases)

			Rate 2											
			All			Hot			Moderate			Cool		
Day Type	Period	Hours	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	6 PM to 9 PM	1.05	0.06	6.1%	1.55	0.11	6.8%	0.86	0.05	5.8%	0.54	0.02	3.9%
	Partial Peak	4 PM to 6 PM, 9 PM to 10 PM	0.99	0.03	3.1%	1.51	0.07	4.3%	0.79	0.01	1.8%	0.47	0.00	0.1%
	Off Peak	12 AM to 4 PM, 10 PM to 12 AM	0.57	-0.01	-2.1%	0.78	-0.01	-1.8%	0.50	-0.02	-3.1%	0.35	0.00	-1.4%
	Day	**All Hours**	**0.68**	**0.00**	**0.4%**	**0.97**	**0.01**	**1.1%**	**0.58**	**0.00**	**-0.6%**	**0.39**	**0.00**	**-0.3%**
Average Weekend	Peak	6 PM to 9 PM	1.05	0.06	5.4%	1.55	0.10	6.2%	0.86	0.04	4.7%	0.54	0.02	3.0%
	Partial Peak	4 PM to 6 PM, 9 PM to 10 PM	1.02	0.03	3.3%	1.55	0.07	4.8%	0.82	0.01	1.5%	0.49	0.00	0.5%
	Off Peak	12 AM to 4 PM, 10 PM to 12 AM	0.61	-0.01	-1.6%	0.84	-0.01	-0.6%	0.52	-0.02	-3.2%	0.37	-0.01	-1.8%
	Day	**All Hours**	**0.71**	**0.00**	**0.6%**	**1.02**	**0.02**	**1.7%**	**0.60**	**-0.01**	**-1.0%**	**0.40**	**0.00**	**-0.7%**
Monthly System Peak Day	Peak	6 PM to 9 PM	1.36	0.12	8.9%	2.06	0.16	7.6%	1.15	0.14	12.4%	0.55	0.03	5.9%
	Partial Peak	4 PM to 6 PM, 9 PM to 10 PM	1.29	0.08	6.2%	2.01	0.11	5.7%	1.08	0.10	9.0%	0.48	0.00	0.2%
	Off Peak	12 AM to 4 PM, 10 PM to 12 AM	0.68	-0.01	-2.0%	0.98	-0.02	-2.2%	0.58	-0.01	-2.0%	0.35	-0.01	-1.4%
	Day	**All Hours**	**0.84**	**0.01**	**1.8%**	**1.24**	**0.02**	**1.4%**	**0.71**	**0.02**	**3.0%**	**0.39**	**0.00**	**0.1%**

[59] Shaded values are NOT statistically significant at the 90% level of confidence.

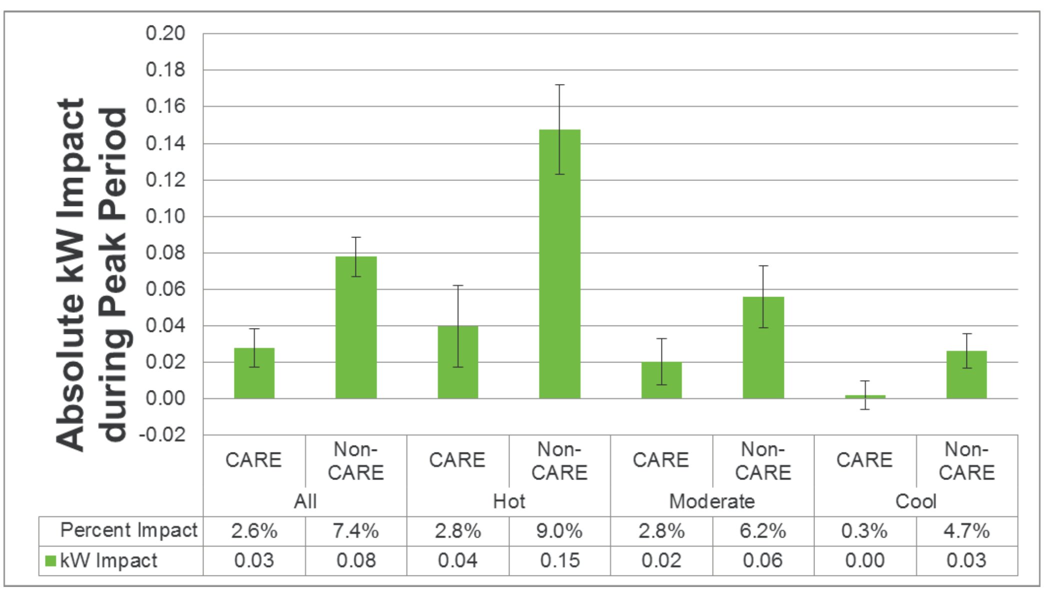
Figures 4.3-9 and 4.3-10 show the estimated peak period load impacts for Rate 2 for CARE/FERA and non-CARE/FERA households for the service territory as a whole and for each climate region. All of the peak period load reductions are statistically significant except for CARE/FERA customers in the cool climate region. There are significant differences in load reductions between the two segments, with load reductions for non-CARE/FERA households being much larger in both percentage and absolute terms than for CARE/FERA households. All of the differences in impacts between the two segments within each climate region are statistically significant in both percentage and absolute terms, including the moderate climate region where the confidence bands for the percentage impacts overlap.

Figure 4.3-9: Average Percent Load Impacts for Peak Period for PG&E Rate 2 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	2.6%	7.4%	2.8%	9.0%	2.8%	6.2%	0.3%	4.7%
kW Impact	0.03	0.08	0.04	0.15	0.02	0.06	0.00	0.03

Figure 4.3-10: Average Absolute Load Impacts for Peak Period for PG&E Rate 2 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	2.6%	7.4%	2.8%	9.0%	2.8%	6.2%	0.3%	4.7%
kW Impact	0.03	0.08	0.04	0.15	0.02	0.06	0.00	0.03

Tables 4.3-8 and 4.3-9 show the load impacts for non-CARE/FERA and CARE/FERA customers, respectively, for each rate period and day-type. As a reminder, the values in the first row of each table are the same as those found in Figures 4.3-9 and 4.3-10. As with the peak period load impacts, there are differences in load impacts between the two segments in other rate periods. For example, while there are statistically significant load reductions in the partial-peak period for non-CARE/FERA customers, most of the load impacts in this rate period for CARE/FERA customers are not statistically significant. In the cool climate region, CARE/FERA customers on average actually increased use in the partial peak period. Furthermore, whereas average non-CARE/FERA customers produced statistically significantly daily reductions in energy use overall and in most climate regions, average CARE/FERA customers either showed no statistically significant change in daily electricity use or showed statistically significant increases in electricity use for some regions and day types. This result is different than for Rate 1, where there were quite small, but often statistically significant, reductions in daily electricity use for non-CARE/FERA customers.

Table 4.3-8: Rate 2 Load Impacts by Rate Period and Day Type – Non-CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

			Rate 2											
Day Type	Period	Hours	All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	6 PM to 9 PM	1.04	0.08	7.4%	1.64	0.15	9.0%	0.89	0.06	6.2%	0.55	0.03	4.7%
	Partial Peak	4 PM to 6 PM, 9 PM to 10 PM	0.97	0.04	4.0%	1.57	0.10	6.2%	0.81	0.02	2.0%	0.48	0.00	0.6%
	Off Peak	12 AM to 4 PM, 10 PM to 12 AM	0.57	-0.01	-2.2%	0.81	-0.01	-1.4%	0.51	-0.02	-3.6%	0.36	-0.01	-1.4%
	Day	**All Hours**	**0.68**	**0.01**	**0.8%**	**1.01**	**0.02**	**2.2%**	**0.60**	**0.00**	**-0.8%**	**0.40**	**0.00**	**-0.1%**
Average Weekend	Peak	6 PM to 9 PM	1.05	0.07	6.5%	1.65	0.14	8.5%	0.89	0.04	4.7%	0.55	0.02	3.6%
	Partial Peak	4 PM to 6 PM, 9 PM to 10 PM	1.01	0.04	4.4%	1.64	0.12	7.2%	0.85	0.01	1.4%	0.50	0.00	0.9%
	Off Peak	12 AM to 4 PM, 10 PM to 12 AM	0.60	-0.01	-1.8%	0.87	0.00	-0.4%	0.53	-0.02	-3.4%	0.38	-0.01	-1.9%
	Day	**All Hours**	**0.71**	**0.01**	**0.9%**	**1.07**	**0.03**	**2.8%**	**0.62**	**-0.01**	**-1.1%**	**0.42**	**0.00**	**-0.6%**
Monthly System Peak Day	Peak	6 PM to 9 PM	1.37	0.14	10.4%	2.23	0.19	8.7%	1.21	0.17	14.2%	0.57	0.04	6.8%
	Partial Peak	4 PM to 6 PM, 9 PM to 10 PM	1.29	0.10	7.6%	2.14	0.15	7.2%	1.13	0.12	10.4%	0.49	0.00	0.0%
	Off Peak	12 AM to 4 PM, 10 PM to 12 AM	0.67	-0.01	-2.2%	1.02	-0.02	-2.3%	0.60	-0.01	-2.0%	0.36	-0.01	-2.1%
	Day	**All Hours**	**0.84**	**0.02**	**2.3%**	**1.31**	**0.03**	**2.0%**	**0.74**	**0.03**	**3.7%**	**0.40**	**0.00**	**-0.2%**

Table 4.3-9: Rate 2 Load Impacts by Rate Period and Day Type – CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

Rate 2														
Day Type	Period	Hours	All, CARE			Hot, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	6 PM to 9 PM	1.07	0.03	2.6%	1.41	0.04	2.8%	0.71	0.02	2.8%	0.49	0.00	0.3%
	Partial Peak	4 PM to 6 PM, 9 PM to 10 PM	1.05	0.01	0.7%	1.41	0.01	1.1%	0.67	0.00	0.6%	0.44	-0.01	-1.9%
	Off Peak	12 AM to 4 PM, 10 PM to 12 AM	0.58	-0.01	-1.8%	0.74	-0.02	-2.3%	0.44	0.00	-0.1%	0.32	0.00	-1.3%
	Day	**All Hours**	**0.70**	**0.00**	**-0.5%**	**0.90**	**-0.01**	**-0.7%**	**0.50**	**0.00**	**0.5%**	**0.36**	**0.00**	**-1.1%**
Average Weekend	Peak	6 PM to 9 PM	1.04	0.02	2.2%	1.38	0.03	2.0%	0.69	0.03	4.4%	0.48	0.00	0.4%
	Partial Peak	4 PM to 6 PM, 9 PM to 10 PM	1.05	0.00	0.5%	1.41	0.01	0.4%	0.67	0.01	1.7%	0.44	0.00	-1.0%
	Off Peak	12 AM to 4 PM, 10 PM to 12 AM	0.62	-0.01	-1.2%	0.78	-0.01	-0.9%	0.45	-0.01	-2.0%	0.33	0.00	-1.3%
	Day	**All Hours**	**0.72**	**0.00**	**-0.3%**	**0.94**	**0.00**	**-0.2%**	**0.51**	**0.00**	**-0.3%**	**0.36**	**0.00**	**-1.0%**
Monthly System Peak Day	Peak	6 PM to 9 PM	1.33	0.06	4.5%	1.80	0.10	5.5%	0.85	0.00	0.1%	0.51	0.01	2.3%
	Partial Peak	4 PM to 6 PM, 9 PM to 10 PM	1.31	0.03	2.4%	1.81	0.05	3.0%	0.83	0.00	-0.3%	0.45	0.01	1.1%
	Off Peak	12 AM to 4 PM, 10 PM to 12 AM	0.69	-0.01	-1.7%	0.90	-0.02	-2.0%	0.49	-0.01	-2.3%	0.33	0.00	1.3%
	Day	**All Hours**	**0.85**	**0.00**	**0.3%**	**1.13**	**0.01**	**0.5%**	**0.58**	**-0.01**	**-1.5%**	**0.36**	**0.01**	**1.5%**

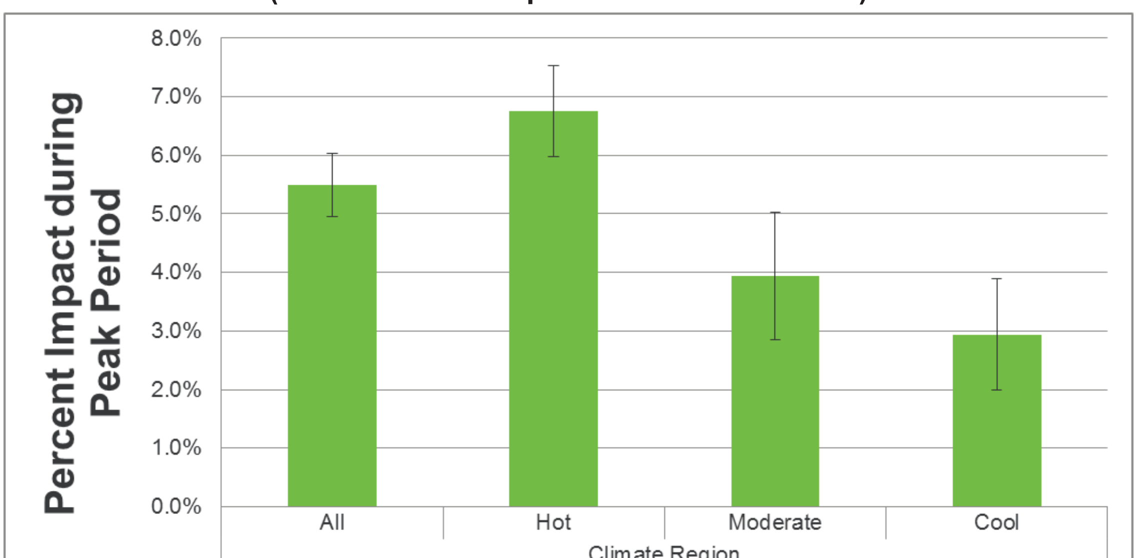
4.3.3 Rate 3

> **Key Findings for PG&E Rate 3**
>
> PG&E's Rate 3 is structurally similar to Rate 1 during the summer period but peak period prices are much higher. Average load impacts and the pattern of impacts across climate regions and customer segments were quite similar to Rate 1.

PG&E's Rate 3 is structurally identical to Rate 1 in the summer (and winter) periods, with a peak period from 4 to 9 PM on weekdays and off-peak prices in effect for all hours on the weekends. In spring, Rate 3 has a super off-peak price in effect from 10 AM to 4 PM on weekdays to encourage increased electricity use during a time when high levels of hydroelectric generation combined with below average electricity use create minimum load issues for the CAISO. In summer the period price is significantly higher for Rate 3 than for Rate 1 (57.2 ¢/kWh for Rate 3 compared with 42.0 ¢/kWh for Rate 1), and the off-peak price is lower (28.6 ¢/kWh versus 31.7 ¢/kWh).

Figures 4.3-11 and 4.3-12 show the peak period load reductions on average weekdays for Rate 3. Once again, the overall load reduction and the pattern in the load reductions across climate regions are very similar to Rates 1 and 2. There are no statistically significant differences in the load reductions between Rate3 and Rate 1 in spite of the significantly higher peak-to-off-peak price ratios (2.0 for Rate 3 versus 1.3 for Rate 1). It may be that an even larger price ratio, say 3 or 4 to 1, is required in order to significantly increase peak-period load reductions. The differences in absolute load impacts across climate regions are all statistically significant and the difference in percentage impacts between hot and moderate regions is also statistically significant. The difference between moderate and cool percentage impacts is not statistically significant.

Figure 4.3-11: Average Percent Load Impacts for Peak Period for PG&E Rate 3[60]
(Positive values represent load reductions)



	All	Hot	Moderate	Cool
Percent Impact	5.5%	6.8%	3.9%	2.9%
kW Impact	0.06	0.11	0.03	0.01

[60] PG&E Rate 3 summer impacts represent July through September 2016

Figure 4.3-12: Average Absolute Load Impacts for Peak Period for PG&E Rate 3 (Positive values represent load reductions)

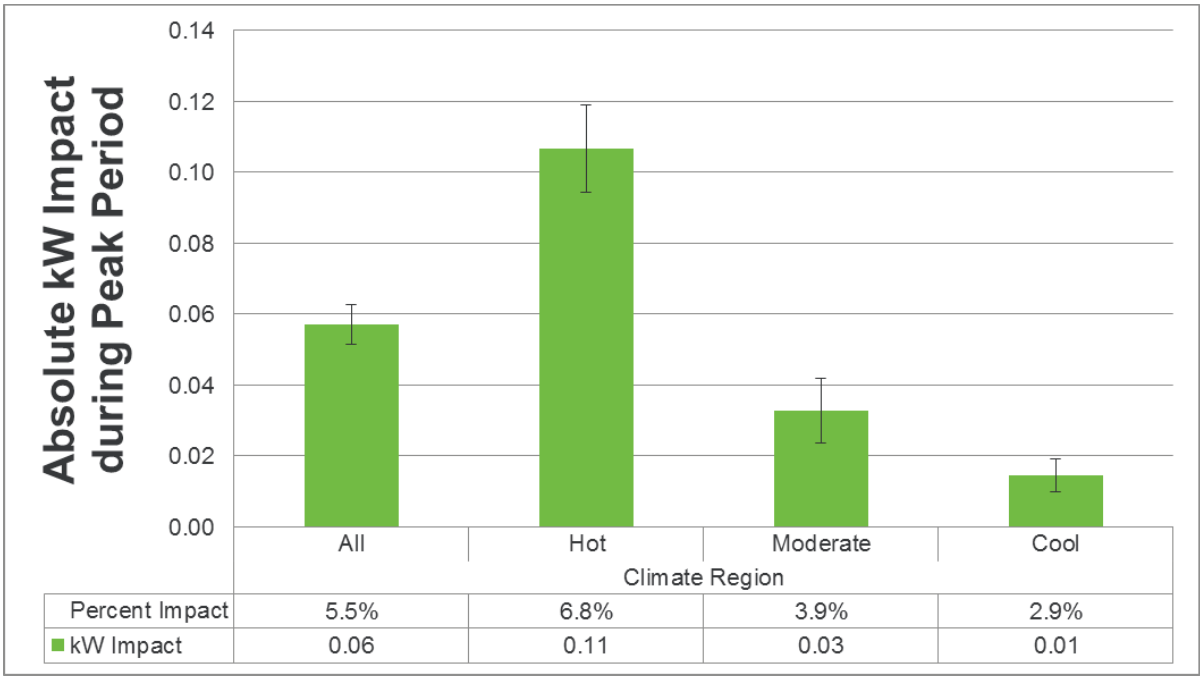


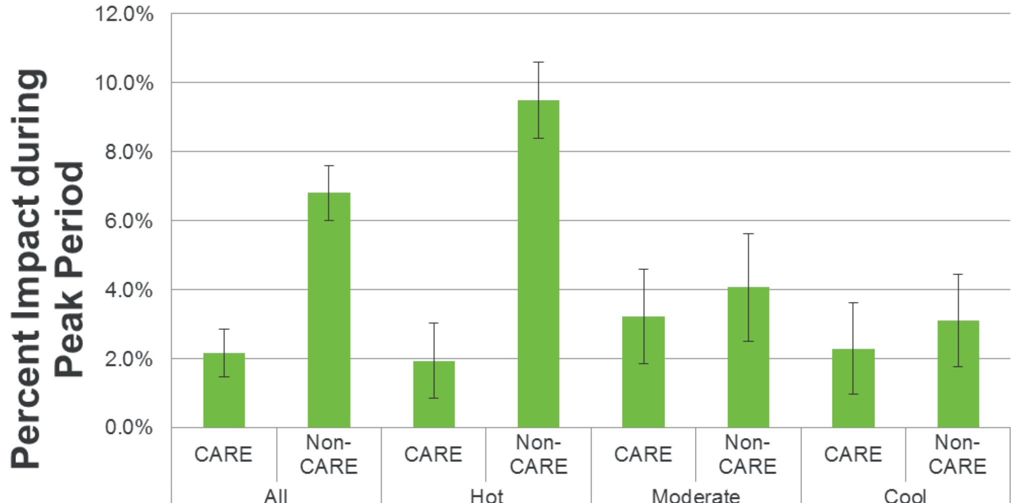
Table 4.3-10 contains estimates of load impacts for all relevant rate periods and day types. On weekdays, the change in usage in the off-peak period differs across regions, with no statistically significant change in the hot region, a statistically significant increase in usage in the moderate region, and a reduction in usage in the cool region. For the service territory as a whole, there was no significant change in off-peak usage on the average weekday. There is an overall conservation effect of 1.6% for the service territory as a whole with a larger, 2.6%, reduction in the hot region. In the moderate climate region, there was no change in daily electricity use on weekdays. The reduction in daily electricity use on weekends is similar to the reduction on weekdays for the service territory as a whole and for the hot climate region.

Table 4.3-10: Rate 3 Load Impacts by Rate Period and Day Type (Positive values represent load reductions, negative values represent load increases)

Rate 3														
Day Type	Period	Hours	All			Hot			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	1.04	0.06	5.5%	1.58	0.11	6.8%	0.83	0.03	3.9%	0.49	0.01	2.9%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.59	0.00	-0.2%	0.81	0.00	0.4%	0.51	-0.01	-1.7%	0.36	0.00	0.9%
	Day	**All Hours**	**0.68**	**0.01**	**1.6%**	**0.97**	**0.02**	**2.6%**	**0.58**	**0.00**	**0.0%**	**0.39**	**0.01**	**1.4%**
Average Weekend	Off Peak	All Hours	0.71	0.01	1.4%	1.02	0.03	2.7%	0.60	0.00	-0.3%	0.40	0.00	0.2%
	Day	**All Hours**	**0.71**	**0.01**	**1.4%**	**1.02**	**0.03**	**2.7%**	**0.60**	**0.00**	**-0.3%**	**0.40**	**0.00**	**0.2%**
Monthly System Peak Day	Peak	4 PM to 9 PM	1.36	0.08	6.0%	2.11	0.12	5.5%	1.14	0.09	8.0%	0.51	0.01	2.7%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.70	-0.01	-1.0%	1.01	-0.01	-1.1%	0.60	-0.01	-1.6%	0.36	0.00	1.1%
	Day	**All Hours**	**0.84**	**0.01**	**1.4%**	**1.24**	**0.02**	**1.2%**	**0.71**	**0.01**	**1.6%**	**0.39**	**0.01**	**1.5%**

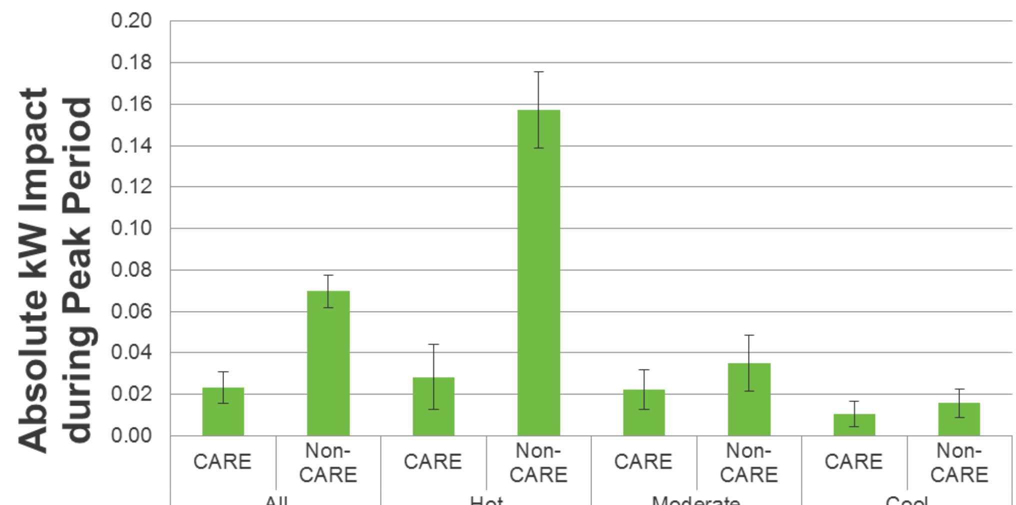
Figures 4.3-13 and 4.3-14 show the peak period load reductions on weekdays for non-CARE/FERA and CARE/FERA customers and Tables 4.3-11 and 4.3-12 show the load impacts for each rate period and day type for the two segments. As seen in the figures, there are large and statistically significant differences in peak period reductions between CARE/FERA and non-CARE/FERA customers in the service territory as a whole and in the hot region. However, the differences in the moderate and cool regions are much smaller and are not statistically significant.

Figure 4.3-13: Average Percent Load Impacts for Peak Period for PG&E Rate 3 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	2.2%	6.8%	1.9%	9.5%	3.2%	4.1%	2.3%	3.1%
kW Impact	0.02	0.07	0.03	0.16	0.02	0.03	0.01	0.02

Figure 4.3-14: Average Absolute Load Impacts for Peak Period for PG&E Rate 3 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	2.2%	6.8%	1.9%	9.5%	3.2%	4.1%	2.3%	3.1%
kW Impact	0.02	0.07	0.03	0.16	0.02	0.03	0.01	0.02

As seen in Tables 4.3-11 and 4.3-12 there are also significant differences in the load impacts between CARE/FERA and non-CARE/FERA customers for other rate periods and day types. For the service territory as a whole, non-CARE/FERA customers reduced daily electricity use by 2.3% and in the hot region, the reduction in daily usage was a very substantial 4.5%. CARE/FERA customers, on the other hand, showed no statistically significant reduction in usage for the service territory as a whole and showed small but statistically significant increases in usage in the hot climate region. In the moderate climate region, CARE/FERA customers had an average reduction in daily electricity use of 1.8%.

Table 4.3-11: Rate 3 Load Impacts by Rate Period and Day Type – Non-CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

			Rate 3											
			All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
Day Type	Period	Hours	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	1.02	0.07	6.8%	1.66	0.16	9.5%	0.86	0.03	4.1%	0.50	0.02	3.1%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.59	0.00	0.3%	0.84	0.02	2.0%	0.53	-0.01	-2.2%	0.37	0.00	1.2%
	Day	**All Hours**	**0.68**	**0.02**	**2.3%**	**1.01**	**0.05**	**4.5%**	**0.60**	**0.00**	**-0.3%**	**0.40**	**0.01**	**1.7%**
Average Weekend	Off Peak	All Hours	0.71	0.01	2.0%	1.07	0.05	4.2%	0.62	0.00	-0.4%	0.42	0.00	0.2%
	Day	**All Hours**	**0.71**	**0.01**	**2.0%**	**1.07**	**0.05**	**4.2%**	**0.62**	**0.00**	**-0.4%**	**0.42**	**0.00**	**0.2%**
Monthly System Peak Day	Peak	4 PM to 9 PM	1.36	0.10	7.1%	2.27	0.16	6.9%	1.20	0.11	8.8%	0.51	0.01	2.6%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.70	0.00	-0.6%	1.06	0.00	-0.2%	0.62	-0.01	-1.9%	0.37	0.01	1.3%
	Day	**All Hours**	**0.84**	**0.02**	**2.0%**	**1.31**	**0.03**	**2.3%**	**0.74**	**0.01**	**1.7%**	**0.40**	**0.01**	**1.7%**

Table 4.3-12: Rate 3 Load Impacts by Rate Period and Day Type – CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

			Rate 3											
			All, CARE			Hot, CARE			Moderate, CARE			Cool, CARE		
Day Type	Period	Hours	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	1.08	0.02	2.2%	1.46	0.03	1.9%	0.69	0.02	3.2%	0.46	0.01	2.3%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.60	-0.01	-1.5%	0.76	-0.02	-2.3%	0.45	0.01	1.2%	0.33	0.00	-0.4%
	Day	**All Hours**	**0.70**	**0.00**	**-0.3%**	**0.90**	**-0.01**	**-0.8%**	**0.50**	**0.01**	**1.8%**	**0.36**	**0.00**	**0.3%**
Average Weekend	Off Peak	All Hours	0.72	0.00	0.1%	0.94	0.00	0.0%	0.51	0.00	0.7%	0.36	0.00	-0.1%
	Day	**All Hours**	**0.72**	**0.00**	**0.1%**	**0.94**	**0.00**	**0.0%**	**0.51**	**0.00**	**0.7%**	**0.36**	**0.00**	**-0.1%**
Monthly System Peak Day	Peak	4 PM to 9 PM	1.36	0.04	2.9%	1.87	0.06	3.0%	0.85	0.02	2.4%	0.48	0.01	3.0%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.71	-0.01	-2.0%	0.93	-0.03	-2.7%	0.50	0.00	0.3%	0.34	0.00	0.2%
	Day	**All Hours**	**0.85**	**0.00**	**-0.3%**	**1.13**	**-0.01**	**-0.8%**	**0.58**	**0.01**	**1.0%**	**0.36**	**0.00**	**0.9%**

4.3.4 Comparison Across Rates

Comparison Across Rates

Using a common set of hours from 6 to 9 PM, there are no statistically significant differences in absolute or percentage peak period load reductions across PG&E's three pilot tariffs. However, there are statistically significant differences in average daily load reductions across tariffs.

Figures 4.3-15 and 4.3-16 compare the load impacts for the three rates tested by PG&E for the common set of peak-period hours, 6 to 9 PM, shared by all three tariffs. Using a common set of hours reduces differences in impacts across rates that might be due to differences in the number of hours included in the peak period or the timing of those hours. The hours from 6 to 9 PM define the peak period for Rate 2, which is a three period rate with a shoulder period from 4 to 6 PM and 9 to 10 PM. Rates 1 and 3 are two period rates with the same peak period, from 4 to 9 PM. Rate three has a higher peak to off-peak price ratio than Rate 1. As such, one would expect the peak-period load reductions to be higher for Rate 3 than for Rate 1. The peak to off-peak price ratio for Rate 2 is in between the other two but the partial peak period and the shorter peak period makes it difficult to predict whether the load reductions might be greater or less than the other rates.

As seen in the figures, there are no statistically significant differences in load impacts for the common hours from 6 to 9 PM across the three rates in either percentage or absolute terms overall or in any climate region. This is true in spite of the fact that the confidence bands are quite narrow.

Figure 4.3-15: Average Percent Impacts from 6 to 9 PM Across Rates|
(Positive values represent load reductions, negative values represent load increases)

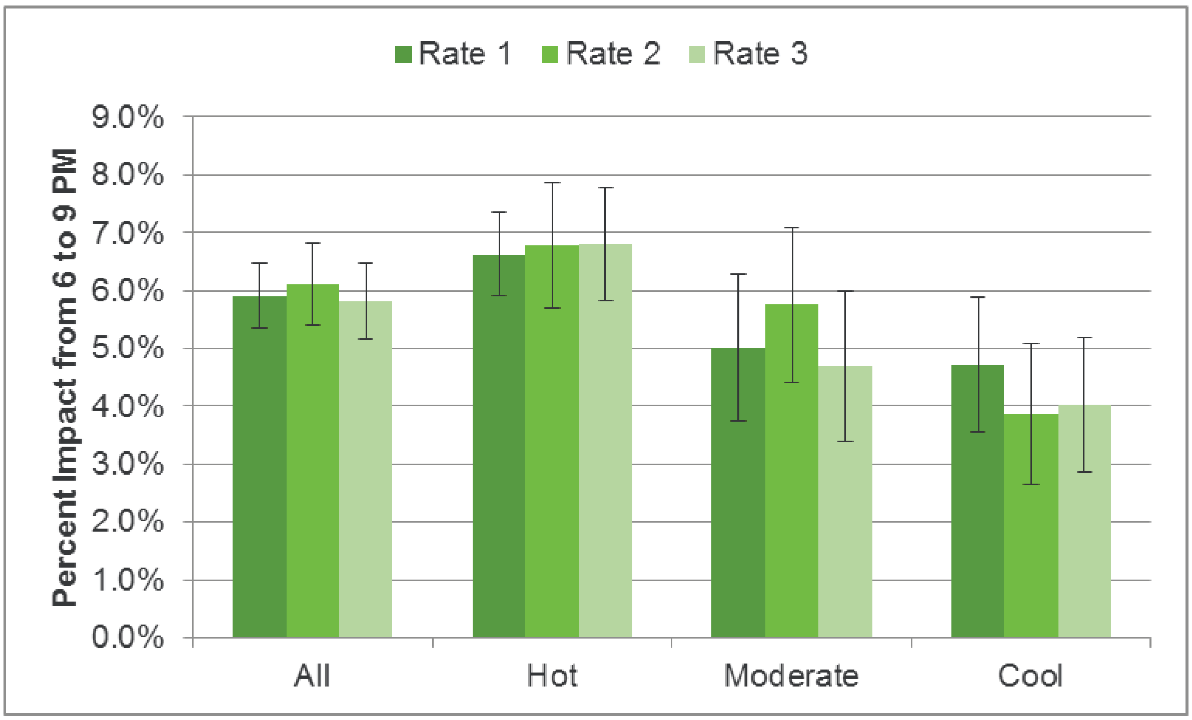
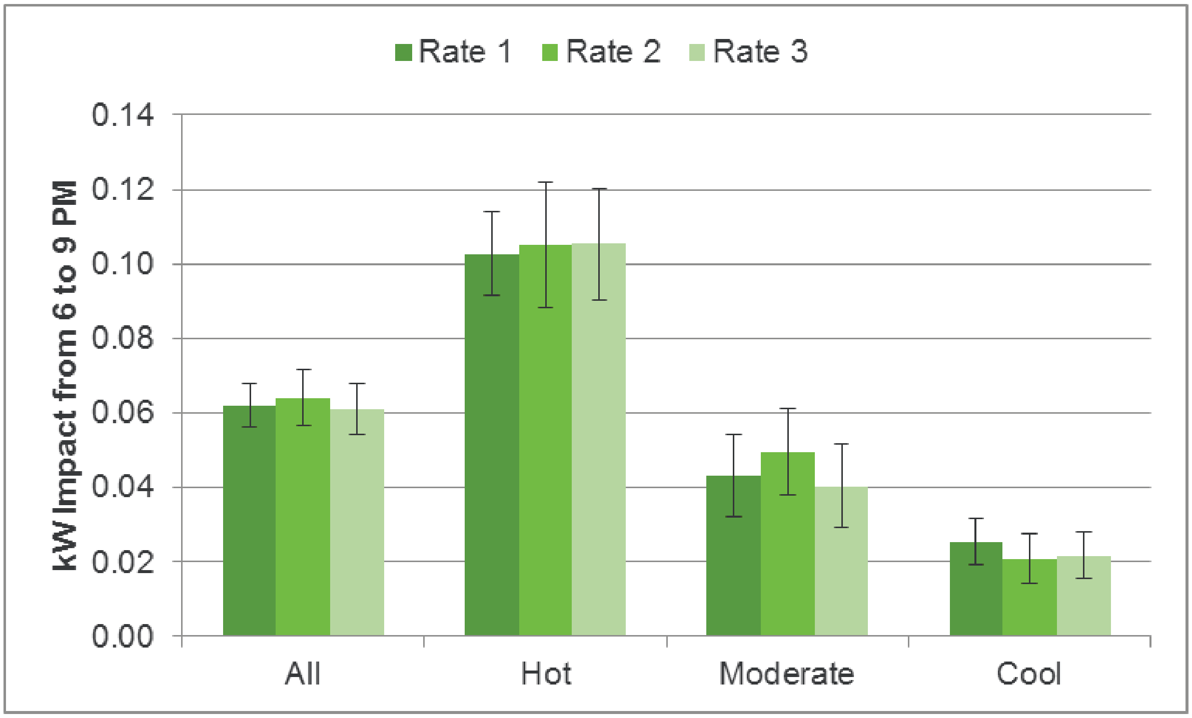


Figure 4.3-16: Average Absolute Impacts from 6 to 9 PM Across Rates
(Positive values represent load reductions, negative values represent load increases)



Figures 4.3-17 and 4.3-18 show the average change in daily electricity use for each rate and climate region. Whether daily electricity use increases or decreases depends on whether consumers respond to the TOU price signals by conserving during the peak period and leaving their off peak usage unchanged, by shifting usage and keeping total usage constant, or by actually increasing consumption of end-uses during off peak periods more than they reduce during peak periods (e.g., are less careful about turning off lights during the lower priced periods or heat a spa to a higher temperature in light of the lower off-peak prices). As seen in the figures, there are significant differences in the reduction in daily electricity consumption between Rate 2 and the other two rates, with the reductions for Rate 2 being significantly less than for the other two rates. Customers on Rates 1 and 3 reduced consumption by about 1.5% for the service territory as a whole and reduced usage between 2% and 2.5% in the hot climate region. Reductions for Rates 1 and 3 were much smaller in both percentage and absolute terms in the moderate and cool regions and in some cases were not statistically significant. Rate 2 also showed a small reduction in daily use in the hot climate region and overall but in the moderate climate region, the average customer on Rate 2 actually used more electricity than they would have on the OAT. In the cool region, the average Rate 2 customer may have increased electricity use slightly but the change is not statistically significant.

Figure 4.3-17: Average Percent Daily kWh Impacts Across Rates
(Positive values represent load reductions, negative values represent load increases)

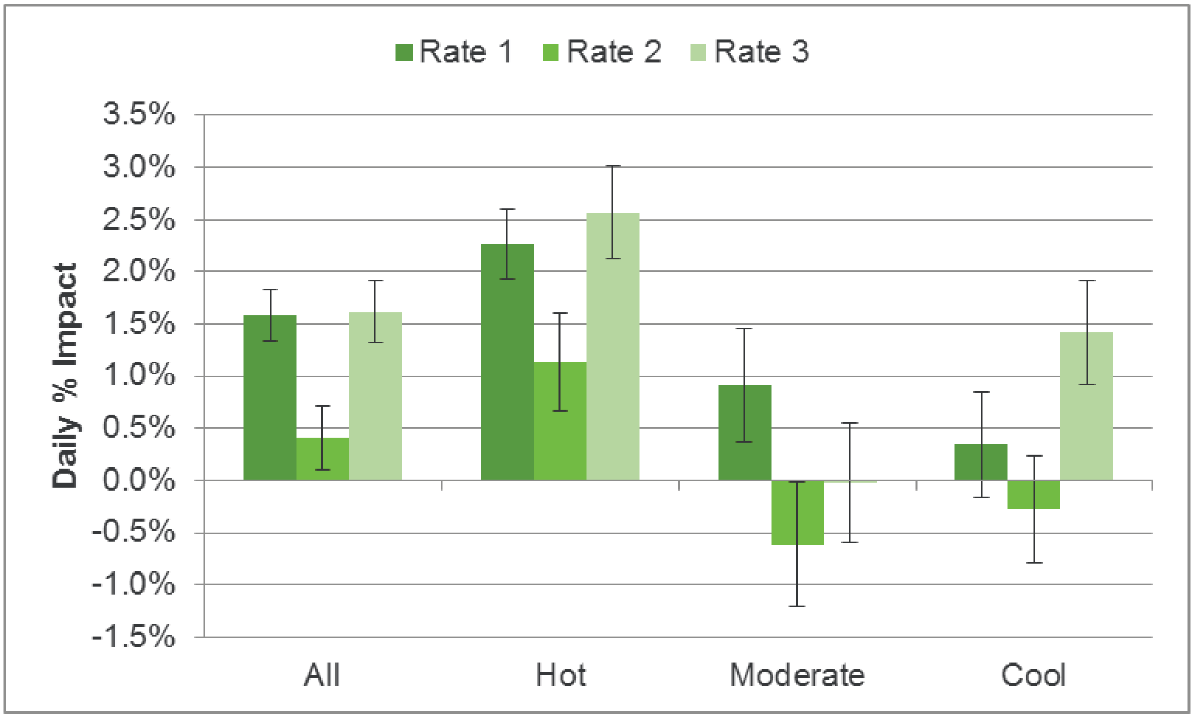
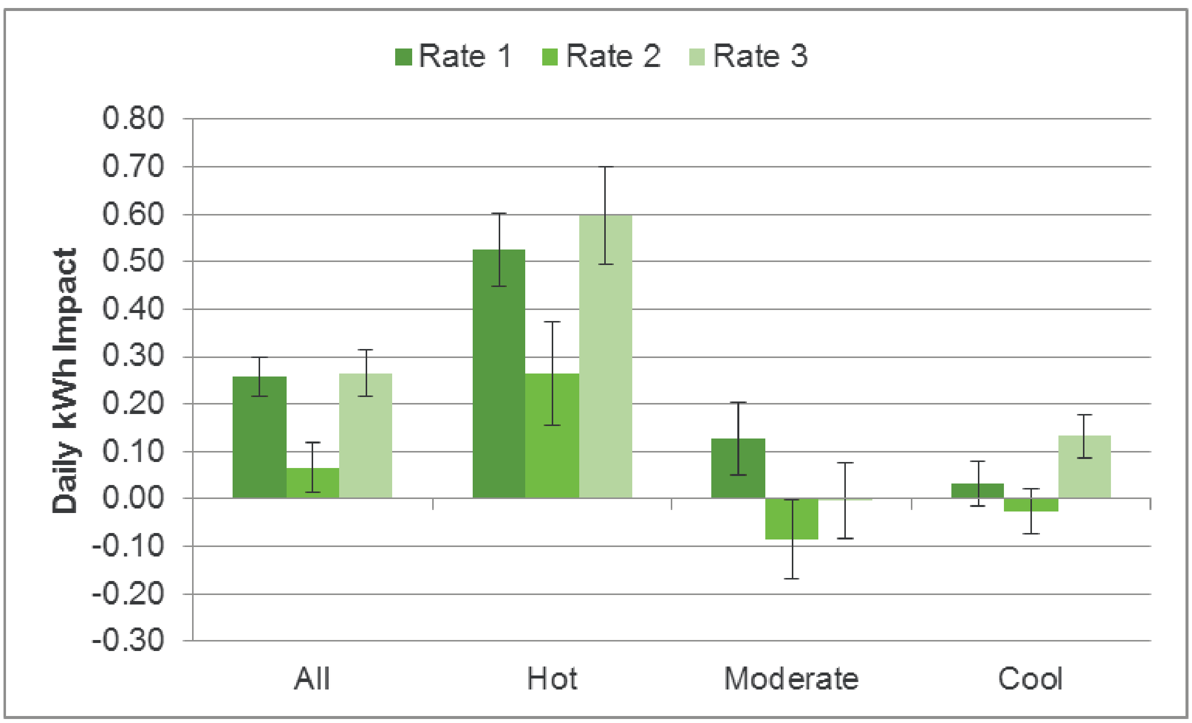


Figure 4.3-18: Average Absolute Daily kWh Impacts Across Rates
(Positive values represent load reductions, negative values represent load increases)



4.4 Bill Impacts

Summer Bills Increased for Almost all Participants

Annually, the majority of customers would experience modest structural bill impacts for all three rates. However, during the summer period, nearly all customers experienced structural bill increases and the average customer was only able to mitigate these bill increases by a small amount through changes in usage. Many consumers can expect to see bill decreases in the winter period and annually.

This section summarizes the bill impact estimates for the three rate treatments tested by PG&E. The CPUC resolution approving PG&E's pilot requires that bill impacts be estimated for the following rates, customer segments, and climate regions:

- Seniors, CARE/FERA customers, non-CARE/FERA customers, households with incomes below 100% of FPG, and households with incomes between 100% and 200% of FPG in PG&E's hot climate region for Rate 1; and
- For CARE/FERA and non-CARE/FERA customers on each rate across PG&E's service territory as a whole and for each climate region.

In addition to these required segments, Nexant estimated bill impacts for seniors, households with incomes below 100% of FPG, and households with incomes between 100% and 200% of FPG in PG&E's hot climate region for Rate 2 and Rate 3. Bill impacts are reported as the average monthly impact for the summer months of July, August, and September[61] for each rate, climate zone, and customer segment summarized above. Following an iterative process with stakeholders to determine the best way to present the analysis so that it clearly answered the policy questions of interest, the following four analyses were conducted:

- **Structural benefiter/non-benefiter analysis based on pretreatment usage-** Displaying the proportions of structural benefiters and non-benefiters for each rate and relevant customer segment based on pretreatment data on an annual and summer season basis;
- **Estimation of the average bill impact due to changes in usage-** Displaying the average bill impact resulting from changes in behavior in response to the new price signals for each rate and relevant customer segment (after controlling for exogenous factors);
- **Estimation of the total bill impact due to both the difference in the tariffs (holding usage constant) and behavior change-** Displaying the bill impact for each rate and relevant customer segment due to structural differences in the rate mitigated by changes in behavior; and
- **Change in the distribution of bill impacts due to behavior change-** Displaying the distribution curves of bill impacts (percentage of customers with bill impacts within $10 incremental bins) with and without behavior change in the same graph to illustrate if the distribution for participants shifted to the left or changed shape compared with the distribution for control customers without behavior change.

A more detailed explanation of each type of analysis and how the analysis was conducted is contained in Section 3.7. The remainder of this section is organized according to the four analysis types summarized above – that is, bill impacts are presented for each rate, relevant customer segment, and climate region for each of the four analyses.

[61] Estimates were not produced for the month of June because enrollment changed dramatically from the beginning to the end of the month and the estimates would not be comparable to those for other months.

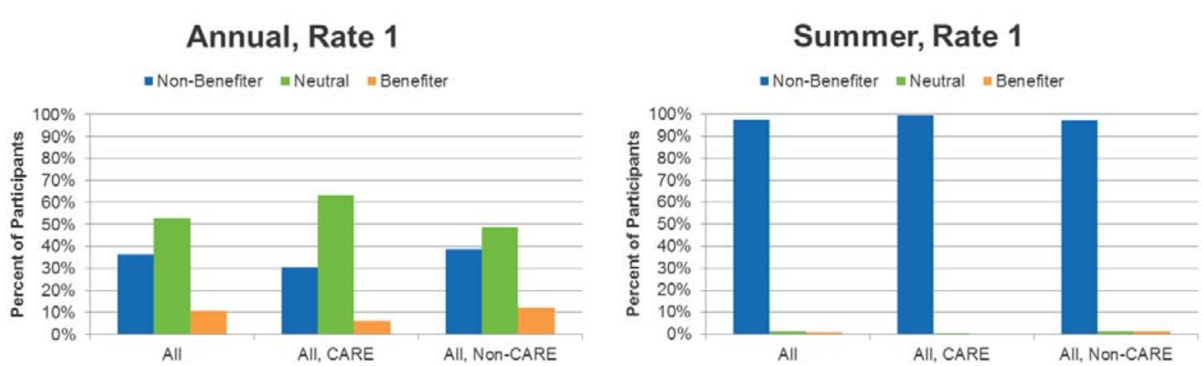
4.4.1 Structural Benefiter/Non-Benefiter Analysis Based on Pretreatment Usage

The structural benefiter analysis was conducted for the summer and annual time periods using pretreatment data from the treatment group for each rate and relevant customer segment. Annual impacts were based on hourly load data from May 2015 through April 2016. Summer impacts were based on June 2015 through September 2015. Monthly bills were estimated for each treatment group customer on the OAT and TOU rate using the hourly load data. The difference in bills based on the TOU rate and the OAT determines if a customer is a structural benefiter, a structural non-benefiter, or falls in a neutral range defined as have a structural bill impact between ±$3.[62]

Final results from the structural benefiter / non-benefiter analysis are presented in column graphs and shown as percentages for the summer season and on an annual basis. For each rate and relevant segment, the percentage of customers who are non-benefiter, neutral (+/- $3), or benefiters based on their average monthly bills for the time period of interest are shown as individual columns. The three columns within each rate and segment combination total to 100%, thus showing the distribution of structural benefiters and non-benefiters for each rate and segment of interest.

Figure 4.4-1 presents the outcome of the structural benefiter analysis for Rate 1 at the aggregate level across climate regions for all customers as well as for CARE/FERA and non-CARE/FERA. The graph on the left presents the analysis on an annual basis and the graph on the right presents the findings for the summer period. Nearly all customers are structural non-benefiters in the summer season, which was expected. A higher proportion of CARE/FERA customers are structural non-benefiters than CARE/FERA customers.

Figure 4.4-1: Rate 1 Structural Benefiter / Non-Benefiter Analysis
All | CARE/FERA | Non-CARE/FERA



[62] See section 3.2.1 for additional details on the methodology.

Figure 4.4-2 presents the outcome of the structural benefiter analysis for Rate 1 at the detailed segment level by climate region. The findings at the aggregate level still hold, with nearly all customers as structural non-benefiters in the summer season. On an annual basis, the hot climate region had a greater proportion of structural non-benefiters than the moderate or cool regions. Finally, a higher proportion of non-CARE/FERA customers than CARE/FERA customers are non-benefiters within each climate region, which is also consistent with the aggregate findings.

Figure 4.4-2: Rate 1 Structural Benefiter / Non-Benefiter Analysis Detailed Segments by Climate Region

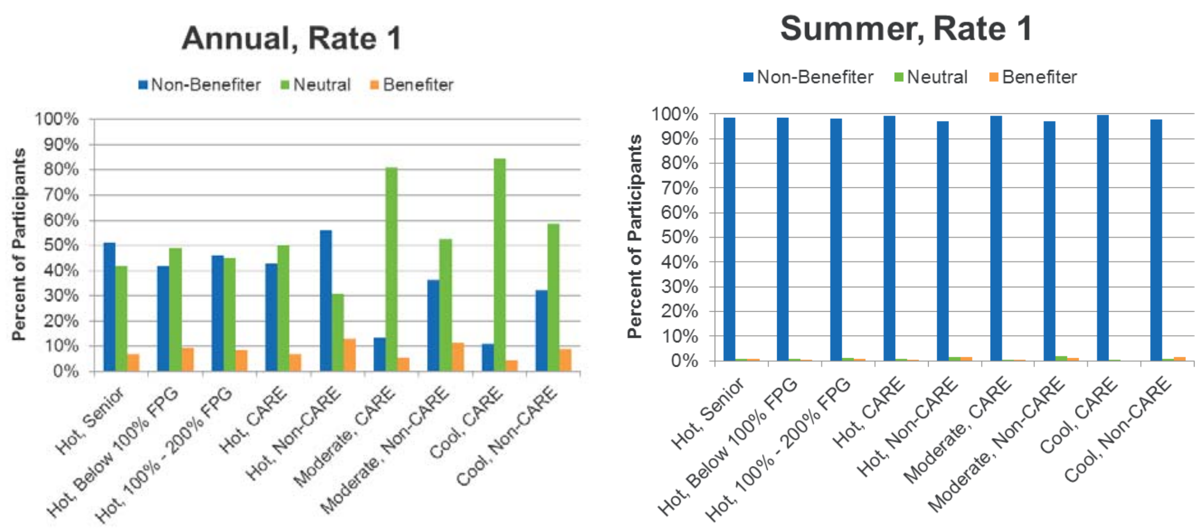


Figure 4.4-3 presents the outcome of the structural benefiter analysis for Rate 2 at the aggregate level across climate regions. Rate 2 differs from Rate 1 in several ways: the peak period is from 6 to 9 PM rather than 4 to 9 PM, it is a three period rate with a shoulder period from 4 to 6 PM and 9 to 10 PM, and prices are the same on weekends and weekdays. Overall, the general pattern of structural benefiters, non-benefiters, and neutrals is similar between Rate 1 and Rate 2. Nearly all customers are structural non-benefiters in the summer season, and there is a higher proportion of structural non-benefiters among non-CARE/FERA customers than among CARE/FERA customers.

Figure 4.4-3: Rate 2 Structural Benefiter / Non-Benefiter Analysis All | CARE/FERA | Non-CARE/FERA

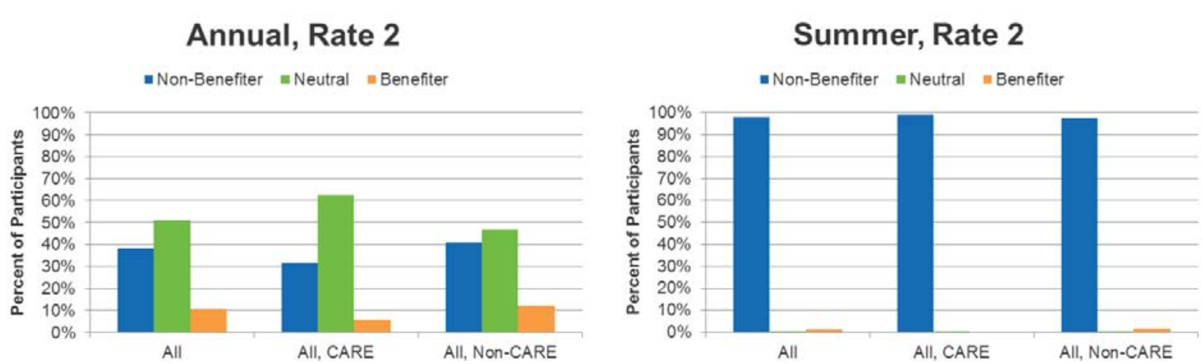


Figure 4.4-4 presents the outcome of the structural benefiter analysis for Rate 2 at the detailed segment level by climate region. The findings at the aggregate level still hold, with nearly all customers as structural non-benefiters in the summer season. On an annual basis, the hot climate region had a greater proportion of structural non-benefiters than the moderate or cool regions. Finally, a higher proportion of non-CARE/FERA customers are non-benefiters than CARE/FERA customers in each climate region, which is also consistent with the aggregate findings. Overall the findings for Rate 2 at the detailed segment level are also very similar to the distribution of structural benefiters and non-benefiters from Rate 1.

Figure 4.4-4: Rate 2 Structural Benefiter / Non-Benefiter Analysis
Detailed Segments by Climate Region

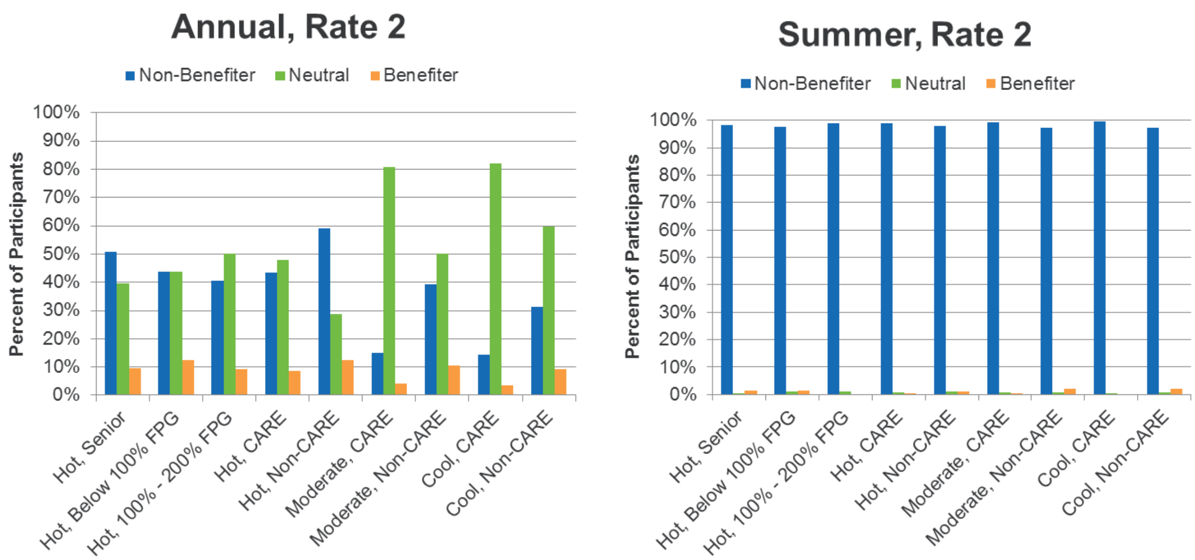


Figure 4.4-5 presents the outcome of the structural benefiter analysis for Rate 3 at the aggregate level across climate regions. PG&E's Rate 3 has the same peak period on weekdays as Rate 1 but has a higher peak-to-off-peak price ratio than Rate 1. Like Rate 1, and unlike Rate 2, all weekend hours are priced at the off-peak rate. Additionally, in the spring, Rate 3 has a super off-peak price from 11 AM to 4 PM. As with the other two rates, nearly all customers are structural non-benefiters in the summer season, and non-CARE/FERA customers have a higher proportion of non-benefiters than CARE/FERA customers

Figure 4.4-5: Rate 3 Structural Benefiter / Non-Benefiter Analysis
All | CARE/FERA | Non-CARE/FERA

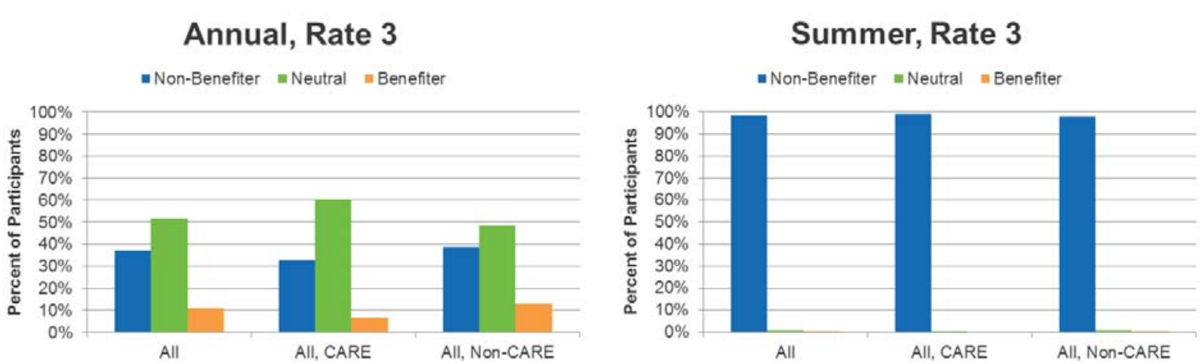
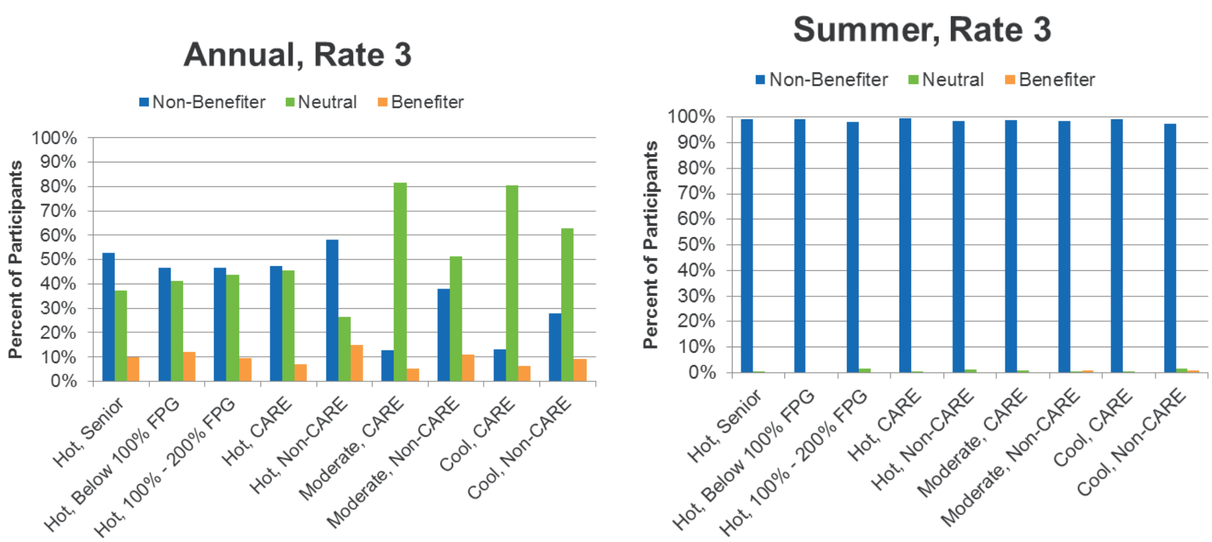


Figure 4.4-6 presents the outcome of the structural benefiter analysis for Rate 3 at the detailed segment level by climate region. As with the other two rates, the findings at the aggregate level still hold.

Figure 4.4-6: Rate 3 Structural Benefiter / Non-Benefiter Analysis Detailed Segments by Climate Region



Overall, a general pattern of structural benefiters and non-benefiters emerged that was consistent across all three rates. Nearly all customers were non-benefiters in the summer season, regardless of climate region or customer segment. On an annual basis, the hot climate region had a greater proportion of structural non-benefiters than the moderate or cool regions, and non-CARE/FERA customers were more likely to be structural non-benefiters than CARE/FERA customers. As noted previously, the large proportion of non-benefiters on an annual basis is due in part to the fact that PG&E's glide path OAT transition has been delayed – the TOU rate was designed to be revenue neutral relative to the 2017 glide path rate but the OAT used here is the 2016 glide path tariff.

The next section presents the analysis showing how much customers were able to reduce their bills as a result of behavior change. Section 4.4.3 combines the findings from the structural benefiter analysis with average bill impact findings to provide the full picture of how much of the structural loss customers were able to offset based on changing their energy use behavior.

4.4.2 Estimation of the Average Bill Impact Due to Changes in Usage

The average bill impact due to customers changing their energy usage in response to the TOU rate was estimated by calculating the difference in bills calculated using the TOU rate and post-enrollment usage for both the control and treatment group minus the difference in bills on the TOU rate using pretreatment usage for both the control and treatment groups. The control group bill calculated on the TOU rate represents the bill that would be expected if a customer was billed on the TOU rate, but didn't change their energy use behavior. The bill for the treatment group customers on TOU rate reflects any behavioral changes in response to being on the TOU rate. By subtracting the treatment group's average bill from the control group's average bill—and removing any pre-existing differences—we are able estimate the average bill impact attributable to the treatment group's change in behavior resulting from exposure to the pilot rate, after controlling for exogenous factors. [63] A positive impact indicates that customers successfully reduced their bills relative to the control group who did not respond to a TOU rate.

Bill impacts due to behavior change are presented in a column graph and shown as dollar impacts for the average summer monthly bill for July, August, and September 2016. The error bars on the graph represent the 90% confidence interval. Therefore, any impacts with error bars that cross below zero are not statistically significant at the 90% confidence level. Impacts are organized by rate, climate region, and segment. The bill impact in percentage terms that corresponds to the dollar amount is also included in the figure to provide context.

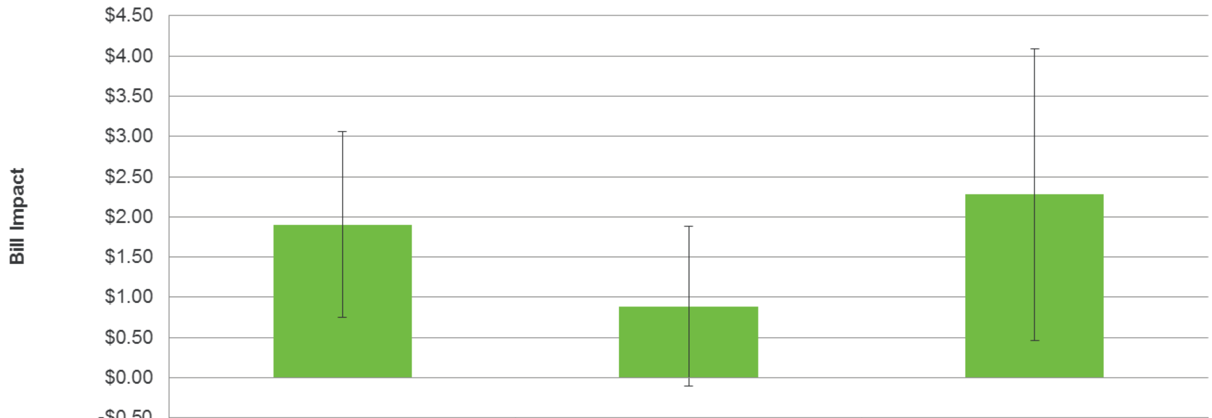
It should be noted that the aggregate level results were weighted following the same approach used for the load impacts.[64] The weights are representative of the mix of customers eligible to participate in the pilot, not just those who enrolled. Consequently, some of the individual segments shown in the detailed findings section may have more or less weight than other segments when they are combined together to develop the aggregate results. It is important to note that small bill impacts do not necessarily indicate customers did not change their behavior. As seen in the load impact section, load reductions in peak or shoulder periods, which would lead to lower bills all other things equal, are sometimes offset by load increases in the off-peak period. Depending on the relative magnitude of each change, bill impacts could go up, down, or remain largely unchanged even though customers made significant changes in behavior. It is also important to note that the values shown here represent changes in bills due to change in behavior – they do not represent the total change in the bill (nearly all bills increased in the summer). The total changes in the bill will be presented in the next section.

Figure 4.4-7 provides the overall results for customers on Rate 1. Through changing their energy use the average Rate 1 customer was able to reduce what their average monthly bill would have otherwise been by $1.90, or 1.6%. Though small, this result is statistically significant at the 90% confidence level. Average hourly peak period load impacts for Rate 1 customers were 5.8% or 0.06 kW. The relatively small bill impact is due, in part, to the relatively short peak period over which load reductions occur and the fact that there were small increases in usage on average in the longer off-peak period. For the five hour peak period, the average daily energy savings is approximately 0.3 kWh (5 hours times 0.06 kWh). If we assume four weeks in a month, and five days a week, the result is twenty days where we would expect to observe the peak period reductions. Multiplying 20 days by the 0.3 kWh we expect to find about 6 kWh savings from the peak period per month. When factoring in both the CARE/FERA and non-CARE/FERA rates, the average summer weekday peak period price per kWh on Rate 1 is $0.37. An impact of 6 kWh per month at $0.37 per kWh equals a total estimated peak period bill reduction of $2.22. When factoring in slight increases in energy use during off-peak hours, the $1.90 monthly bill impact appears quite reasonable. Bill impacts due to behavior change for CARE/FERA customers were less than half of the average customer impact at $0.88 (1%) and were not statistically significant. Non-CARE/FERA customer bill impacts were statistically significant at $2.28 (1.7%) per month.

[63] See section 3.2.2 for additional details on the methodology.

[64] See section 4.3 for a detailed discussion of the weighting approach.

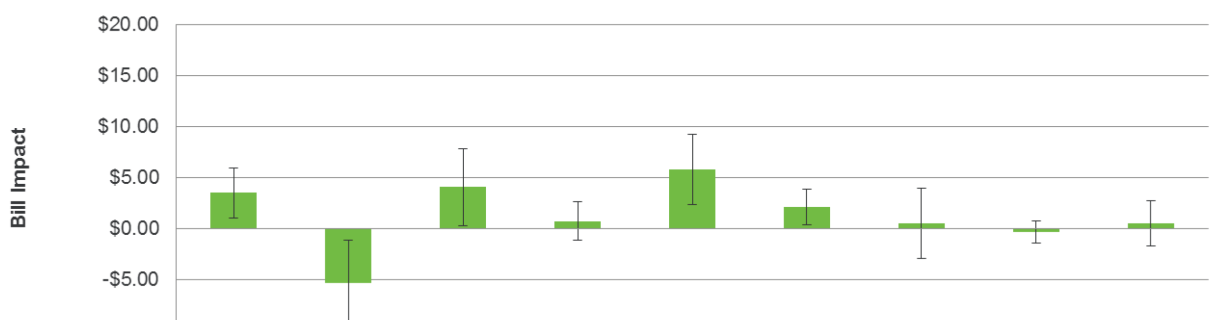
Figure 4.4-7: Rate 1 Average Bill Impacts from Behavior Change
All | CARE/FERA | Non-CARE/FERA
(Positive values represent bill reductions)



	All Customers	CARE	Non-CARE
		All	
Bill Impact	$1.90	$0.88	$2.28
Percent Impact	1.6%	1.0%	1.7%

Figure 4.4-8 provides the detailed results by climate region and segment for customers on Rate 1. Non-CARE/FERA customers in the hot climate region exhibited the largest bill reduction due to changes in behavior at $5.87 per month (2.7%). Seniors and customers between 100% and 200% of FPG also exhibited statistically significant bill reductions due to behavior change of $3.56 (2.3%) and $4.10 (2.9%), respectively. Low income customers in the hot climate region saw statistically significant bill increases from behavior change. As seen in Table 4.3-6, low income customers increased usage on the TOU rate in all rate periods relative to the control group. This may be at least partially attributable to low income customers having a lower understanding of the rate design, as discussed in Section 4.5. As seen in Table 4.5-33, almost 20% of the customers below 100% of FPG could not correctly identify a single hour that fell within the peak period compared with only 6% of non-CARE/FERA customers who could not identify a single correct peak period hour.

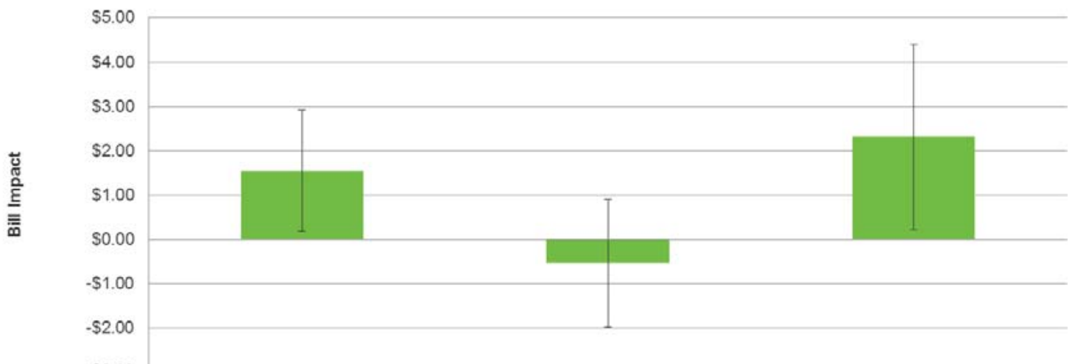
Figure 4.4-8: Rate 1 Average Bill Impacts from Behavior Change
Detailed Segments by Climate Region
(Positive values represent bill reductions)



	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
			Hot			Moderate		Cool	
Bill Impact	$3.56	-$5.32	$4.10	$0.79	$5.87	$2.16	$0.55	-$0.30	$0.54
Percent Impact	2.3%	-4.4%	2.9%	0.7%	2.7%	3.5%	0.5%	-0.7%	0.7%

Figure 4.4-9 provides the overall results for customers on Rate 2, which are generally very similar to Rate 1. Through changes in behavior, the average Rate 2 customer was able to reduce what their average monthly bill would have otherwise been by $1.54, or 1.2%. This result is statistically significant at the 90% confidence level. Average hourly peak period load impacts for Rate 2 customers were 6.1% or 0.06 kW. Bill impacts for CARE/FERA customers were negative—meaning CARE/FERA customers' bills increased slightly as a result of their energy use behavior—however, the impacts are not statistically significant. Similar to Rate 1, non-CARE/FERA customer bill impacts were statistically significant at $2.31 (1.6%) per month.

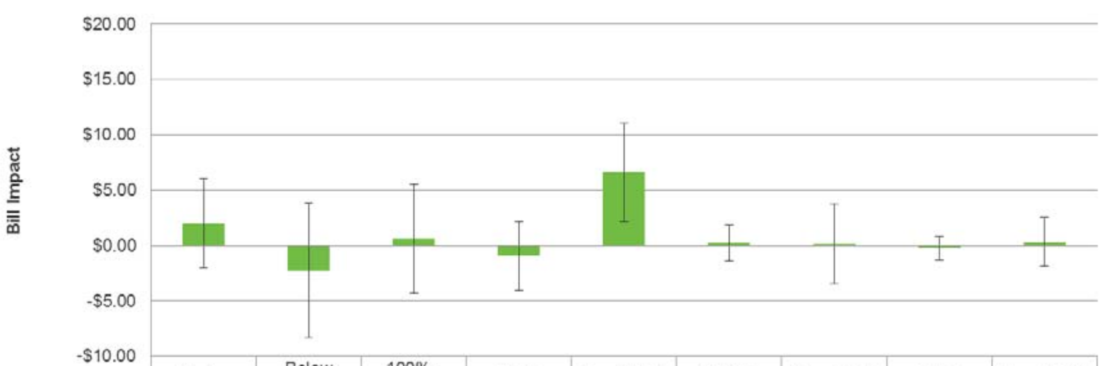
Figure 4.4-9: Rate 2 Average Bill Impacts from Behavior Change
All | CARE/FERA | Non-CARE/FERA
(Positive values represent bill reductions)



	All Customers	CARE	Non-CARE
		All	
Bill Impact	$1.54	-$0.53	$2.31
Percent Impact	1.2%	-0.6%	1.6%

Figure 4.4-10 provides the detailed level results by climate region and segment for customers on Rate 2. Similar to Rate 1, non-CARE/FERA customers in the hot climate region exhibited the largest bill reductions due to changes in behavior at $6.64 per month (3.1%). No other segments exhibited statistically significant bill reductions due to changes in behavior.

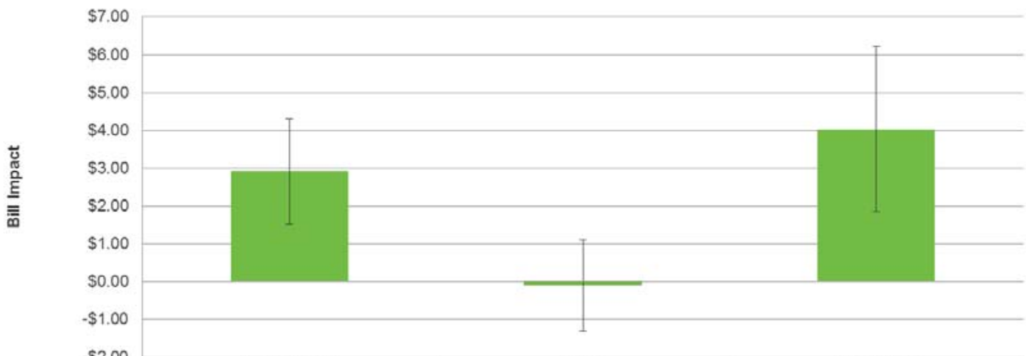
Figure 4.4-10: Rate 2 Average Bill Impacts from Behavior Change
Detailed Segments by Climate Region
(Positive values represent bill reductions)



	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
	Hot					Moderate		Cool	
Bill Impact	$2.00	-$2.26	$0.60	-$0.94	$6.64	$0.22	$0.16	-$0.25	$0.31
Percent Impact	1.3%	-1.7%	0.4%	-0.8%	3.1%	0.4%	0.1%	-0.6%	0.4%

Figure 4.4-11 provides the overall results for customers on Rate 3. PG&E's Rate 3 has the same peak period on weekdays as Rate 1 but has a higher peak-to-off-peak price ratio than Rate 1. In fact, Rate 3 has the highest peak period price of all PG&E rates, and is significantly higher than Rates 1 and 2. Like Rate 1, and unlike Rate 2, all weekend hours are priced at the off-peak rate. Through changing their energy use, the average Rate 3 customer was able to reduce what their average monthly bill would have otherwise been by $2.92, or 2.4%. This result is statistically significant at the 90% confidence level and nearly twice the size of the bill impacts from Rates 1 and 2. Average hourly peak period load impacts for Rate 3 customers were 5.5% or 0.06 kW. Bill impacts due to behavior change for CARE/FERA customers were close to zero and weren't statistically significant. Non-CARE/FERA customer bill impacts were statistically significant at $4.03 (2.9%) per month.

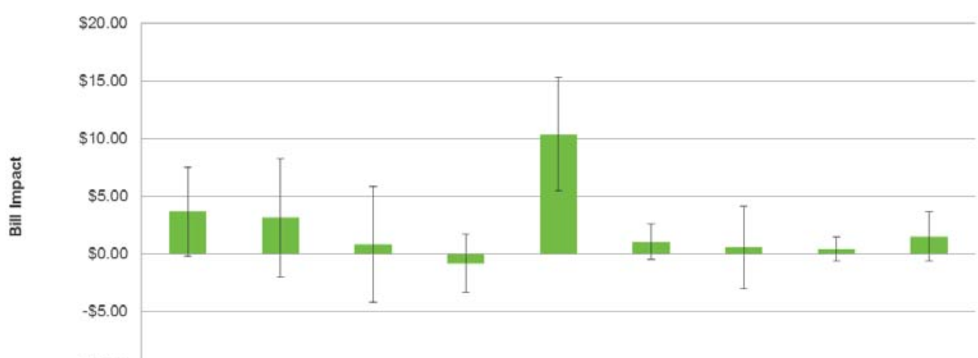
Figure 4.4-11: Rate 3 Average Bill Impacts from Behavior Change
All | CARE/FERA | Non-CARE/FERA
(Positive values represent bill reductions)



	All Customers	CARE	Non-CARE
		All	
Bill Impact	$2.92	-$0.10	$4.03
Percent Impact	2.4%	-0.1%	2.9%

Figure 4.4-12 provides the detailed level results by climate region and segment for customers on Rate 3. Similar to Rates 1 and 2, non-CARE/FERA customers in the hot climate region exhibited the largest bill reductions due to changes in behavior at $10.41 per month (4.7%). No other segments exhibited statistically significant bill reductions due to changes in behavior.

Figure 4.4-12: Rate 3 Average Bill Impacts from Behavior Change
Detailed Segments by Climate Region
(Positive values represent bill reductions)



	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
	Hot					Moderate		Cool	
Bill Impact	$3.70	$3.16	$0.87	-$0.78	$10.41	$1.08	$0.56	$0.48	$1.55
Percent Impact	2.3%	2.3%	0.6%	-0.7%	4.7%	1.9%	0.5%	1.1%	2.0%

Overall, bill impacts due to behavior change across all of the rates appear to have been largely driven by the non-CARE/FERA customers in the hot climate region. Other segments, such as seniors in the hot climate region on Rate 1, also experienced statistically significant bill impacts, but for the most part, bill impacts for other segments, rates, and climate regions were very small and not statistically significant.

4.4.3 Estimation of the Total Bill Impact Due to Differences in the Tariffs (Holding Usage Constant) and Behavior Change

Total bill impacts experienced by customers on a TOU rate can be decomposed into two components: the structural impact, and the behavioral impact. The structural impact represents the change in customer bills based solely on the change in the underlying structure of the rate. In this case, it is the change from the OAT to the time-differentiated TOU pilot rates. The behavioral impact represents how the customer changed their energy usage in response to the new pricing structure of the rate—which includes higher prices in the afternoon and evening and lower prices at other times of the day. During the summer period, nearly all customers on the TOU rates experienced a structural increase in their bills. However, customers also had an opportunity to offset that increase by changing their energy use behavior in response to the new price signals. As noted above, it is the combination of structural and behavioral bill impacts that produces the total bill impact experienced by the average study participant on each rate.

The results from this analysis represent the average monthly bill across the summer months of July, August, and September 2016. Three different bills were calculated for each customer segment:[65]

- **No Change in Behavior or Tariff [1]:** This represents what the treatment group bills would have been in the post-treatment period if they were on the OAT and had not changed their behavior
- **No Change in Behavior, Change in Tariff [2]:** This represents what the treatment group bills would have been in the post-treatment period if they were on the TOU rate and had not changed their behavior
- **Change in Behavior and in Tariff [3]:** This represents what the treatment group bills were in the post-treatment period on the TOU rate with a change in behavior

Based off of components defined above, the following metrics were calculated:

- The difference between **[1]** and **[2]** is the structural bill impact (based on post-treatment usage after adjusting for any pretreatment difference between control and treatment customers);
- The difference between **[1]** and **[3]** is the bill impact due to structural differences in the rates, but mitigated by changes in behavior; and
- The difference between **[2]** and **[3]** is the amount customers were able reduce their bills by changing their behavior.

[65] See section 3.2.3 for additional details on the methodology.

In the bill impact analysis, a major policy question was to better understand the relationship between the structural bill impacts, and how customers were able to respond. This relationship is represented by the "percentage of structural loss mitigated by change in behavior" shown in the data table at the bottom of the figures below. Put differently, this percentage represents how much of the structural bill increase from the TOU rate the average customer was able to offset. Results are organized by rate, climate region, and segment; similarly to the other bill impact analysis sections.

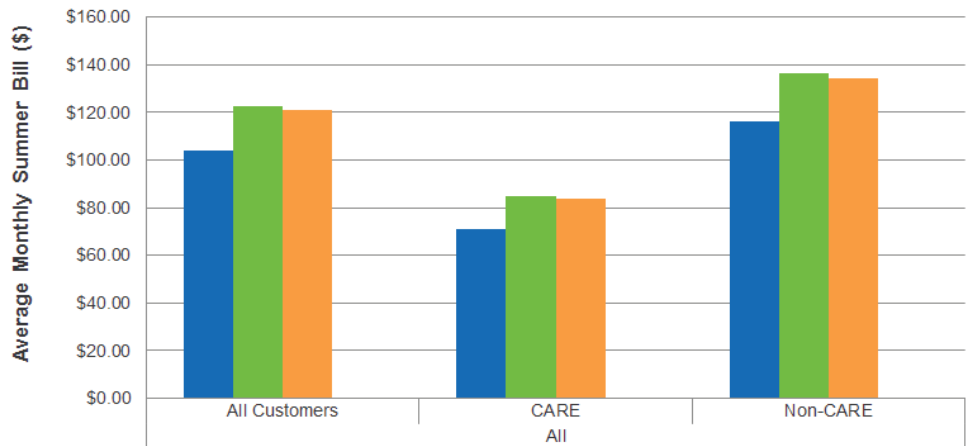
Figure 4.4-13 presents a set of three average monthly bills as defined above for all customers, CARE/FERA customers, and non-CARE/FERA customers on Rate 1. The blue bar represents a typical summer monthly bill for a customer still on the OAT and not responding to a TOU rate— noted as "No Change in Behavior or Tariff." For the average customer on Rate 1, this dollar amount was $104.14. The green bar represents what a typical summer monthly bill would be for a customer who was billed on a TOU rate, but didn't change their energy use behavior— noted as "No Change in Behavior, Change in Tariff." This dollar amount is $122.70 for the average Rate 1 customer. The difference between the two values, $18.56, is the average increase a customer would see in their bills by changing from the OAT to Rate 1, and not changing their energy use behavior; this is also referred to as the customer's structural loss. The orange bar represents the average Rate 1 customer's bill after factoring in the change in rate from the OAT to the Pilot Rate 1, and then also taking into account any changes in energy use behavior— noted as "With Change in Behavior and Tariff." This bill amount averaged $120.80 for the typical Rate 1 customer. Based off these values, it is possible to estimate the total change in bills including both the change in tariff and in behavior, which was a bill increase of $16.60 per month (16%). The total change in bill is calculated by subtracting the blue ($104.14) from the orange ($120.80).

An additional important metric is the percent of the structural loss—increase in the bills due strictly to the change in tariff—that can be offset or mitigated by customers changing their energy use behavior. As noted above, the average structural loss for Rate 1 customers was $18.56. The amount customers were able to reduce their bills by changing their behavior—compared to what it would have been without any behavior change—is obtained by subtracting the orange bar ("With Change in Behavior and Tariff": $120.80) from the green bar ("No Change in Behavior, Change in Tariff": $122.70), which equals $1.90. Based on these values, customers were able to offset $1.90 out of the $18.56 structural loss, or 10.3%. This value is provided at the bottom of the data table in each figure for convenience.

CARE/FERA customers experienced an average structural loss of $14.01 (20%). Through changes in energy use behavior they were able to offset $0.88 (6.3%), resulting in a total monthly bill increase of $13.30 (19%) after factoring in both changes in the tariff and behavior. It should be noted that the bill impact due to behavior change for CARE/FERA customers on Rate 1 was not statistically significant. Given the small dollar amount to begin with, and the lack of statistical significance, the key take away from this analysis is that the average CARE/FERA customer on Rate 1 did not change their energy use behavior sufficiently to mitigate any of the structural loss.

Conversely, non-CARE/FERA customers were able to mitigate some of their structural loss, though only a relatively small portion at 11.3% ($2.28). The average structural loss for non-CARE/FERA customers was $20.23 (17%), resulting in a total monthly bill increase of $17.95 (15%) after factoring in changes in the tariff, and behavior.

Figure 4.4-13: Rate 1 Total Bill Impact Due to Differences in the Tariff and Behavior Change (All | CARE/FERA | Non-CARE/FERA)

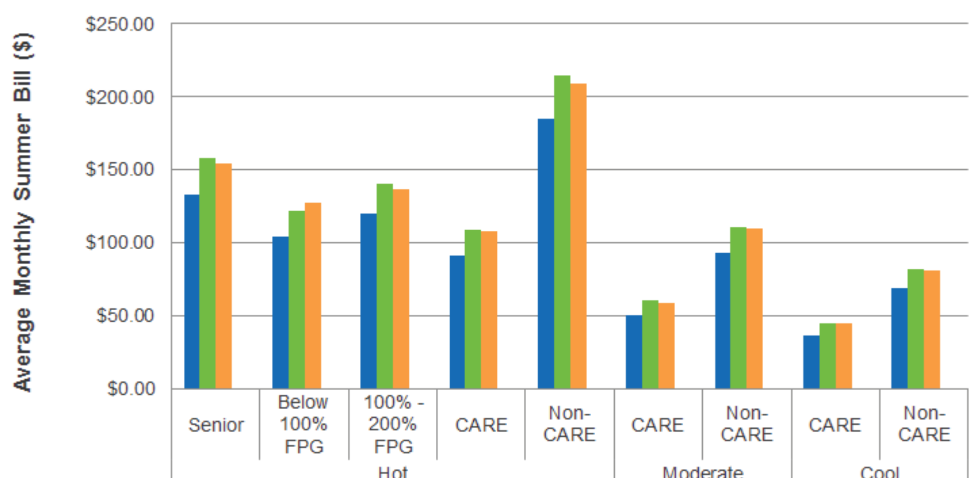


	All Customers	CARE	Non-CARE
No Change in Behavior or Tariff	$104.14	$70.77	$116.44
No Change in Behavior, Change in Tariff	$122.70	$84.77	$136.67
With Change in Behavior and Tariff	$120.80	$83.89	$134.39
% of structural loss mitigated by change in behavior	10.3%*	6.3%	11.3%*

* Indicates statistically significant result

Figure 4.4-14 presents the three sets of average monthly bills as defined above for the detailed segments by climate region on Rate 1. CARE/FERA customers in the moderate region, non-CARE/FERA customers in the hot region, seniors in the hot region, and customers with incomes between 100 and 200% of FPG in the hot region offset their structural bill increase by ~20% through behavior change. Behavioral offsets for the other customer segments were less than 5% and not statistically significant.

Figure 4.4-14: Rate 1 Total Bill Impact Due to Differences in the Tariff and Behavior Change (Detailed Segments by Climate Region)

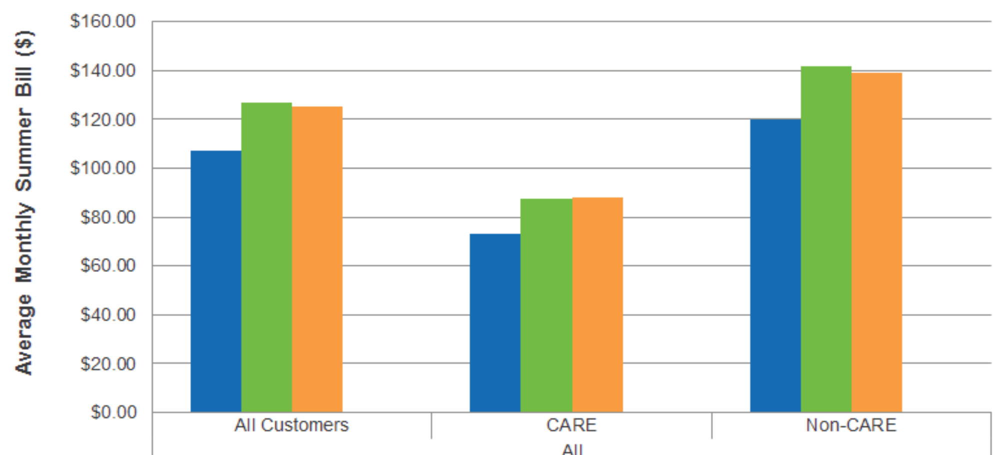


	Hot: Senior	Hot: Below 100% FPG	Hot: 100% - 200% FPG	Hot: CARE	Hot: Non-CARE	Moderate: CARE	Moderate: Non-CARE	Cool: CARE	Cool: Non-CARE
No Change in Behavior or Tariff	$133.23	$103.69	$119.80	$91.16	$184.43	$50.39	$93.25	$35.92	$68.99
No Change in Behavior, Change in Tariff	$157.49	$122.15	$140.42	$108.46	$214.55	$60.82	$110.46	$44.66	$81.80
With Change in Behavior and Tariff	$153.94	$127.48	$136.32	$107.67	$208.68	$58.67	$109.91	$44.96	$81.26
% of structural loss mitigated by change in behavior	14.7%*	-28.8%*	19.9%*	4.6%	19.5%*	20.7%*	3.2%	-3.5%	4.2%

* Indicates statistically significant result

Figure 4.4-15 presents the three sets of average monthly bills for all customers, CARE/FERA customers, and non-CARE/FERA customers on Rate 2, which were similar in nature to Rate 1. The average Rate 2 customer experienced a structural loss of $19.63 (18%). Through changes in energy use behavior they were able to offset $1.54 (7.9%), resulting in a total monthly bill increase of $18.09 (17%) after factoring in both changes in the tariff and behavior. CARE/FERA customers experienced an average structural loss of $14.23 (19%). They did not reduce energy usage compared to the control group, resulting in a total monthly bill increase of $14.76 (20%) after factoring in changes in the tariff and behavior. Non-CARE/FERA customers were able to mitigate some of their structural loss, though only a relatively small portion at 10.7% ($2.31). The average structural loss for non-CARE/FERA customers was $21.62 (18%), resulting in a total monthly bill increase of $19.31 (16%) after factoring in the changes in the tariff, and behavior.

Figure 4.4-15: Rate 2 Total Bill Impact Due to Differences in the Tariff and Behavior Change (All | CARE/FERA | Non-CARE/FERA)

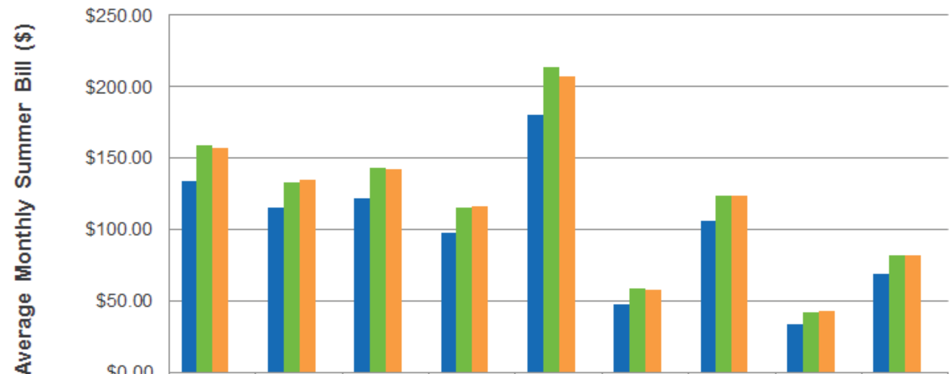


	All Customers	CARE	Non-CARE
No Change in Behavior or Tariff	$107.37	$73.25	$119.93
No Change in Behavior, Change in Tariff	$127.00	$87.48	$141.56
With Change in Behavior and Tariff	$125.45	$88.02	$139.25
% of structural loss mitigated by change in behavior	7.9% *	-3.8%	10.7% *

* Indicates statistically significant result

Figure 4.4-16 presents the three sets of average monthly bills for the detailed segments by climate region on Rate 2. Non-CARE/FERA customers in the hot region were the only segment to offset any portion of their structural bill increase through behavior change at 19.8%. Behavioral offsets for the other customer segments were less than 8% and not statistically significant; or even negative in some cases.

Figure 4.4-16: Rate 2 Total Bill Impact Due to Differences in the Tariff and Behavior Change (Detailed Segments by Climate Region)

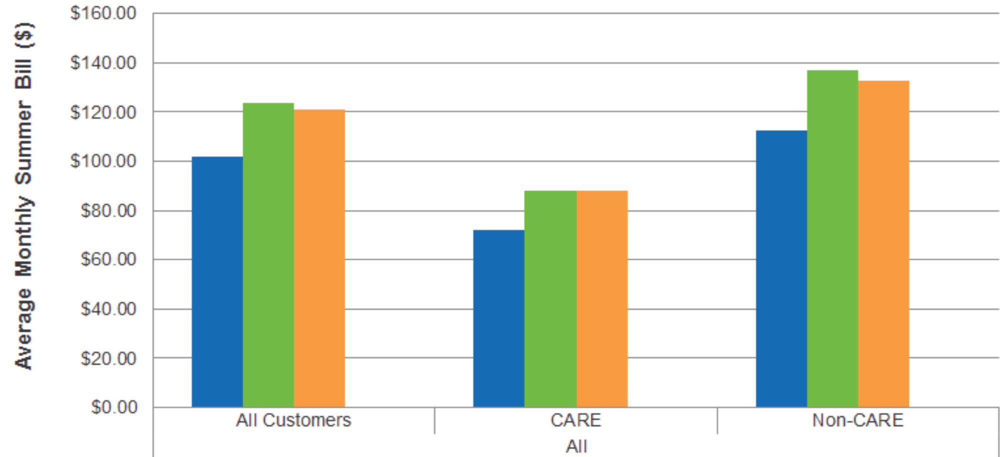


	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$133.48	$114.81	$121.41	$97.39	$179.75	$47.90	$105.58	$33.44	$69.05
No Change in Behavior, Change in Tariff	$158.65	$132.83	$142.73	$115.08	$213.31	$58.32	$123.51	$42.17	$81.76
With Change in Behavior and Tariff	$156.65	$135.09	$142.12	$116.02	$206.68	$58.10	$123.35	$42.41	$81.45
% of structural loss mitigated by change in behavior	7.9%	-12.5%	2.8%	-5.3%	19.8%*	2.1%	0.9%	-2.8%	2.5%

* Indicates statistically significant result

Figure 4.4-17 presents the three sets of average monthly bills for all customers, CARE/FERA customers, and non-CARE/FERA customers on Rate 3, which were similar to Rates 1 and 2. The average Rate 3 customer experienced a structural loss of $21.97 (22%). Through changes in energy use behavior they were able to offset $2.92 (13.3%), resulting in a total monthly bill increase of $19.05 (19%) after factoring in the changes in the tariff and behavior. CARE/FERA customers experienced an average structural loss of $15.52 (21%). Similar to Rate 2, they did not reduce energy usage compared to the control group, resulting in a total monthly bill increase of $15.62 (22%) after factoring in the changes in the tariff and behavior. Non-CARE/FERA customers were able to mitigate some of their structural loss, though only a relatively small portion at 16.6% ($4.03). The average structural loss for non-CARE/FERA customers was $24.35 (22%), resulting in a total monthly bill increase of $21.31 (18%) after factoring in the changes in the tariff, and behavior.

Figure 4.4-17: Rate 3 Total Bill Impact Due to Differences in the Tariff and Behavior Change (All | CARE/FERA | Non-CARE/FERA)

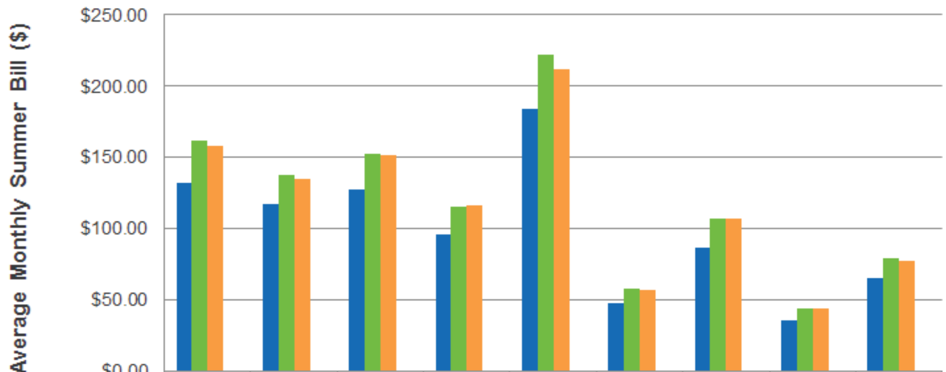


	All Customers	CARE	Non-CARE
No Change in Behavior or Tariff	$101.71	$72.31	$112.54
No Change in Behavior, Change in Tariff	$123.68	$87.83	$136.89
With Change in Behavior and Tariff	$120.76	$87.93	$132.86
% of structural loss mitigated by change in behavior	13.3% *	-0.7%	16.6% *

* Indicates statistically significant result

Figure 4.4-18 presents the three sets of average monthly bills for the detailed segments by climate region on Rate 3. Similar to Rate 2, non-CARE/FERA customers in the hot region were the only segment to offset any portion of their structural bill increase through behavior change at 27.0%. This was the largest offset among any customer segments. Behavioral offsets for the other customer segments varied, but were not statistically significant; and were even negative in the case of CARE/FERA customers in the hot climate region.

Figure 4.4-18: Rate 3 Total Bill Impact Due to Differences in the Tariff and Behavior Change (Detailed Segments by Climate Region)



	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
	Hot					Moderate		Cool	
No Change in Behavior or Tariff	$131.52	$117.02	$127.70	$95.38	$183.59	$47.09	$86.72	$35.41	$65.37
No Change in Behavior, Change in Tariff	$161.15	$137.47	$152.19	$115.31	$222.16	$57.65	$106.99	$43.99	$78.63
With Change in Behavior and Tariff	$157.45	$134.31	$151.33	$116.10	$211.75	$56.56	$106.43	$43.51	$77.08
% of structural loss mitigated by change in behavior	12.5%	15.4%	3.5%	-3.9%	27.0%*	10.3%	2.8%	5.6%	11.7%

* Indicates statistically significant result

Overall, the average customer across each of the rates was able to offset a small portion of the structural bill impact by between 8% and 13%. However, the offsets were largely driven by the non-CARE/FERA customers in the hot climate region who were able to offset between 20% and 27% of their structural loss. For the most part, the other segments were not able to offset much of their structural loss and many of the observed behavioral impacts were not statistically significant.

4.4.4 Change in the Distribution of Bill Impacts Due to Behavior Change

The fourth analysis presents the distribution of bill impacts[66] for customers with and without behavioral change, and is designed to show how the distribution shifts when customers respond to the rates by changing behavior. Similar to the other analyses, impact distributions are based on the average summer monthly bills for July, August, and September. Bill impacts were estimated for two cases—with and without behavior change. Both are based on the structural bill impact calculations; however, impacts with behavior change show how behavioral impacts are able to affect the structural impact distribution. Customers were segmented into ranges of bill impacts. The percentage of customers in each $10 increment from negative $100 to positive $100 per month was determined with and without behavior change. The underlying calculations used to develop the distributions are based off of a difference-in-differences approach that compares the treatment and control customers based on both pre- and post-treatment bill impacts.[67]

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[66] Bill impacts without behavior change represent the structural bill impact distribution; bill impacts with behavior change show how behavioral impacts affect the structural bill impact distribution.

[67] See section 3.2.4 for additional details on the methodology.

The two distributions are presented on a line graph, with the height of the line at any given $10 increment representing the percentage of customers experiencing a bill impact of the corresponding dollar amount. In this case, the bill impact is measured as the difference between the TOU bill and the OAT bill. If the line for the group with changes in behavior is to the left of the line representing the group with no change in behavior, it shows that at least some customers were able to modify their energy usage such that they had lower total bill impacts compared to if they had not changed their behavior.

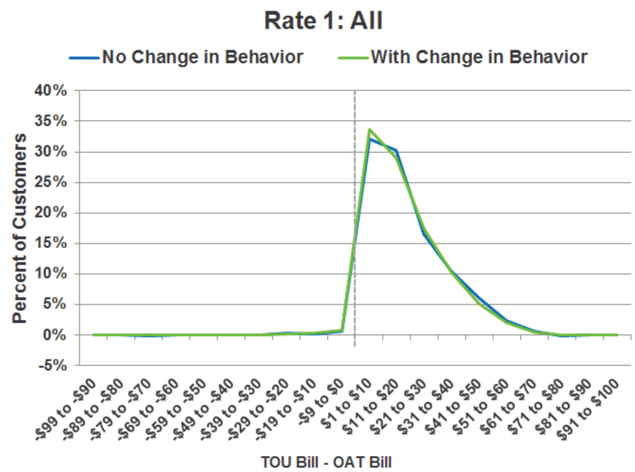
Figure 4.4-19 presents the distribution of bill impacts with and without energy use behavior change. The blue line represents the structural bill impacts that result when customers are billed on the TOU rate and do not change their energy use behavior. The green line shows the total bill impacts when customers have responded to the TOU rate and, in some cases, changed their energy use behavior. Bill impacts are calculated as the difference between the TOU bill and the OAT bill. Each point along the line graph represents the percentage of customers within a specific bill impacts bin or range. For example, on Rate 1, approximately 30% of the customers have structural bill impact of $11 to $20 per month—the blue line. In other words, approximately 30% of the Rate 1 customers would experience an increase of $11 to $20 per month on Rate 1 compared to the OAT without changing their behavior. The green line represents the total bill impacts when customers have had the opportunity to respond to the TOU rate. In this case, the percent of customers experiencing an increase of $11 to $20 per month on Rate 1 compared to the OAT is 29%, showing a slight reduction.

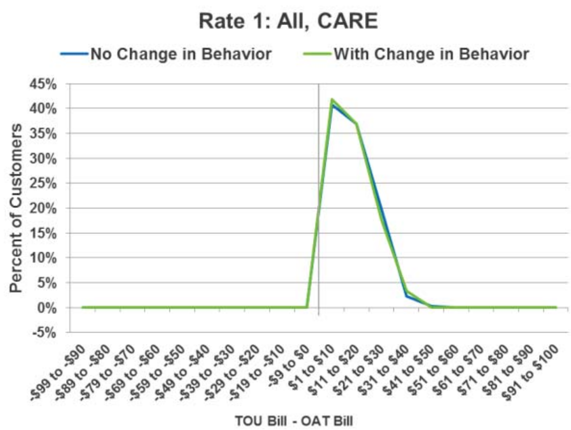
It is important to note that customers could move up or down through the incremental impact bins, and could potentially move more than one bin—meaning that a customer could potentially experience a bill increase due to their behavioral response, or they could jump down several bins and go from a $21 to $30 per month bill impact down to $1 to $10 impact, for example. In the case of the average Rate 1 customers, there is an increase in the percent of customers with a total bill impact of between $1 and $10 per month. With no change in behavior, 32% of customers were in this bin and with behavior change 34% of customers are now in this bin. Looking at the shape of the distributions and the table reporting the percentages, it is clear that with behavior change there were fewer customers in the $41 to $50 range, and in the$11 to $20 range. While it isn't clear exactly where those customers moved, it is clear that ultimately some customers were able to make changes in their energy use behavior that resulted in offsetting some of the structural loss, as covered in the previous sections. While the percentage of customers in the $1 to $10 bin increased, it was because they were originally in higher bill impact ranges and have since transitioned down to a lower bin.

As noted in the previous section, CARE/FERA customers on average did not offset any of the structural loss through behavior change. This is also apparent in the graph below, where there is very little separation between the green and blue lines. On the other hand, the non-CARE/FERA customers were able to slightly offset the structural bill impacts, and this can be observed in the graph where sections of the green line are to the left of or below the blue line. It's also important to note that instances where the green line is to the right of or above the blue line in the lower bill impact ranges indicate more customers have moved into that bin, likely from higher impact bins. This is the case where there is a higher percentage of non-CARE/FERA customers in the $1 to $10 range after behavior change compared to before behavior change.

Figure 4.4-19: Rate 1 Change in the Distribution of Bill Impacts Due to Behavior Change All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0%	0%
-$89 to -$80	0%	0%
-$79 to -$70	0%	0%
-$69 to -$60	0%	0%
-$59 to -$50	0%	0%
-$49 to -$40	0%	0%
-$39 to -$30	0%	0%
-$29 to -$20	0%	0%
-$19 to -$10	0%	0%
-$9 to $0	1%	1%
$1 to $10	32%	34%
$11 to $20	30%	29%
$21 to $30	17%	17%
$31 to $40	10%	10%
$41 to $50	6%	5%
$51 to $60	2%	2%
$61 to $70	1%	1%
$71 to $80	0%	0%
$81 to $90	0%	0%
$91 to $100	0%	0%





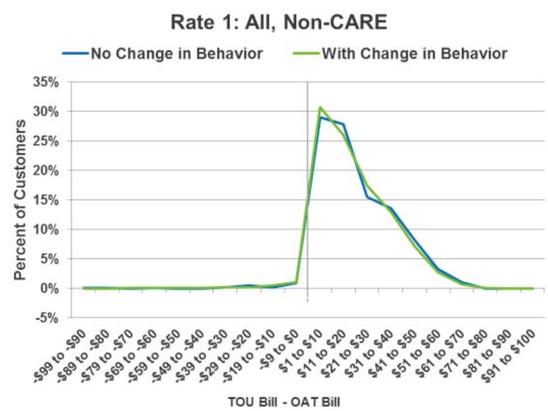
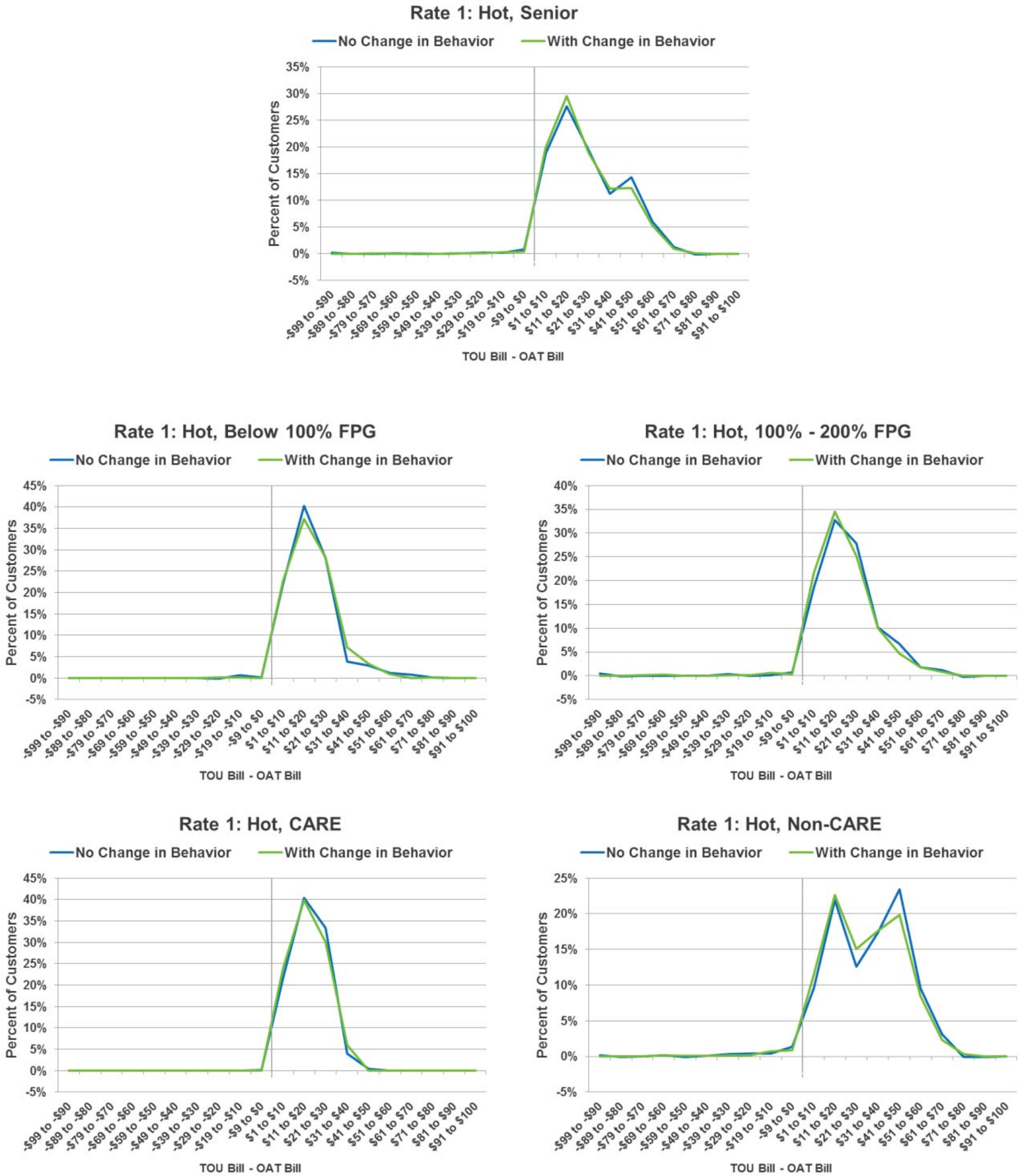
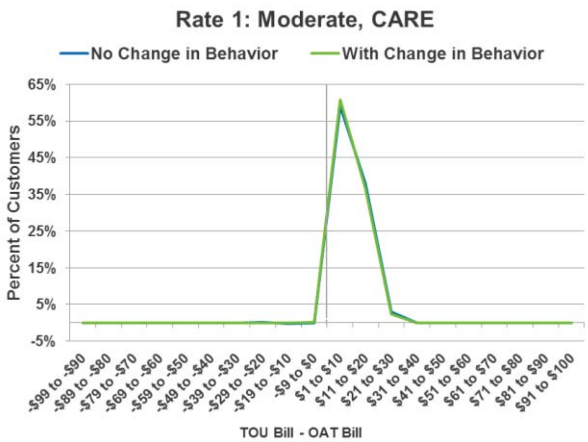
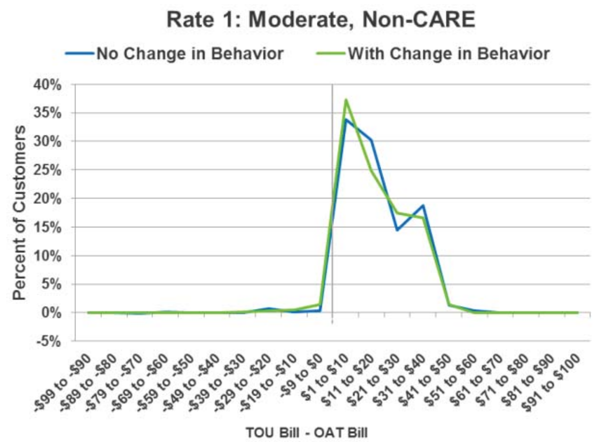


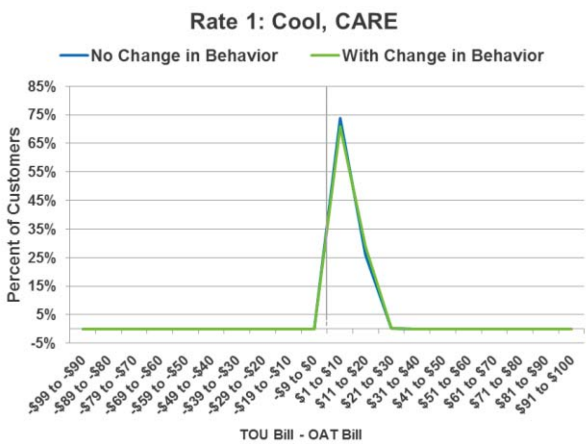
Figure 4.4-20 provides the distribution of bill impacts for the detailed segments by climate zone. As noted above in section 4.4.2 , the only Rate 1 segments with statistically significant bill impacts due to behavior change were Seniors, 100% to 200% FPG, non-CARE/FERA customers in the hot region, and CARE/FERA customers in the moderate region. In each of those segments, it is possible to see how the distribution has shifted slightly. It's also worth noting that there are instances such as non-CARE/FERA customers in the moderate region where there weren't statistically significant bill impacts. However, it's clear some shifting took place. Nevertheless, based on the outcomes it is apparent that not all of the shifting was into lower bill impact ranges given that the overall outcome for that segment was near zero and not statistically significant.

Figure 4.4-20: Rate 1 Change in the Distribution of Bill Impacts Due to Behavior Change Detailed Segments by Climate Region









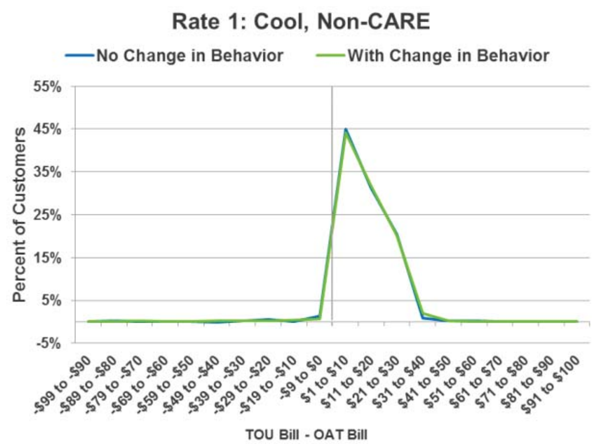
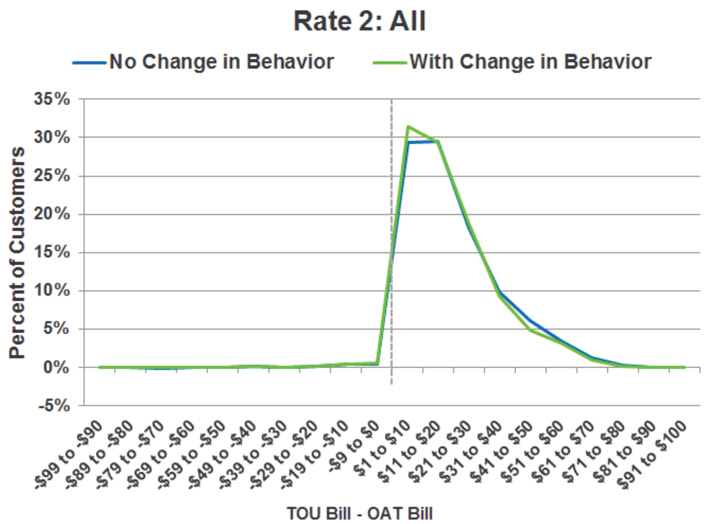
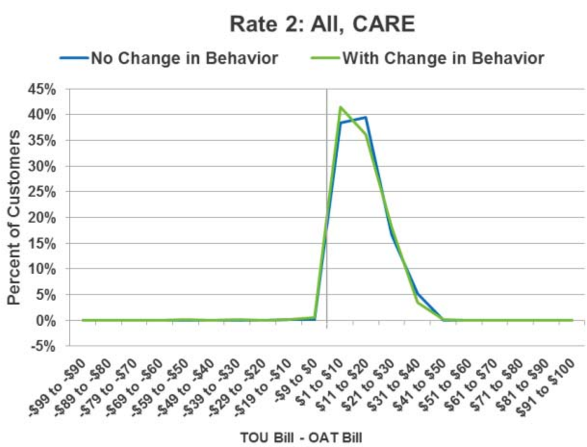


Figure 4.4-21 provides the distributions of bill impacts for all customers and CARE/FERA and non-CARE/FERA customers on Rate 2. The average Rate 2 customer was able to offset approximately $1.54 (7.9%) of the structural loss through behavior change. Based on the graph, some customers with larger impacts in the $50 range were able to transition down to lower bins. On average, Rate 2 CARE/FERA customers were not able to offset any of the structural loss. However, it appears that at least some customers were able to move into lower bill impact bins. As with Rate 1, non-CARE/FERA customers show the largest behavioral bill impacts. This is shown where there is a notable reduction in the $50 per month bill impact range, and growth in the lower impact ranges.

Figure 4.4-21: Rate 2 Change in the Distribution of Bill Impacts Due to Behavior Change All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0%	0%
-$89 to -$80	0%	0%
-$79 to -$70	0%	0%
-$69 to -$60	0%	0%
-$59 to -$50	0%	0%
-$49 to -$40	0%	0%
-$39 to -$30	0%	0%
-$29 to -$20	0%	0%
-$19 to -$10	0%	1%
-$9 to $0	0%	1%
$1 to $10	29%	31%
$11 to $20	30%	29%
$21 to $30	18%	19%
$31 to $40	10%	9%
$41 to $50	6%	5%
$51 to $60	4%	3%
$61 to $70	1%	1%
$71 to $80	0%	0%
$81 to $90	0%	0%
$91 to $100	0%	0%





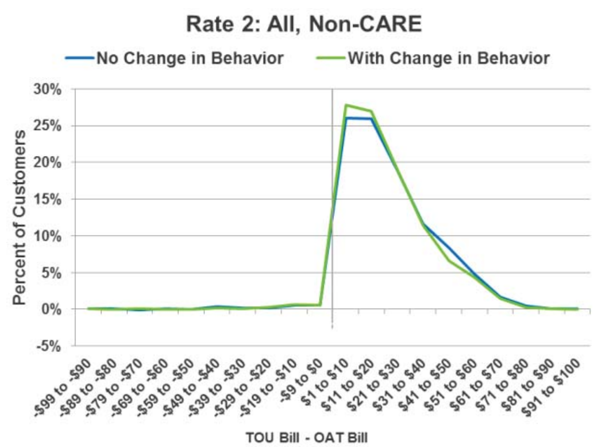
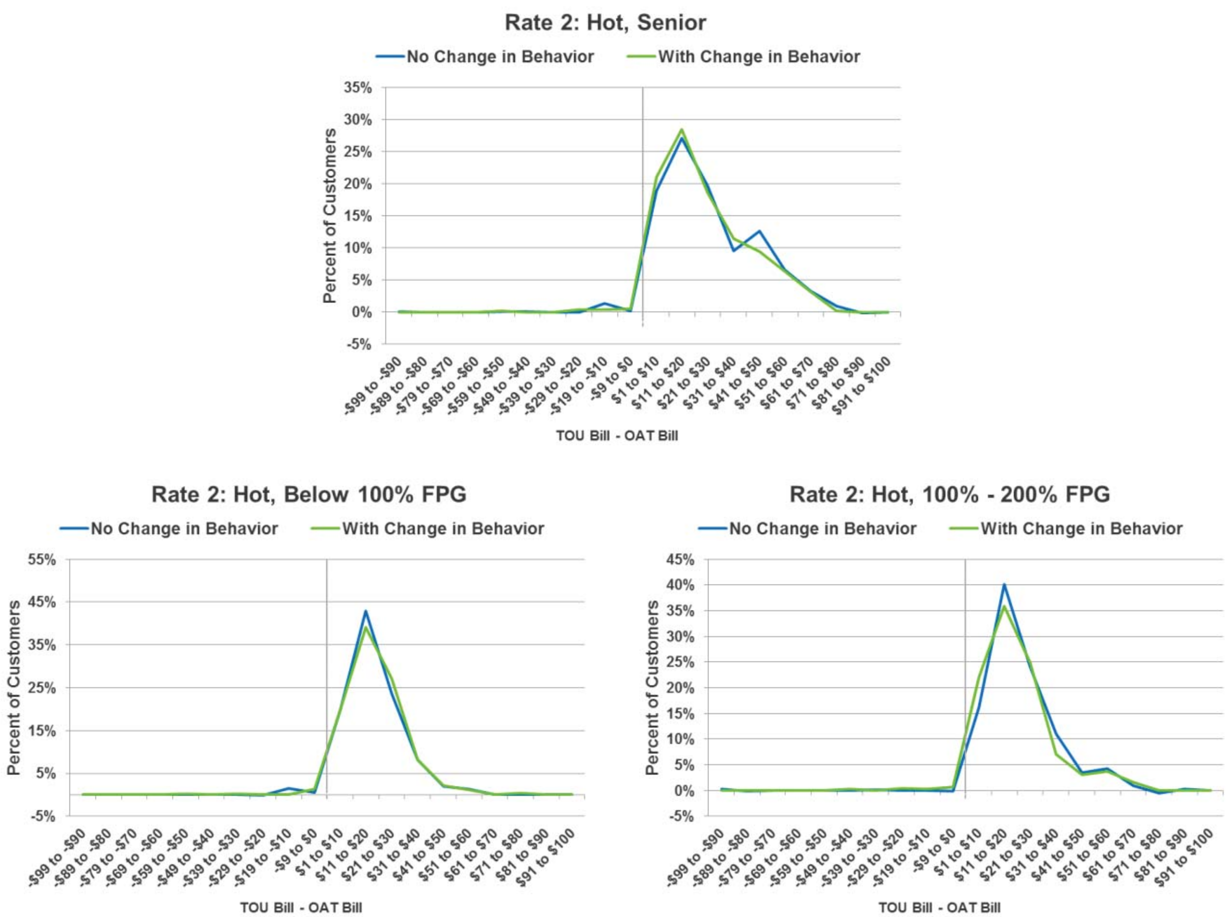
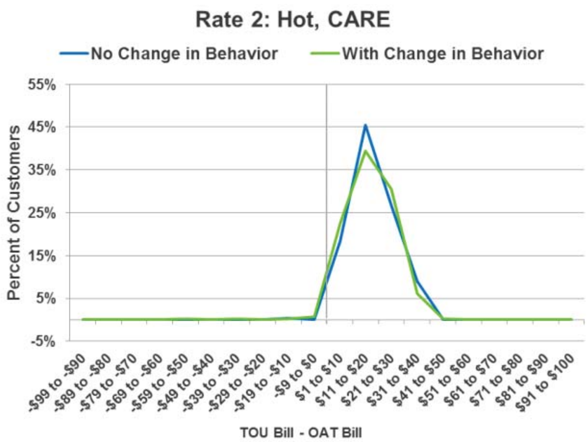
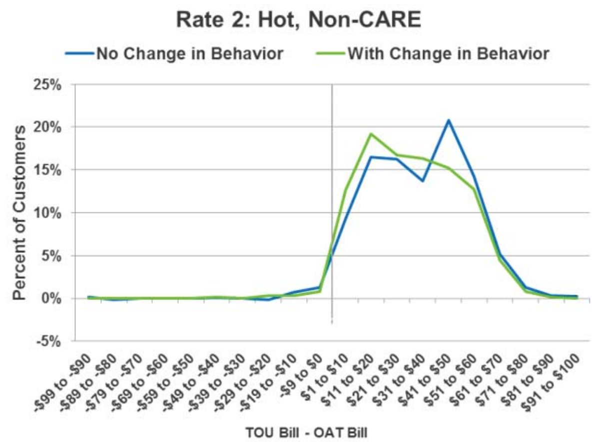


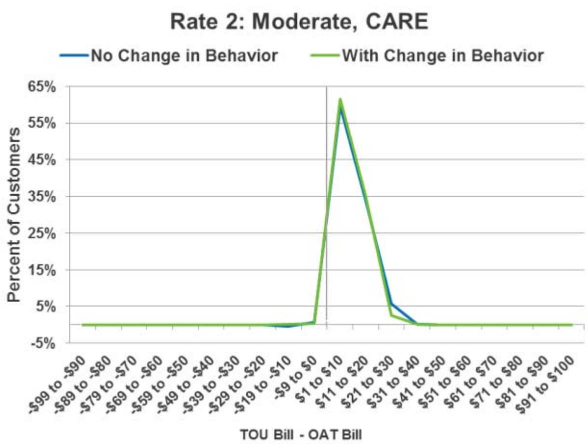
Figure 4.4-22 shows the distribution of bill impacts for the detailed segments by climate zone for Rate 2. As noted above in section 4.4.2, the only Rate 2 segment with statistically significant bill impacts from behavior change was non-CARE/FERA customers in the hot region. This segment shows a dramatic shift in the distribution of bill impacts with and without behavior change. Some of the other segments, such as hot 100% to 200% FPG customers and moderate CARE/FERA customers show changes in the distribution. However, the bill impacts from behavior change for the remaining segments were not statistically significant. This indicates that while, on average, there were no behavioral bill impacts, there are customers within the segments that produced significant bill impacts due to behavior change.

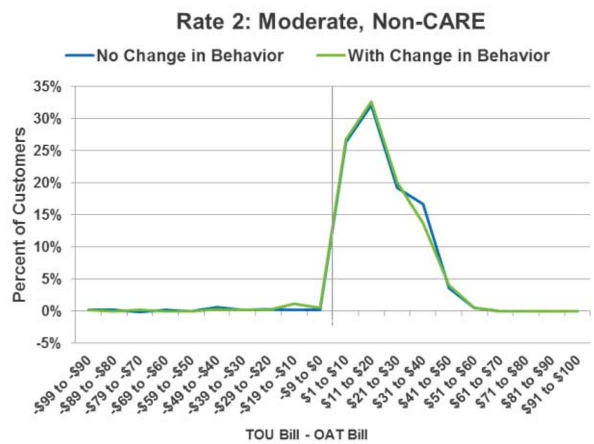
Figure 4.4-22: Rate 2 Change in the Distribution of Bill Impacts Due to Behavior Change Detailed Segments by Climate Region

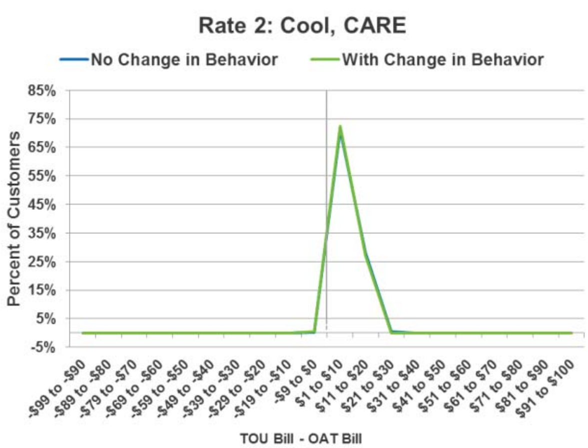



Rate 2: Hot, CARE
No Change in Behavior
With Change in Behavior
Percent of Customers
TOU Bill - OAT Bill


Rate 2: Hot, Non-CARE
No Change in Behavior
With Change in Behavior
Percent of Customers
TOU Bill - OAT Bill


Rate 2: Moderate, CARE
No Change in Behavior
With Change in Behavior
Percent of Customers
TOU Bill - OAT Bill


Rate 2: Moderate, Non-CARE
No Change in Behavior
With Change in Behavior
Percent of Customers
TOU Bill - OAT Bill


Rate 2: Cool, CARE
No Change in Behavior
With Change in Behavior
Percent of Customers
TOU Bill - OAT Bill

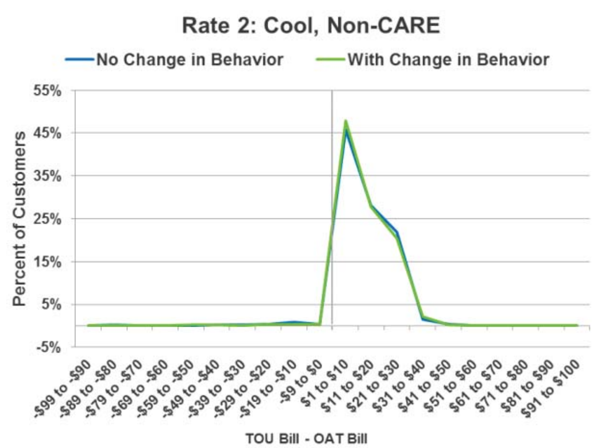
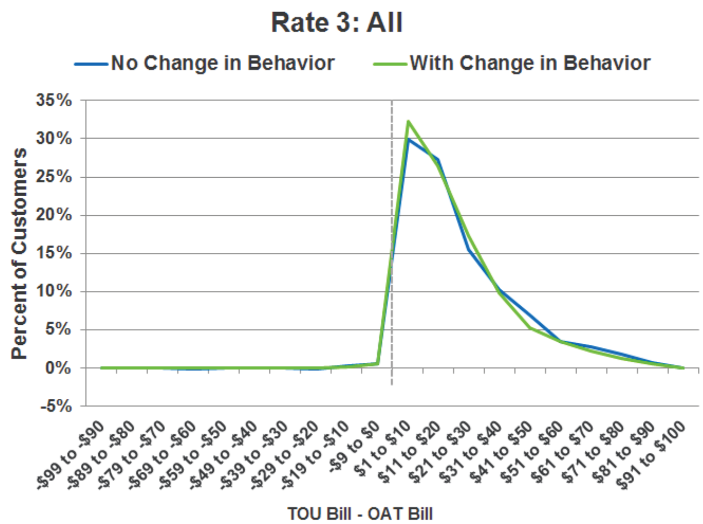
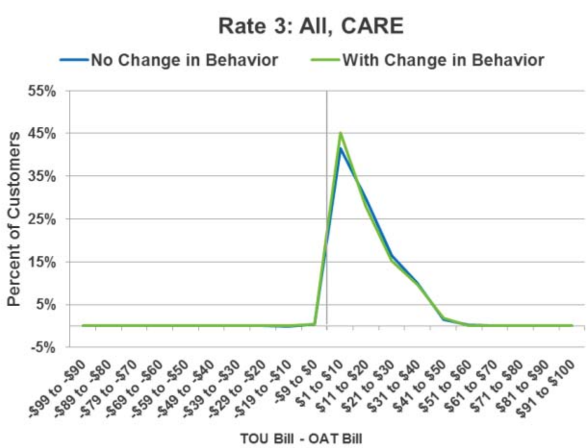

Rate 2: Cool, Non-CARE
No Change in Behavior
With Change in Behavior
Percent of Customers
TOU Bill - OAT Bill

Figure 4.4-23 shows the distribution of bill impacts for all customers and for CARE/FERA and non-CARE/FERA customers on Rate 3. The average Rate 3 customer was able to offset approximately $2.92 (13.3%) of the structural loss. Based on the graph, some customers with larger impacts in the $50 range were able to transition down to lower bins. On average, Rate 3 CARE/FERA customers were not able to offset any of the structural loss. As with Rates 1 and 2, non-CARE/FERA customers were the segment showing the largest behavioral bill impacts. This is shown where there is a notable reduction in the $50 per month bill impact range, and growth in the lower impact ranges.

Figure 4.4-23: Rate 3 Change in the Distribution of Bill Impacts Due to Behavior Change All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0%	0%
-$89 to -$80	0%	0%
-$79 to -$70	0%	0%
-$69 to -$60	0%	0%
-$59 to -$50	0%	0%
-$49 to -$40	0%	0%
-$39 to -$30	0%	0%
-$29 to -$20	0%	0%
-$19 to -$10	0%	0%
-$9 to $0	1%	1%
$1 to $10	30%	32%
$11 to $20	27%	26%
$21 to $30	15%	17%
$31 to $40	10%	10%
$41 to $50	7%	5%
$51 to $60	4%	3%
$61 to $70	3%	2%
$71 to $80	2%	1%
$81 to $90	1%	1%
$91 to $100	0%	0%





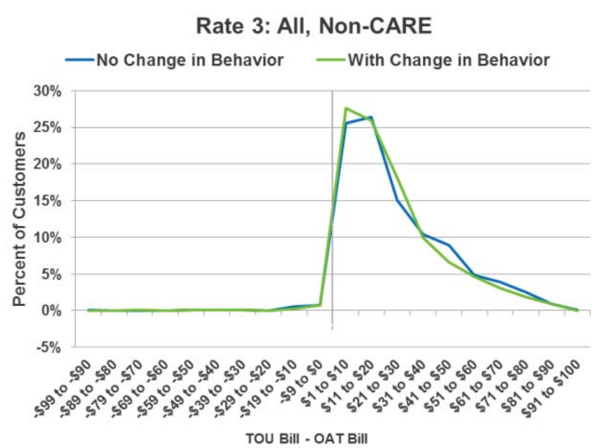
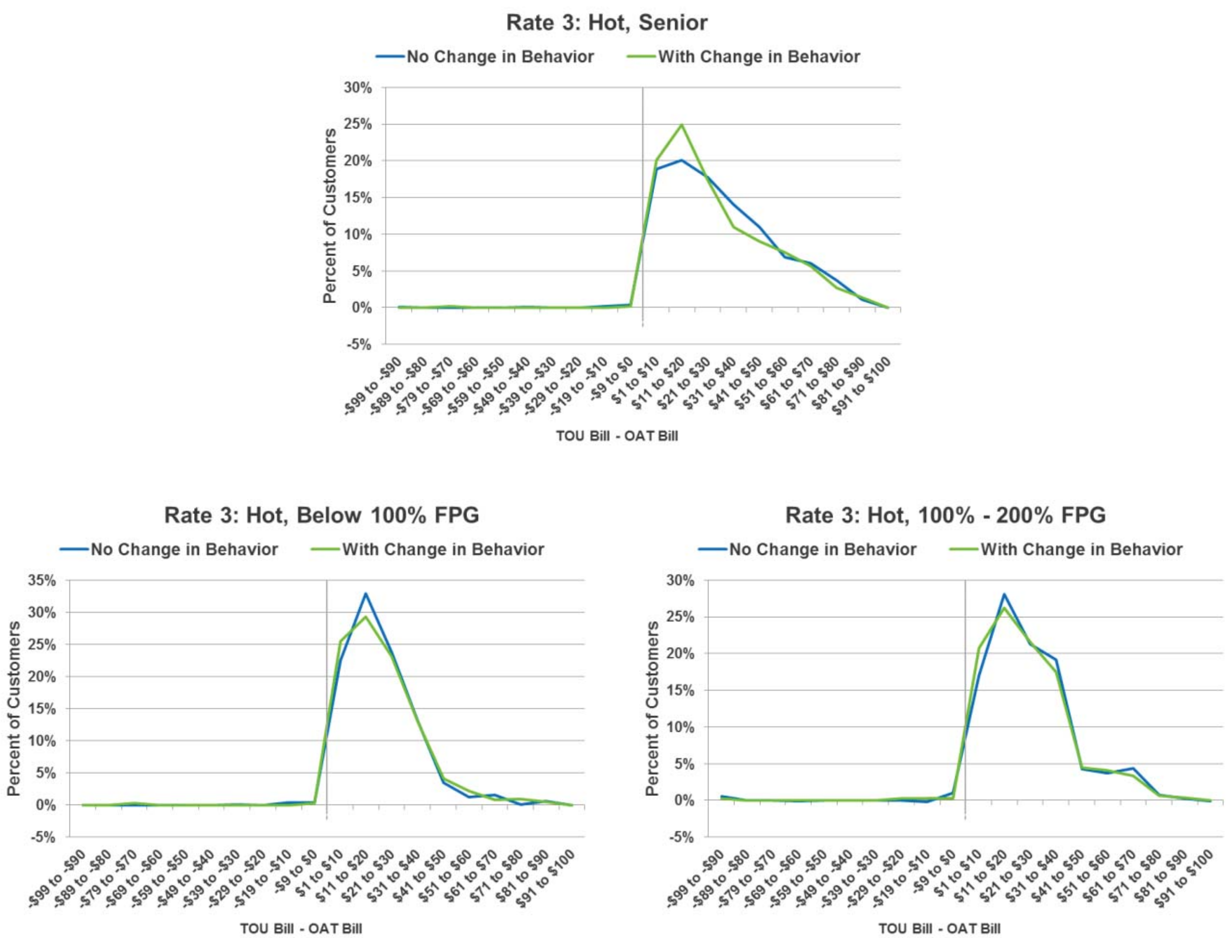
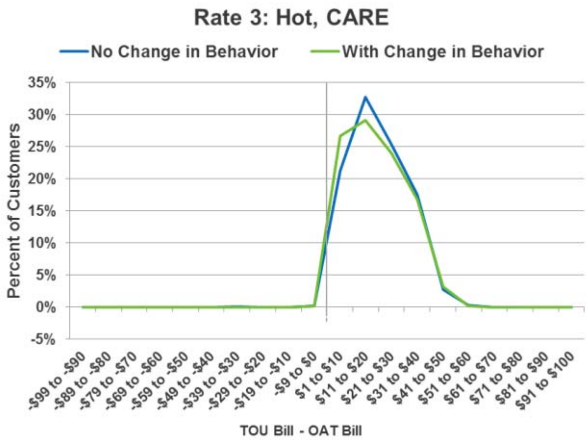
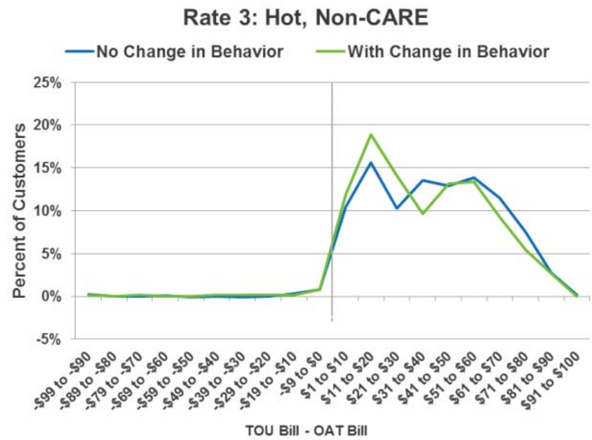


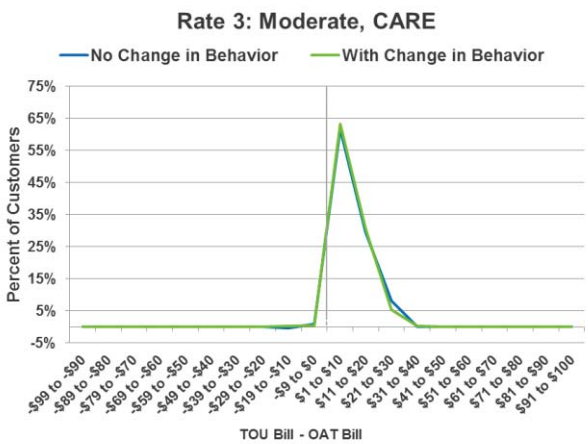
Figure 4.4-24 shows the distribution of bill impacts for the detailed segments by climate zone for Rate 3. As noted above in Section 4.4.2 , the only Rate 3 segment with statistically significant bill impacts was non-CARE/FERA customers in the hot region. This segment shows a dramatic shift, where the distribution with behavior change is clearly shifted. Some of the other segments such as the seniors in the hot climate region and the moderate CARE/FERA customers show changes in the distribution. However, the bill impacts for those and the remainder of the segments were not statistically significant. This indicates that while on average there were no behavioral bill impacts, there are customers within the segments that produced significant bill impacts due to behavior change.

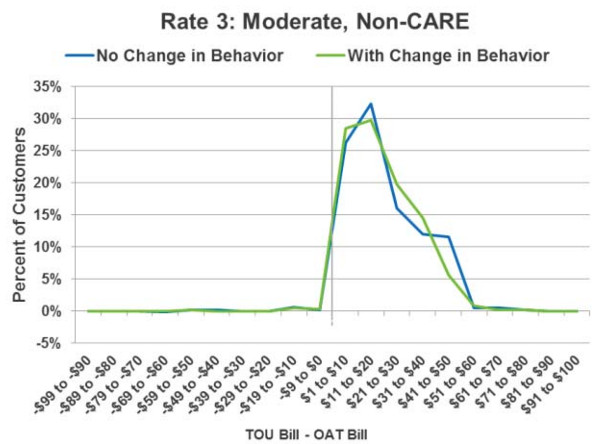
Figure 4.4-24: Rate 3 Change in the Distribution of Bill Impacts Due to Behavior Change Detailed Segments by Climate Region

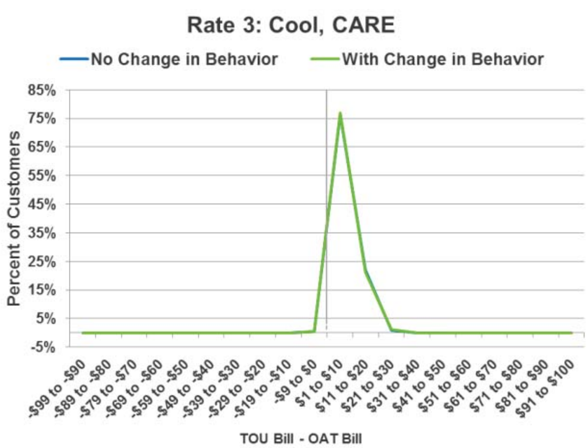


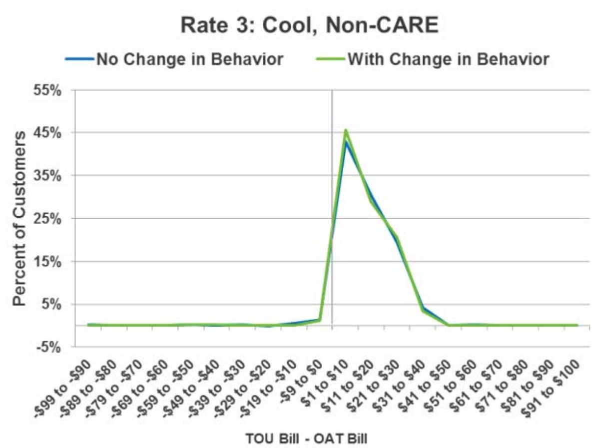

Rate 3: Hot, CARE
No Change in Behavior
With Change in Behavior
Percent of Customers
TOU Bill - OAT Bill


Rate 3: Hot, Non-CARE
No Change in Behavior
With Change in Behavior
Percent of Customers
TOU Bill - OAT Bill


Rate 3: Moderate, CARE
No Change in Behavior
With Change in Behavior
Percent of Customers
TOU Bill - OAT Bill


Rate 3: Moderate, Non-CARE
No Change in Behavior
With Change in Behavior
Percent of Customers
TOU Bill - OAT Bill


Rate 3: Cool, CARE
No Change in Behavior
With Change in Behavior
Percent of Customers
TOU Bill - OAT Bill


Rate 3: Cool, Non-CARE
No Change in Behavior
With Change in Behavior
Percent of Customers
TOU Bill - OAT Bill

4.5 Survey Findings

This section summarizes the survey findings for the three rate treatments tested by PG&E. The CPUC resolution approving PG&E's pilot requires that survey findings be reported for the following rates, customer segments, and climate regions:

- Seniors, CARE/FERA customers, non-CARE/FERA customers and households with incomes below 100% of FPG, and households with incomes between 100% and 200% of FPG in PG&E's hot climate region for Rate 1, and
- CARE/FERA and non-CARE/FERA customers for each rate for each climate region.

Sub-Appendix C in Appendix Volume 1 describes the reporting requirements for PG&E's opt-in pilot.

4.5.1 Findings Relevant to Section 745 Decisions

Descriptive Statistics of Economic/Health Scores

To assess whether any of the pilot TOU rates caused economic changes, difference in average economic index scores were compared between the rate treatment and control groups for the segments shown in Table 4.5-1.

Table 4.5-1: Segments Tested by Rate

Climate	Segment	Control vs. Rate 1	Control vs. Rate 2	Control vs. Rate 3
Hot	Non-CARE/FERA	X	X	X
	CARE/FERA	X	X	X
	CARE/FERA - on or eligible	X	X	X
	Below 100% FPG	X		
	100 to 200% FPG	X		
	Seniors	X		
Moderate	Non-CARE/FERA	X	X	X
	CARE/FERA	X	X	X
	CARE/FERA – on or eligible	X	X	X
Cool	Non-CARE/FERA	X	X	X
	CARE/FERA	X	X	X
	CARE/FERA – on or eligible	X	X	X

Values for descriptive statistics provided in Table 4.5-2 and Figure 4.5-1 to Figure 4.5-3 are shown for all respondents combined, including control and treatment customers, with no weighting applied to adjust for oversampling of sub-segments in the hot climate region or oversampling of CARE/FERA customers in all climate regions.

Table 4.5-2 provides the mean, median, and the 25th and 75th percentile economic index scores for all PG&E respondents and Figure 4.5-1 shows the histogram of economic index scores. The dotted line on the histogram shows the median, while the orange line shows the mean. Economic index scores can range from a low of 0 to a high of 10. The higher the score, the more economic difficulty a respondent has. PG&E pilot participants had a mean economic index score of 2.9 and median score of 2.5. The distribution of economic index scores is positively skewed.

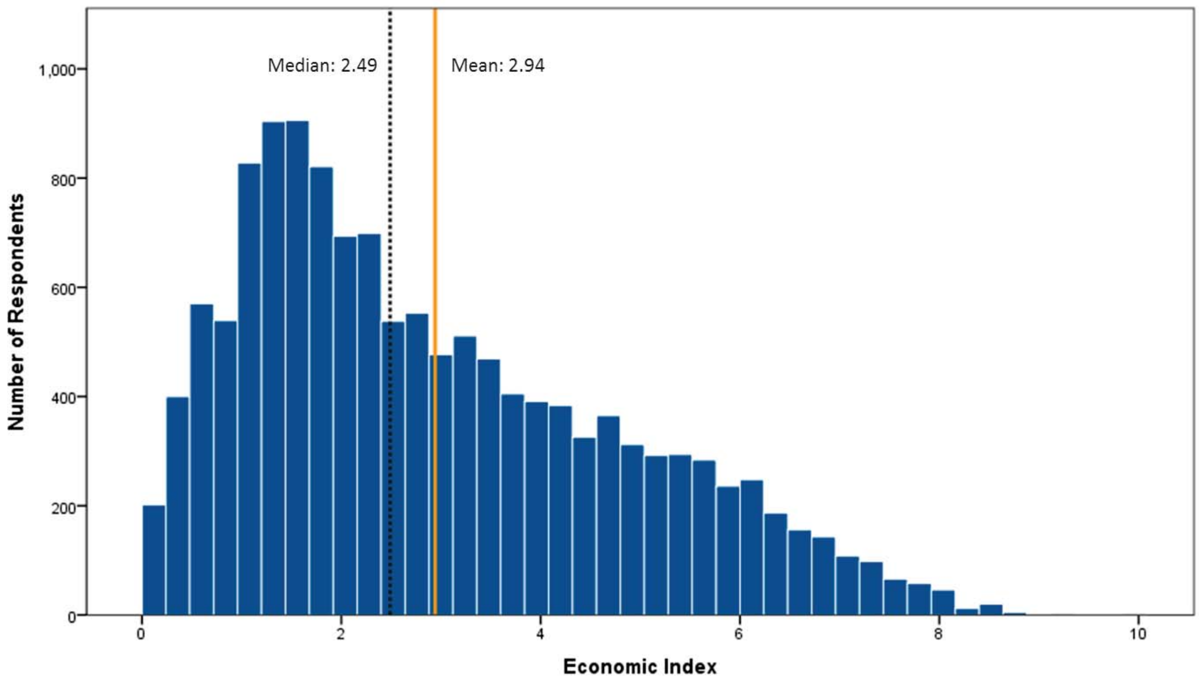
Table 4.5-2: Measures of Central Tendency for Economic Index[1,2]

Statistic	All PG&E Sample	Non-CARE/FERA	CARE/FERA	Seniors
Mean	2.94	2.14	3.98	2.73
25th Percentile	1.42	1.05	2.56	1.35
Median	2.49	1.70	3.89	2.31
75th Percentile	4.24	2.82	5.32	3.87

[1] Higher mean index scores = more economic difficulty.

[2] Values are shown for all respondents combined, including control and treatment customers, with no weighting used to adjust for oversampling of sub-segments in the hot climate region or oversampling of CARE/FERA customers in all climate regions.

Figure 4.5-1: Histogram of Economic Index Scores[1, 2]

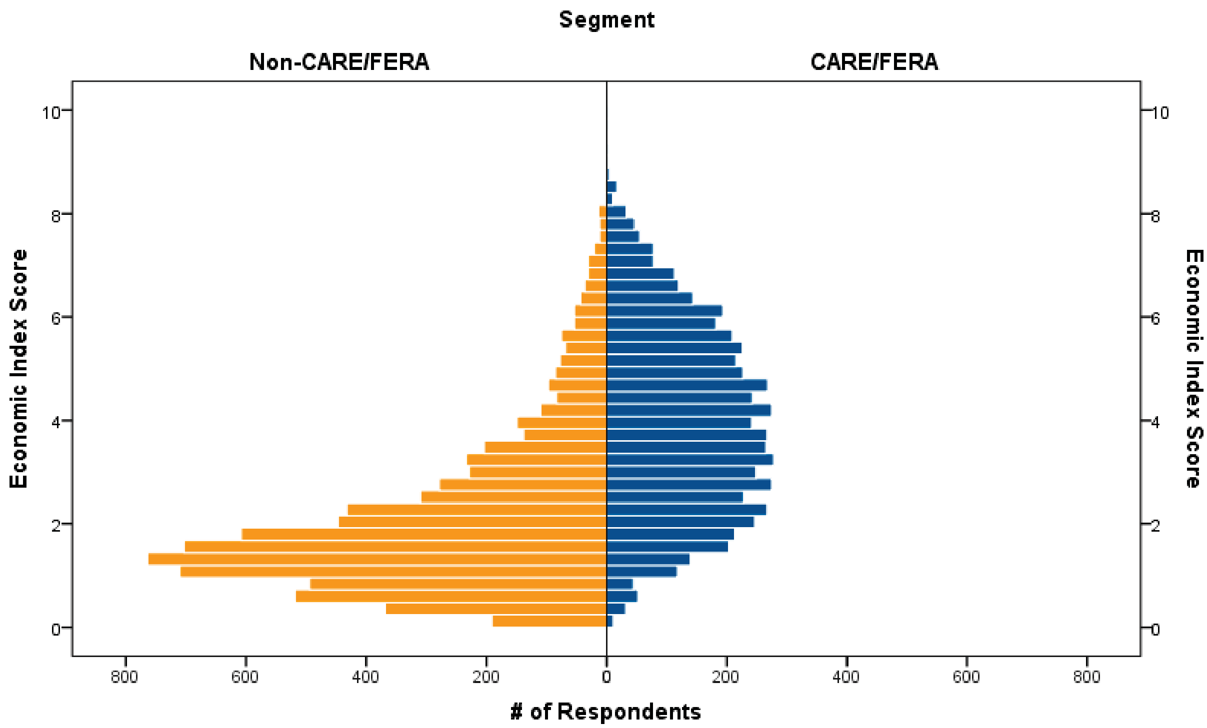


[1] Higher index scores = more economic difficulty.

[2] Values are shown for all respondents combined, including control and treatment customers, with no weighting used to adjust for oversampling of sub-segments in the hot climate region or oversampling of CARE/FERA customers in all climate regions.

As shown in Figure 4.5-2, the distribution of economic index scores is different for CARE/FERA and non-CARE/FERA groups. Both groups show a large spread of economic index scores, but the distribution of CARE/FERA scores is normally distributed, with equal distribution around the average score of 3.95. When comparing the two distributions, the reader is reminded that the CARE/FERA population depicted in the figure includes oversampling for households with incomes below 100% of FPG in the hot climate region and other non-random sampling across climate regions and does not accurately represent the distribution of economic index scores for CARE/FERA customers from the general PG&E population.

Figure 4.5-2: Histogram of Economic Index Scores For CARE/FERA And Non-CARE/FERA Segments[1, 2]

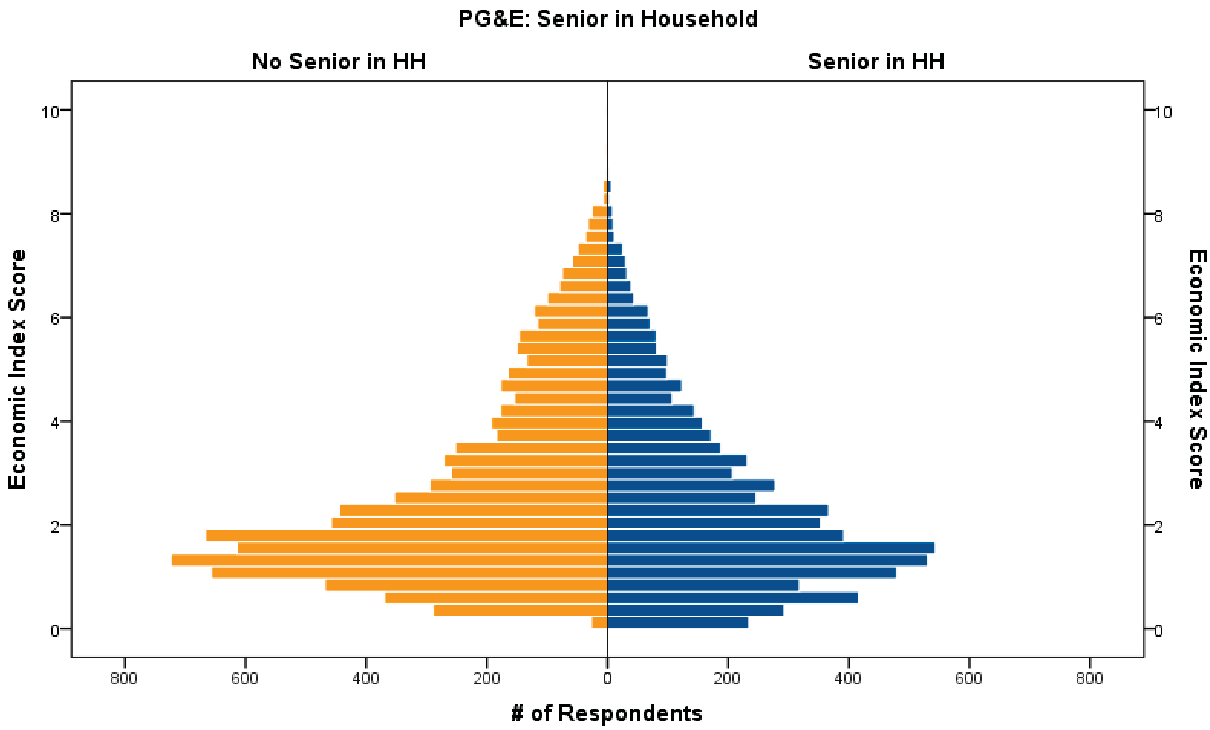


[1] Higher index scores = more economic difficulty.

[2] Values are shown for all respondents combined, including control and treatment customers, with no weighting used to adjust for oversampling of sub-segments in the hot climate region or oversampling of CARE/FERA customers in all climate regions.

As shown in Figure 4.5-3, the distribution of economic index scores is very similar for households with a senior as a head of household versus a non-senior as a head of household. Both groups show a large spread of economic index scores and the distributions are both positively skewed. Once again, however, it is important to keep in mind that oversampling of seniors in the hot climate region means that the distributions displayed in the figure do not represent the distribution of scores for senior households from the general PG&E population.

Figure 4.5-3: Histogram of Economic Index Scores for Seniors and Non-Seniors[1,2]



[1] Higher index scores = more economic difficulty.

[2] Values are shown for all respondents combined, including control and treatment customers, with no weighting used to adjust for oversampling of sub-segments in the hot climate region or oversampling of CARE/FERA customers in all climate regions.

Health Index: Table 4.5-3 shows the percent of respondents who reported a household member who sought medical attention due to excess heat from among the small minority of respondents who indicated that a household member had a medical condition that required keeping their house cool in the summer. All respondents in each segment also indicated that their home has some form of air conditioning. CARE/FERA customers and those with incomes below 100% of FPG were more likely to report a household member who sought medical attention because of excess heat than other segments. Also noteworthy, and surprising, is that more CARE/FERA respondents in the cool climate region reported a household member who sought medical attention for excess heat compared to customers in the moderate or hot regions.

Table 4.5-3: Distribution of Health Index Responses from Customers with AC and a Disability that Requires Cooling by Segment[1]

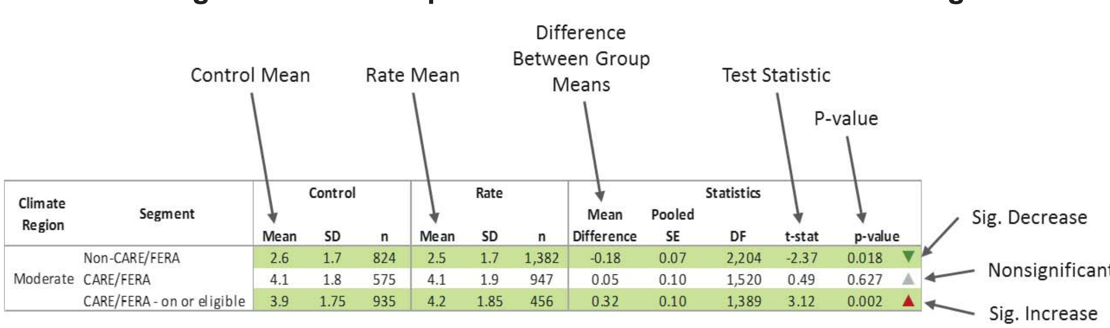
Climate Region	Segment	Total in segment	Total seeking medical attention	% seeking medical attention
Hot	Non-CARE/FERA	238	43	18%
	CARE/FERA	351	76	22%
	CARE/FERA - on or eligible	459	105	23%
	Below 100% FPG	322	85	26%
	100 to 200% FPG	198	41	21%
	Seniors	649	106	16%
Moderate	Non-CARE/FERA	82	8	10%
	CARE/FERA	136	30	22%
	CARE/FERA - on or eligible	165	35	21%
Cool	Non-CARE/FERA	14	2	14%
	CARE/FERA	57	19	33%
	CARE/FERA - on or eligible	61	19	31%

[1] Table includes all respondents who indicated someone in their household had a disability that required they keep their home cool during the summer and had a form of air conditioning in their home. Totals include all control and treatment respondents by segment.

Economic and Health Changes – Control versus Rate Comparisons

This section compares the average values for the economic and health indices for control and TOU treatment customers for each customer segment, rate and climate region. Given the RCT design, any statistically significant differences between control and treatment customers can be attributed to the TOU rates (or random chance). Statistically significant differences between control and rate groups are highlighted in green. Color-coded triangles are also provided to facilitate interpretation of the results as shown in Figure 4.5-4.

Figure 4.5-4: Example of Results Table with Color Coding



Climate Region	Segment	Control Mean	Control SD	Control n	Rate Mean	Rate SD	Rate n	Statistics Mean Difference	Pooled SE	DF	t-stat	p-value
Moderate	Non-CARE/FERA	2.6	1.7	824	2.5	1.7	1,382	-0.18	0.07	2,204	-2.37	0.018 ▼
	CARE/FERA	4.1	1.8	575	4.1	1.9	947	0.05	0.10	1,520	0.49	0.627 ▲
	CARE/FERA - on or eligible	3.9	1.75	935	4.2	1.85	456	0.32	0.10	1,389	3.12	0.002 ▲

Rate 1

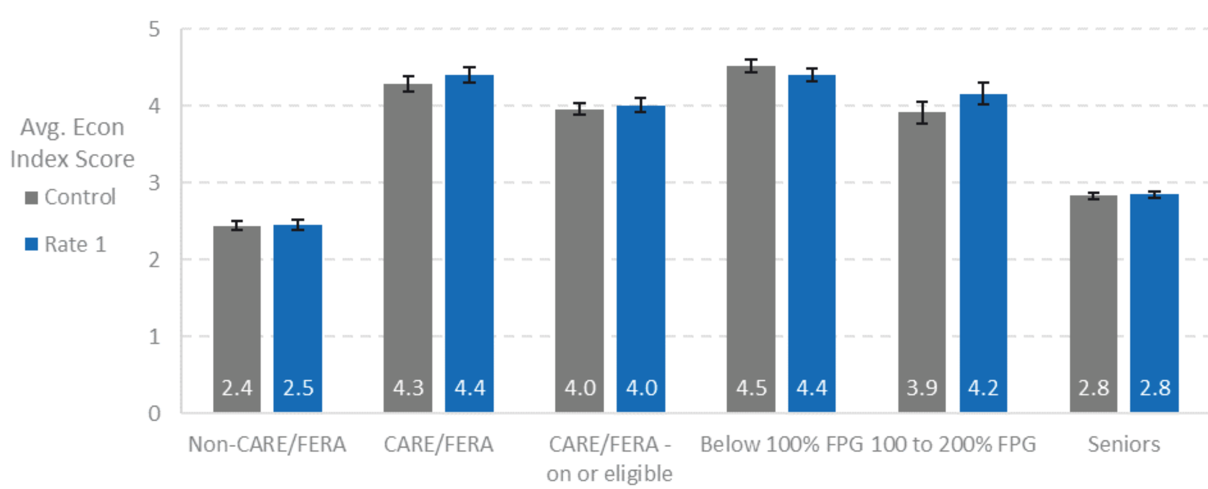
Economic Index: Table 4.5-4 shows the economic index scores for Rate 1 and control group customers by segment and climate region. There was no statistically significant increase in the economic index for customers on Rate 1 in any segment or climate region, including all low-income segments and seniors in the hot climate region. However, low-income segments and seniors in both the control and treatment groups had substantially higher economic index scores than compared with non-CARE/FERA households. For example, low income segments in hot climate region had almost twice as high average economic index scores (on average) compared with non-CARE/FERA households in the same climate region as shown in the table and Figure 4.5-5.

Table 4.5-4: Comparison of Economic Index Means, Control vs. Rate 1[1]

Climate Region	Segment	Control			Rate 1			Statistics					
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value	
Hot	Non-CARE/FERA	2.4	1.7	672	2.5	1.8	624	0.01	0.10	1,294	0.12	0.901	▲
	CARE/FERA	4.3	1.8	339	4.4	1.8	332	0.12	0.14	669	0.84	0.403	▲
	CARE/FERA - on or eligible	4.0	1.9	563	4.0	2.0	538	0.05	0.12	1,099	0.42	0.672	▲
	Below 100% FPG	4.5	1.8	498	4.4	1.8	506	-0.12	0.11	1,002	-1.06	0.291	▼
	100 to 200% FPG	3.9	1.9	200	4.2	2.1	207	0.25	0.20	405	1.23	0.219	▲
	Seniors	2.8	1.8	1,625	2.8	1.8	1,535	0.01	0.07	3,158	0.21	0.830	▲
Moderate	Non-CARE/FERA	2.1	1.4	470	2.0	1.4	462	-0.09	0.09	930	-1.01	0.313	▼
	CARE/FERA	3.8	1.6	322	4.0	1.7	322	0.21	0.13	642	1.63	0.103	▲
	CARE/FERA - on or eligible	3.6	1.7	422	3.8	1.7	415	0.22	0.12	835	1.81	0.070	▲
Cool	Non-CARE/FERA	1.9	1.4	548	1.8	1.3	535	-0.13	0.08	1,081	-1.65	0.100	▼
	CARE/FERA	3.7	1.8	351	3.7	1.8	336	-0.01	0.14	685	-0.07	0.941	▼
	CARE/FERA - on or eligible	3.5	1.8	475	3.4	1.8	440	-0.09	0.12	913	-0.79	0.432	▼

[1] Higher mean index scores = more economic difficulty.

Figure 4.5-5: Mean Economic Index Scores, Control vs. Rate 1 for Targeted Segments in Hot Region[1]



[1] Higher mean index scores = more economic difficulty.

Health Index: Table 4.5-5 shows the health index proportions for control and treatment customers on Rate 1. The values in the table represent customers in the samples that have air conditioning and who reported a household member who required cooling due to a disability. The proportions shown in the table represent the percent of this population who reported a household member who sought medical attention because of excess heat. The health index proportion is lower for customers on Rate 1 relative to the control group for five of the six customer segments in the hot climate region although none of these differences are statistically significant. In addition, the health index is higher for low-income segments compared to non-CARE/FERA and senior segments. Given the small sample sizes for some segments, relatively large differences between the proportions for those on Rate 1 and those in the control group are not statistically significant.

Table 4.5-5: Comparison of Health Index Proportions, Control vs. Rate 1[1, 2]

Climate Region	Segment	Control % with Event	Control Total N	Rate 1 % with Event	Rate 1 Total N	Statistics % Difference	SE	Z-stat	p-value	
Hot	Non-CARE/FERA	19%	95	14%	57	-5%	0.06	0.78	0.44	▼
	CARE/FERA	25%	100	24%	96	-1%	0.06	0.17	0.87	▼
	CARE/FERA - on or eligible	26%	140	23%	124	-3%	0.05	0.57	0.57	▼
	Below 100% FPG	27%	138	31%	109	4%	0.06	0.76	0.45	▲
	100 to 200% FPG	28%	50	16%	62	-12%	0.08	1.52	0.13	▼
	Seniors	17%	262	16%	264	-0.9%	0.03	0.27	0.78	▼
Moderate	Non-CARE/FERA	7%	29	7%	14	0%	0.08	0.03	0.98	▲
	CARE/FERA	14%	35	24%	37	10%	0.09	1.08	0.28	▲
	CARE/FERA - on or eligible	14%	44	23%	43	10%	0.08	1.16	0.25	▲
Cool	Non-CARE/FERA	25%	4	33%	3	8%	0.35	0.24	0.81	▲
	CARE/FERA	33%	12	35%	17	2%	0.18	0.11	0.91	▲
	CARE/FERA - on or eligible	31%	13	33%	18	3%	0.17	0.15	0.88	▲

[1] Table shows health index results for respondents who indicated someone in their household had a disability that required they keep their home cool during the summer and had air conditioning in their home.

[2] The number of total customers that require cooling for a disability and have air conditioning in the moderate and cool climate region are very small. The results are included here for completeness, but the statistical outcomes are not valid due to small sample sizes.

Rate 2

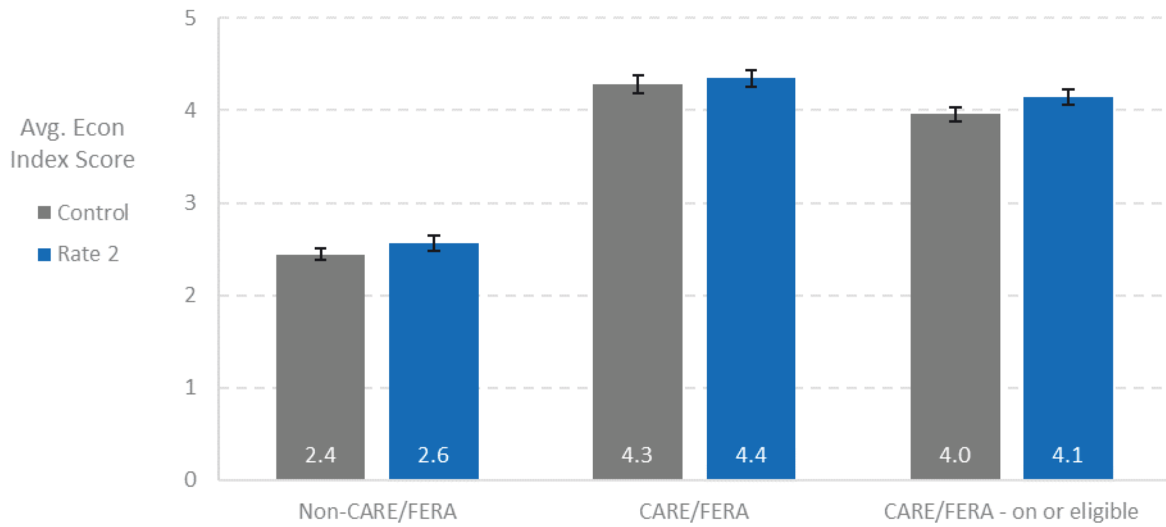
Economic Index: Table 4.5-6 shows the economic index values for control and treatment customers for PG&E's Rate 2. There were no statistically significant differences in the index for any customer segments in any climate region. As shown in the table and in Figure 4.5-6, the index value is nearly twice as high for CARE/FERA customers and CARE/FERA eligible customers compared with non-CARE/FERA customers.

Table 4.5-6: Comparison of Economic Index Means, Control vs. Rate 2[1]

Climate Region	Segment	Control Mean	Control SD	Control n	Rate 2 Mean	Rate 2 SD	Rate 2 n	Statistics Mean Difference	Pooled SE	DF	t-stat	p-value	
Hot	Non-CARE/FERA	2.4	1.66	672	2.6	1.82	469	0.12	0.10	1,139	1.11	0.266	▲
	CARE/FERA	4.3	1.8	339	4.4	1.8	394	0.06	0.13	731	0.47	0.637	▲
	CARE/FERA - on or eligible	4.0	1.88	563	4.1	1.87	535	0.18	0.11	1,096	1.59	0.113	▲
Moderate	Non-CARE/FERA	2.1	1.4	470	2.0	1.3	490	-0.10	0.09	958	-1.14	0.256	▼
	CARE/FERA	3.8	1.6	322	4.0	1.9	309	0.15	0.14	629	1.10	0.273	▲
	CARE/FERA - on or eligible	3.6	1.7	422	3.7	1.9	411	0.10	0.12	831	0.84	0.402	▲
Cool	Non-CARE/FERA	1.9	1.39	548	1.9	1.41	547	-0.01	0.08	1,093	-0.07	0.948	▼
	CARE/FERA	3.7	1.81	351	3.7	1.80	341	-0.05	0.14	690	-0.34	0.730	▼
	CARE/FERA - on or eligible	3.5	1.80	475	3.4	1.82	448	-0.08	0.12	921	-0.66	0.508	▼

[1] Higher mean index scores = more economic difficulty.

Figure 4.5-6: Mean Economic Index Scores, Control vs. Rate 2 for Key Segments in Hot Region[1]



[1] Higher mean index scores = more economic difficulty.

Health Index: Table 4.5-7 shows the health index, or the proportion of respondents reporting at least one medical event due to heat in the summer. The data show no statistically significant increases in respondents reporting a household member who sought medical attention due to Rate 2. In addition, the health index is higher for low-income segments compared to non-CARE/FERA segments. However, the samples sizes for non-CARE/FERA and CARE/FERA eligible segments in the moderate and cool regions are too small to provide accurate results.

Table 4.5-7: Comparison of Health Index Proportions, Control vs. Rate 2[1, 2]

Climate Region	Segment	Control % with Event	Control Total N	Rate 2 % with Event	Rate 2 Total N	Statistics % Difference	SE	Z-stat	p-value	
Hot	Non-CARE/FERA	19%	95	16%	45	-3.4%	0.07	0.49	0.62	▼
	CARE/FERA	25%	100	17%	82	-8%	0.06	1.30	0.19	▼
	CARE/FERA - on or eligible	26%	140	19%	100	-7%	0.06	1.34	0.18	▼
Moderate	Non-CARE/FERA	7%	29	29%	14	22%	0.11	1.92	0.06	▲
	CARE/FERA	14%	35	29%	31	14.7%	0.10	1.46	0.14	▲
	CARE/FERA - on or eligible	14%	44	30%	37	16.1%	0.09	1.77	0.08	▲
Cool	Non-CARE/FERA	25%	4	0%	2	-25%	0.32	0.77	0.44	▼
	CARE/FERA	33%	12	36%	14	2%	0.19	0.13	0.90	▲
	CARE/FERA - on or eligible	31%	13	33%	15	3%	0.18	0.14	0.88	▲

[1] Table shows health index results for respondents who indicated someone in their household had a disability that required they keep their home cool during the summer and had air conditioning in their home.

[2] The number of total customers that require cooling for a disability and have air conditioning in the moderate and cool climate region are very small. The results are included here for completeness, but the statistical outcomes are not valid due to small sample sizes.

Rate 3

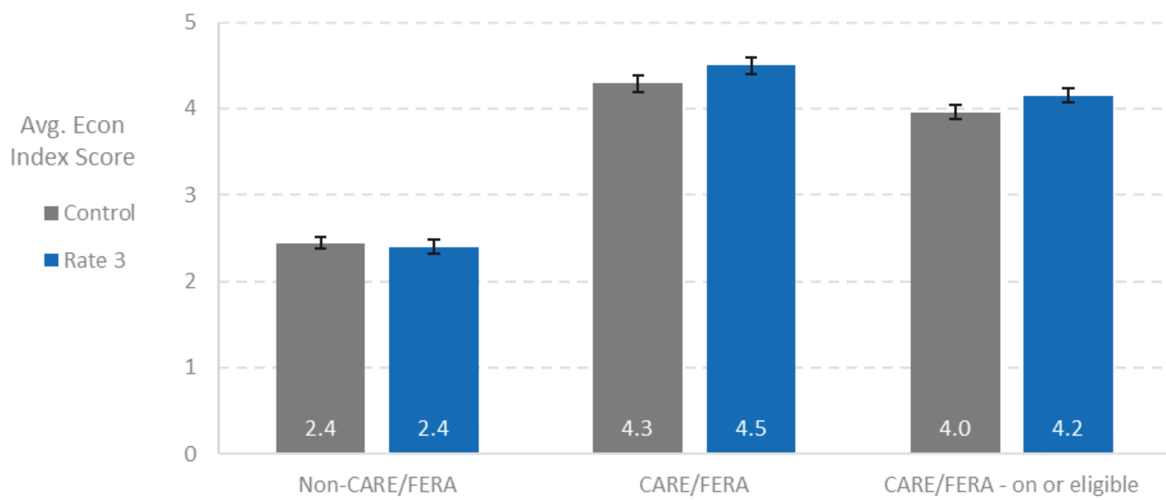
Economic Index: Table 4.5-8 and Figure 4.5-7 show the economic index score for customers on Rate 3 and the corresponding control group. As with Rates 1 and 2, there are no statistically significant differences in the index values for any customer segment or climate region. However, the index value is nearly twice as high for CARE/FERA customers and CARE/FERA eligible customers compared with non-CARE/FERA customers.

Table 4.5-8: Comparison of Economic Index Means, Control vs. Rate 3[1]

Climate Region	Segment	Control			Rate 3			Statistics				
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	Non-CARE/FERA	2.4	1.66	672	2.4	1.79	470	-0.04	0.10	1,140	-0.42	0.671 ▼
	CARE/FERA	4.3	1.8	339	4.5	1.8	398	0.21	0.13	735	1.55	0.121 ▲
	CARE/FERA - on or eligible	4.0	1.88	563	4.2	1.95	555	0.19	0.11	1,116	1.65	0.099 ▲
Moderate	Non-CARE/FERA	2.1	1.4	470	2.0	1.4	454	-0.09	0.09	922	-0.94	0.346 ▼
	CARE/FERA	3.8	1.6	322	3.9	1.7	330	0.06	0.13	650	0.45	0.655 ▲
	CARE/FERA - on or eligible	3.6	1.7	422	3.7	1.7	426	0.08	0.12	846	0.69	0.492 ▲
Cool	Non-CARE/FERA	1.9	1.39	548	1.9	1.35	510	0.01	0.08	1,056	0.07	0.942 ▲
	CARE/FERA	3.7	1.81	351	3.7	1.84	306	0.02	0.14	655	0.17	0.863 ▲
	CARE/FERA - on or eligible	3.5	1.80	475	3.5	1.83	411	0.01	0.12	884	0.11	0.912 ▲

[1] Higher mean index scores = more economic difficulty.

Figure 4.5-7: Mean Economic Index Scores, Control vs. Rate 3 for Key Segments in Hot Region[1]



[1] Higher mean index scores = more economic difficulty.

Health Index: Table 4.5-9 shows the health index, or the proportion of households reporting at least one medical event due to heat in the summer. As with Rates 1 and 2, the percentage of respondents across all segments in Rate 3 who reported a household member needed to seek medical attention is not statistically different than the percentage of respondents in corresponding control groups. In addition, the health index is higher for low-income segments compared to non-CARE/FERA segments. However, the samples sizes for non-CARE/FERA and CARE/FERA eligible segments in the moderate and cool regions are too small to provide accurate results.

Table 4.5-9: Comparison of Health Index Proportions, Control vs. Rate 3[1, 2]

Climate Region	Segment	Control: % with Event	Control: Total N	Rate 3: % with Event	Rate 3: Total N	Statistics: % Difference	SE	Z-stat	p-value	
Hot	Non-CARE/FERA	19%	95	24%	41	5%	0.08	0.72	0.47	▲
	CARE/FERA	25%	100	19%	73	-6%	0.06	0.91	0.37	▼
	CARE/FERA - on or eligible	26%	140	21%	95	-5%	0.06	0.94	0.35	▼
Moderate	Non-CARE/FERA	7%	29	4%	25	-3%	0.06	0.46	0.64	▼
	CARE/FERA	14%	35	21%	33	7%	0.09	0.75	0.45	▲
	CARE/FERA - on or eligible	14%	44	20%	41	5.9%	0.08	0.73	0.47	▲
Cool	Non-CARE/FERA	25%	4	0%	5	-25%	0.21	1.19	0.24	▼
	CARE/FERA	33%	12	29%	14	-5%	0.18	0.26	0.79	▼
	CARE/FERA - on or eligible	31%	13	27%	15	-4%	0.17	0.24	0.81	▼

[1] Table shows health index results for respondents who indicated someone in their household had a disability that required they keep their home cool during the summer and had air conditioning in their home.

[2] The number of total customers that require cooling for a disability and have air conditioning in the moderate and cool climate region are very small. The results are included here for completeness, but the statistical outcomes are not valid due to small sample sizes.

Cross-Group Analysis

Overall, there is no evidence that TOU rates increased economic or health index scores on average for any customer segment in PG&E's service territory, including CARE/FERA customers. Further, TOU rates did not increase economic index scores for seniors in the hot climate region (all statistical comparisons between control and rate treatments for seniors were insignificant). Survey data suggest that senior households may be better able to shift their electricity use during peak hours. Not only did senior households in hot climate regions rate their ease of shifting usage in the afternoons and evenings slightly higher than non-senior households ($M_{seniors}$=6.7, $M_{non\text{-}seniors}$=6.3, t=8.42, p<.001), but seniors reported fewer key barriers to shifting use compared to non-seniors in the hot climate region (Table 4.5-10).

No Increase in Economic or Health Index Scores

Overall, there is no evidence that TOU rates increased economic or health index scores on average for any customer segment in PG&E's service territory, including CARE/FERA customers.

Table 4.5-10: Fewer Factors Keep Seniors in Hot Climates from Shifting or Reducing Their Usage[1]

Barriers to reducing or shifting electricity usage in the afternoon and evenings	Seniors	Non-seniors
My household already uses very little electricity	31%	27%
My home gets uncomfortable if I try to reduce electricity usage	23%	31%
Nothing keeps me from shifting my usage	23%	15%
Working from home makes it difficult to use less electricity	5%	11%
My schedule doesn't allow me to reduce my usage	4%	18%
Child(ren) in household make it difficult to change our routines	4%	24%

[1]All differences are significant (z-test for proportions, p<.001).

Question-Level Findings

The following sections compare responses between treatment and control customers for individual questions that underlie the economic and health indices. Results are presented for all three rates to enable cross-rate comparisons and facilitate identification of patterns in the results. Because of the random assignment of customers to treatment and control conditions, statistically significant differences in values between the two groups can be attributed to the TOU rates. Statistically significant differences between the control and rate groups are shaded in grey as shown in the example Table 4.5-11. To facilitate readability, each table provides estimates for the rate with additional targeted segments first, Rate 1, followed by estimates for Rates 2 and 3.

Table 4.5-11: Example of Question-Level Results Table

Rate with targeted segments

Rates without targeted segments

Climate Region	Segment	C	R1		R2		R3	
Hot	Non-CARE/FERA	15%	20%	▲	16%	▲	16%	▲
	CARE/FERA	24%	29%	▲	23%	▼	22%	▼
	Below 100% FPG	27%	28%	▲	-		-	
	100 to 200% FPG	22%	25%	▲	-		-	
	Senior	14%	17%	▲	-		-	
Moderate	Non-CARE/FERA	10%	6%	▼	8%	▼	7%	▼
	CARE/FERA	21%	24%	▲	21%	▲	20%	▼
Cool	Non-CARE/FERA	2%	1%	▼	3%	▲	3%	▲
	CARE/FERA	13%	13%	▼	8%	▼	12%	▼

Grey shading = statistical significance

Customers Worried about Having Enough Money to Pay Electricity Bill

Respondents rated their agreement with six statements designed to measure respondents' attitudes towards adopting energy saving behaviors using an 11-point scale with 0 meaning "do not agree at all" and 10 meaning "completely agree". One of these statements, "I often worry whether there is enough money to pay my electricity bill" is used to create the economic index (Table 4.5-12).

Surveyed customers provided low to moderate agreement ratings, 1.0 to 6.1, to this statement. When comparing responses between Control and Rate treatment groups, two significant differences were found for Rate 2; with both showing that non-CARE/FERA customers on Rate 2 in the moderate and cool climate regions were less worried about having enough money to pay their electricity bill compared with control customers. All significant differences were small, with differences between Control and treatment group ratings less than a point on the 11-point rating scale.

Respondents in the CARE/FARE segments provided substantially higher agreement ratings to the statement compared to those in the non-CARE/FERA segments. Additionally, respondents in the hot climate region provided slightly higher ratings to the statement compared to similar segments in the moderate and cool climate regions.

Table 4.5-12: Percentage of Respondents Reporting They Often Worry About Having Enough Money to Pay Their Electricity Bill[1]

Climate Region	Segment	I often worry whether there is enough money to pay my electricity bill			
		C	R1	R2	R3
Hot	Non-CARE/FERA	2.4	2.5	2.6	2.6
	CARE/FERA	5.4	5.5	4.9	5.7
	Below 100% FPG	5.9	6.1	-	-
	100 to 200% FPG	4.7	5.0	-	-
	Senior	3.1	3.2	-	-
Moderate	Non-CARE/FERA	1.8	1.6	1.5	1.7
	CARE/FERA	4.6	4.4	4.8	4.7
Cool	Non-CARE/FERA	1.4	1.3	1.0	1.5
	CARE/FERA	4.2	4.0	4.2	4.2

[1] Used t-test, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Customers Experiencing Issues with Paying their Bills

Respondents reported the number of times – since participating in the pilot – that their household struggled to pay: a) electricity bills, and b) bills for other basic needs such as food, housing, medicine, and other important bills. Respondents answered on a 4-point scale ranging from "none" to "3 or more times."

Table 4.5-13 shows the percent of respondents who reported having difficulty paying either their electricity bill or some other bill at least once during the summer. As shown, there is substantial variability across segments (16% to 78% reporting difficulty paying their bills) but there is little variability in responses across RCT group. No significant differences were found between rate and control customers but a higher percentage of respondents from low income segments reported bill payment difficulty than non-low income segments. Across climate regions, hot region customers were the most likely to report any difficulty paying bills.

Table 4.5-13: Percentage of Respondents Reporting Difficulty Paying Bills Since June 2016[1]

Climate Region	Segment	C	R1	R2	R3
Hot	Non-CARE/FERA	31%	30% ▼	33% ▲	29% ▼
	CARE/FERA	75%	74% ▼	73% ▼	78% ▲
	Below 100% FPG	75%	74% ▼	-	-
	100 to 200% FPG	65%	66% ▲	-	-
	Senior	40%	39% ▼	-	-
Moderate	Non-CARE/FERA	20%	19% ▼	16% ▼	18% ▼
	CARE/FERA	66%	64% ▼	63% ▼	61% ▼
Cool	Non-CARE/FERA	21%	17% ▼	19% ▼	21% ▼
	CARE/FERA	61%	60% ▼	61% ▲	59% ▼

[1] Table shows the percent of respondents who either had difficulty paying their electricity bill or other bills at least one time during the summer.

Financial Well-Being (CFPB)

To gauge respondents' financial health, respondents were asked about five items sourced from the Consumer Financial Protection Bureau (CFPB). For the first three items, respondents are asked how each describes their situation using a scale including "not at all," "very little," "somewhat," "very well," and "completely." For the last two items, respondents were asked how often each applies to them using a scale including "never," "rarely," "sometimes," "often," and "always." The CFPB items are:

- Because of my money situation, I feel like I will never get the things I want in life.
- I am just getting by financially.
- I am concerned that the money I have won't last.
- I have money left over at the end of the month.
- My finances control my life.

Using answers to these five items, each respondent's financial well-being score was calculated, with values ranging from 19 (low financial well-being) to 90 (high financial well-being).[68]

As shown in Table 4.5-14, PG&E respondents demonstrated a relatively tight range of financial well-being scores, with average scores ranging from 46 to 60 (higher scores indicate higher financial well-being). Customers on TOU rates did not have significantly lower CFPB scores than control rate customers. Rate 3 CARE/FERA customers in the cool region had higher CFPB scores when compared to their control group, but the difference was less than 2 points out of roughly 49 points. Compared to other segments, non-CARE/FERA customers had the highest financial well-being scores.

Table 4.5-14: Average Financial Well-Being Scores[1]

Climate Region	Segment	CFPB C	CFPB R1		CFPB R2		CFPB R3	
Hot	Non-CARE/FERA	57.1	57.9	▲	57.2	▲	58.3	▲
	CARE/FERA	47.1	46.9	▼	46.7	▼	45.6	▼
	Less than 100% FPG	46.4	47.0	▲	-		-	
	100%-200% FPG	49.1	48.1	▼	-		-	
	Senior	54.8	54.9	▲	-		-	
Moderate	Non-CARE/FERA	58.2	59.1	▲	59.2	▲	58.7	▲
	CARE/FERA	48.0	48.2	▲	48.0	▲	47.9	▼
Cool	Non-CARE/FERA	59.3	60.3	▲	59.5	▲	59.7	▲
	CARE/FERA	47.5	48.3	▲	48.7	▲	49.3	▲

[1] Grey shading indicates a significant difference in the responses between control and rate group for that segment (using t-test and an alpha level of .05)

[68] The financial well-being score is a methodologically rigorous scale from the Consumer Financial Protection Bureau that measures a customer's financial well-being. The Consumer Financial Protection Bureau's methods for the abbreviated version of their "Financial Well-Being Scale" was followed. See the following documentation for full methodological details: http://files.consumerfinance.gov/f/201512_cfpb_financial-well-being-user-guide-scale.pdf

Number of Alternative Methods Used to Pay Bills

Respondents reported how they afforded to pay electricity bills and/or other basic needs over the summer. Respondents selected as many of the following options that applied to their household:

- Use your household's current income
- Use your household's savings or other investments
- Cut back on non-essential spending for things your household wants
- Reduce your household energy usage
- Borrow money from family, friends, or peers
- Borrow money using a short-term loan
- Use a credit card that you can't pay off right away
- Leave rent/mortgage unpaid
- Leave some household bills unpaid past the due date
- Received emergency assistance from [IOU NAME]
- Received emergency assistance from other city or regional programs

Reducing household energy usage[69] and cutting back on non-essential spending are included in the percent of respondents (by rate and segment) that reported using any of the options other than 'current income.' This metric, therefore, measured the maximum number of customers in each segment, by rate that took some type of action, however small, to help pay their bills.

As shown in Table 4.5-15, two-fifths or more of each segment on each rate plan reported using non-income strategies to afford bill payments. Seniors in the hot climate region is the only segment that shows a statistically significant difference between the control and TOU rate groups, although the difference is relatively small. Within each climate region, CARE/FERA customers were the most likely to report non-income strategies for making bill payments.

[69] The percentages in Table 4.5-15 are significantly lower if "reduce your household energy use" is excluded from the tabulations. For non-CARE/FERA households in the hot climate region, for example, dropping this option from the tabulation reduces the percentages by about 20 percentage points (from 55% to 35%). The main conclusion, that there are few statistically significant differences between treatment and control customers, does not change, although if this response option is dropped, the one segment where there is a statistically significant difference is for CARE/FERA customers on Rate 2 in the hot climate region rather than for senior customers on Rate 1 in the hot climate region.

Table 4.5-15: Percentage of Respondents Reporting Affording Summer Bill Payments Using Sources Other than Current Income[1]

Climate Region	Segment	C	R1		R2		R3	
Hot	Non-CARE/FERA	55%	58%	▲	60%	▲	54%	▼
	CARE/FERA	77%	82%	▲	82%	▲	82%	▲
	Below 100% FPG	82%	83%	▲	-		-	
	100 to 200% FPG	73%	73%	▼	-		-	
	Senior	64%	67%	▲	-		-	
Moderate	Non-CARE/FERA	48%	44%	▼	45%	▼	46%	▼
	CARE/FERA	74%	78%	▲	75%	▲	73%	▼
Cool	Non-CARE/FERA	41%	40%	▼	40%	▼	44%	▲
	CARE/FERA	71%	71%	▼	71%	▼	73%	▲

[1] Grey shading indicates a significant difference in the responses between control and rate group for that segment (using t-test and an alpha level of .05)

4.5.2 Other Research Topics

The remainder of this section summarizes findings from the other research topics that were covered by the survey.

Motivations for Participating in the Study

Participation Recall Rate

Nearly all surveyed PG&E customers (between 84% and 99%) recalled participating in the study (Table 4.5-16). When comparing responses between Control and Rate groups, four segments in the hot climate region and the non-CARE/FERA segment in the cool climate region exhibited significant differences, although none of the differences are larger than 4%. In addition, slightly fewer respondents in the CARE/FERA segments recalled participating in the study compared to those in the non-CARE/FERA segments (differences ranging between 5% and 10%).

Table 4.5-16: TOU Study Participation Recall Rates[1]

Climate Region	Segment	Recalls participating in the study			
		C	R1	R2	R3
Hot	Non-CARE/FERA	95%	96%	97%	98%
	CARE/FERA	88%	91%	89%	91%
	Below 100% FPG	84%	88%	-	-
	100 to 200% FPG	93%	92%	-	-
	Senior	91%	93%	-	-
Moderate	Non-CARE/FERA	96%	98%	98%	97%
	CARE/FERA	88%	87%	90%	88%
Cool	Non-CARE/FERA	96%	95%	98%	98%
	CARE/FERA	87%	89%	91%	88%

[1] Chi-square used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

Motivations to Participate

Approximately two-fifths to over one-half (38% to 56%) of surveyed customers across all segments reported their primary motivation for participating in the study was to save money on their electricity bills (Table 4.5-17). More respondents in the CARE/FERA segments reported their primary motivation as saving money compared to non-CARE/FERA respondents. Earning a bill credit was the second most frequent motivation reported by respondents across all segments (ranging from 22% to 31%), and slightly more non-CARE/FERA customers selected this motivation compared to low-income customers. Since it was not expected that motivation to participate would be influenced by rate treatment group assignment, responses across Control and Rate groups are combined for this analysis.

Table 4.5-17: Primary Motivation for TOU Study Participation

Climate Region	Segment	To save money on electricity bill	To earn a bill credit	Environmentally responsible	Other[1]
Hot	Non-CARE/FERA	45%	27%	8%	20%
	CARE/FERA	56%	23%	7%	14%
	Less than 100% FPG	56%	22%	7%	15%
	100%-200% FPG	55%	24%	6%	14%
	Senior	52%	23%	9%	17%
Moderate	Non-CARE/FERA	44%	27%	10%	19%
	CARE/FERA	52%	23%	9%	15%
Cool	Non-CARE/FERA	38%	31%	12%	19%
	CARE/FERA	51%	23%	10%	16%

[1] 'Other' includes: bill protection makes it risk free, to be one of the first to learn about new rates, to give PG&E my feedback on the plan, and other.

Customer Outreach: Welcome Packet

PG&E sent Rate group customers a welcome packet that included information about their rate and tips for reducing or shifting their energy usage. PG&E also sent Control group customers a letter that included information about the study and some tips for reducing or shifting their energy usage.

Most surveyed customers, between 69% and 96%, reported receiving their TOU welcome packet, and of those, between 71% and 92% reported looking through it (Table 4.5-18). The lowest read-rates were reported by customers in the low-income groups. Significantly more rate group customers across all segments recalled receiving and looking through the packet than customers in the corresponding control groups.

Table 4.5-18: Percentage Who Received and Looked Through the TOU Welcome Packet[1]

Climate Region	Segment	Received welcome packet				Looked through welcome packet[2]			
		C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	77%	93% ▲	94% ▲	95% ▲	80%	91% ▲	92% ▲	92% ▲
	CARE/FERA	75%	89% ▲	88% ▲	86% ▲	80%	87% ▲	87% ▲	87% ▲
	Below 100% FPG	71%	85% ▲	-	-	80%	84% ▲	-	-
	100 to 200% FPG	77%	88% ▲	-	-	79%	86% ▲	-	-
	Senior	78%	89% ▲	-	-	80%	88% ▲	-	-
Moderate	Non-CARE/FERA	78%	96% ▲	95% ▲	93% ▲	79%	91% ▲	92% ▲	90% ▲
	CARE/FERA	74%	83% ▲	83% ▲	87% ▲	72%	84% ▲	80% ▲	85% ▲
Cool	Non-CARE/FERA	75%	94% ▲	95% ▲	94% ▲	77%	91% ▲	92% ▲	91% ▲
	CARE/FERA	69%	85% ▲	86% ▲	87% ▲	71%	86% ▲	83% ▲	83% ▲

[1] Chi-square used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.
[2] Asked only to respondents who reported receiving the welcome packet.

Customers who reported looking through the welcome packet or letter rated their level of agreement with several aspects about the packet/letter. These customers mostly agreed that the information in the packet explained what to expect during the study (asked of control group) or how the price of electricity varies on their rate plan (asked of rate groups, Table 4.5-19).[70] Customers gave these items the highest average rating on an 11-point scale where 0 means “do not agree at all” and 10 means “completely agree”. Customers also mostly agreed that the items in the packet were easy to understand, that they understood how their rate worked after looking at the packet, and that they used many of the tips included in the packet; customers somewhat agreed that the decals/stickers were helpful.

Since control and rate group customers received different information, separate, but similar versions of the question about aspects of the welcome packet/letter were used. However, two of the items in each question were sufficiently alike to allow for statistical comparisons of ratings between the groups. No significant differences were found between the Control and Rate groups on the first aspect – the items in the packet were easy to understand.

All the customers in the Rate groups reported significantly lower average agreement ratings compared to customers in the Control groups across all climate regions and segments for the second aspect about the welcome packet: that customers used many of the tips provided in the packet. These statistical differences are also substantively small (about one point or less on an 11-point scale).

In general, low-income customers reported slightly higher agreement ratings, compared to non-CARE/FERA customers, for nearly all aspects asked about the welcome packet, and particularly with the helpfulness of the decals and stickers. Low-income customers reported a slightly lower average rating, compared to non-CARE/FERA customers, on one aspect of the packet: the information in the packet explained how the price of electricity is different depending on the time of day and season of the year.

[70] No comparisons were made between the rate and control groups for these items since they were worded differently and the Control group item was included only in the web survey (not the mail or phone surveys).

Table 4.5-19: Average Level of Agreement with Aspects of the TOU Welcome Packet[1,2]

Climate Region	Segment	Packet explained what to expect[3]	Info explained how price varied by time of day, etc.[4]			The items were easy to understand				After packet I understand how rate works[4]			I've used many of the tips in the packet				The decals or stickers were helpful[4]		
		C	R1	R2	R3	C	R1	R2	R3	R1	R2	R3	C	R1	R2	R3	R1	R2	R3
Hot	Non-CARE/FERA	7.7	8.1	8.1	8.1	7.6	7.9	7.8	7.9	7.6	7.6	7.5	7.6	6.9	7.0	7.2	4.5	4.7	5.0
	CARE/FERA	8.5	8.3	7.8	8.1	8.2	8.0	7.6	7.8	7.6	7.0	7.3	8.2	7.5	7.1	7.3	6.1	6.2	6.3
	Below 100% FPG	8.4	8.1	-	-	8.1	7.8	-	-	7.3	-	-	8.1	7.3	-	-	6.0	-	-
	100 to 200% FPG	8.0	8.3	-	-	7.9	8.0	-	-	7.6	-	-	7.9	7.4	-	-	5.7	-	-
	Senior	7.9	8.3	-	-	7.8	8.0	-	-	7.6	-	-	7.8	7.3	-	-	4.9	-	-
Moderate	Non-CARE/FERA	7.8	8.2	8.1	8.3	7.7	8.0	7.7	7.9	7.7	7.5	7.7	7.7	6.9	6.7	6.6	5.0	5.4	5.3
	CARE/FERA	8.2	8.1	8.1	8.0	8.1	7.7	7.8	7.8	7.6	7.6	7.5	8.1	7.3	7.4	7.0	6.2	6.6	6.4
Cool	Non-CARE/FERA	7.7	8.1	8.1	8.3	7.6	7.8	7.8	7.8	7.5	7.4	7.6	7.6	6.3	6.4	6.7	4.5	4.7	4.9
	CARE/FERA	8.0	8.3	8.1	8.0	7.9	8.1	7.8	7.7	7.6	7.5	7.6	7.9	7.1	7.0	6.9	6.1	5.7	5.8

1 Agreement ratings are based on an 11-point scale where 0 means ‘do not agree at all’ and 10 means ‘completely agree’.

2 T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

3 Asked only of control groups since they received a welcome letter instead of a packet.

4 Asked only of rate groups since they received a welcome packet instead of a letter.

Satisfaction

Satisfaction with PG&E and Rate Plan

Overall, respondents reported being somewhat to mostly satisfied with PG&E and their rate plan. Ratings were based on an 11-point scale, where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'. As shown in Table 4.5-20 , customers were slightly more satisfied with PG&E (6.4 to 7.8) than with their rate plan (5.5 to 7.2). Control group customers were slightly more satisfied with PG&E and their rate plan compared to rate group customers across all segments. A few of the Control/Rate group comparisons are statistically significant, particularly with regard to satisfaction with the rate. However, these differences are substantively small (less than one point on an 11-point scale). In addition, customers in the low-income segments were slightly more satisfied with PG&E and the rate plan compared to the non-CARE/FERA customers.

Table 4.5-20: Average Level of Satisfaction with PG&E and Rate Plan[1,2]

Climate Region	Segment	Satisfaction with PG&E				Satisfaction with rate			
		C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	6.8	6.6 ▼	6.4 ▼	6.5 ▼	5.9	5.7 ▼	5.5 ▼	5.6 ▼
	CARE/FERA	7.6	7.4 ▼	7.4 ▼	7.3 ▼	7.0	6.8 ▼	6.6 ▼	6.5 ▼
	Below 100% FPG	7.7	7.5 ▼	-	-	7.1	6.9 ▼	-	-
	100 to 200% FPG	7.7	7.5 ▼	-	-	6.6	6.7 ▲	-	-
	Senior	7.5	7.3 ▼	-	-	6.8	6.6 ▼	-	-
Moderate	Non-CARE/FERA	6.9	6.8 ▼	6.8 ▼	6.9 ▲	6.4	6.4 ▼	5.9 ▼	6.1 ▼
	CARE/FERA	7.8	7.7 ▼	7.6 ▼	7.7 ▼	7.3	7.1 ▼	7.1 ▼	7.1 ▼
Cool	Non-CARE/FERA	6.8	6.6 ▼	6.6 ▼	6.6 ▼	6.3	6.0 ▼	6.0 ▼	6.2 ▼
	CARE/FERA	7.6	7.5 ▼	7.6 ▲	7.4 ▼	7.2	7.2 ▼	7.1 ▼	7.1 ▼

[1] Satisfaction ratings are based on an 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Table 4.5-21 to Table 4.5-23 show additional statistics for Control vs. Rate group comparisons of average satisfaction with PG&E. Table 4.5-24 to Table 4.5-26 show additional statistics for Control vs. Rate group comparisons of average satisfaction with the rate.

Table 4.5-21: Average Level of Satisfaction with PG&E, Control vs. Rate 1[1,2]

Climate Region	Segment	Control			Rate 1			Statistics				
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	Non-CARE/FERA	6.8	2.4	1,012	6.6	2.4	965	-0.17	0.11	1,975	-1.53	0.126 ▼
	CARE/FERA	7.6	2.6	543	7.4	2.5	503	-0.14	0.16	1,044	-0.84	0.401 ▼
	Below 100% FPG	7.3	2.6	311	7.3	2.4	321	0.03	0.20	630	0.16	0.872 ▲
	100 to 200% FPG	7.7	2.4	893	7.5	2.4	852	-0.18	0.12	1,743	-1.56	0.120 ▼
	Senior	7.5	2.5	1,860	7.3	2.5	1,737	-0.21	0.08	3,595	-2.58	0.010 ▼
Moderate	Non-CARE/FERA	6.9	2.2	526	6.8	2.2	503	-0.09	0.14	1,027	-0.64	0.522 ▼
	CARE/FERA	7.8	2.4	395	7.7	2.4	372	-0.11	0.17	765	-0.65	0.515 ▼
Cool	Non-CARE/FERA	6.8	2.2	575	6.6	2.2	566	-0.24	0.13	1,139	-1.84	0.066 ▼
	CARE/FERA	7.6	2.4	415	7.5	2.3	378	-0.01	0.17	791	-0.07	0.943 ▼

[1] Satisfaction ratings are based on an 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.

[2] T-test used, highlighted p-values indicate statistically significant difference versus Control group at p≤.05.

Table 4.5-22: Average Level of Satisfaction with PG&E, Control vs. Rate 2[1,2]

Climate Region	Segment	Control Mean	Control SD	Control n	Rate 2 Mean	Rate 2 SD	Rate 2 n	Difference	SE	DF	t-stat	p-value
Hot	Non-CARE/FERA	6.8	2.4	1,012	6.4	2.5	520	-0.36	0.132	1530	-2.68	0.007 ▼
	CARE/FERA	7.6	2.6	543	7.4	2.5	446	-0.18	0.164	987	-1.12	0.262 ▼
Moderate	Non-CARE/FERA	6.9	2.2	526	6.8	2.1	515	-0.11	0.135	1039	-0.84	0.403 ▼
	CARE/FERA	7.8	2.4	395	7.6	2.4	379	-0.22	0.171	772	-1.29	0.196 ▼
Cool	Non-CARE/FERA	6.8	2.2	575	6.6	2.2	581	-0.20	0.130	1154	-1.50	0.133 ▼
	CARE/FERA	7.6	2.4	415	7.6	2.3	385	0.06	0.168	798	0.36	0.716 ▲

[1] Satisfaction ratings are based on an 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.
[2] T-test used, highlighted p-values indicate statistically significant difference versus Control group at p≤.05.

Table 4.5-23: Average Level of Satisfaction with PG&E, Control vs. Rate 3[1,2]

Climate Region	Segment	Control Mean	Control SD	Control n	Rate 3 Mean	Rate 3 SD	Rate 3 n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	Non-CARE/FERA	6.8	2.4	1,012	6.5	2.5	505	-0.32	0.134	1515	-2.36	0.019 ▼
	CARE/FERA	7.6	2.6	543	7.3	2.6	440	-0.23	0.169	981	-1.37	0.172 ▼
Moderate	Non-CARE/FERA	6.9	2.2	526	6.9	2.1	491	0.02	0.137	1015	0.13	0.896 ▲
	CARE/FERA	7.8	2.4	395	7.7	2.4	401	-0.12	0.167	794	-0.73	0.466 ▼
Cool	Non-CARE/FERA	6.8	2.2	575	6.6	2.2	545	-0.21	0.131	1118	-1.58	0.113 ▼
	CARE/FERA	7.6	2.4	415	7.4	2.2	373	-0.10	0.167	786	-0.62	0.534 ▼

[1] Satisfaction ratings are based on an 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.
[2] T-test used, highlighted p-values indicate statistically significant difference versus Control group at p≤.05.

Table 4.5-24: Average Level of Satisfaction with Rate, Control vs. Rate 1[1,2]

Climate Region	Segment	Control Mean	Control SD	Control n	Rate 1 Mean	Rate 1 SD	Rate 1 n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	Non-CARE/FERA	5.9	2.4	1,044	5.7	2.7	988	-0.19	0.11	2,030	-1.69	0.090 ▼
	CARE/FERA	7.0	2.7	566	6.8	2.7	539	-0.18	0.16	1,103	-1.13	0.260 ▼
	Below 100% FPG	7.1	2.7	626	6.9	2.8	626	-0.24	0.16	1,250	-1.50	0.133 ▼
	100 to 200% FPG	6.6	2.6	325	6.7	2.6	339	0.07	0.20	662	0.34	0.733 ▲
	Senior	6.8	2.6	1,939	6.6	2.7	1,844	-0.26	0.09	3,781	-3.02	0.003 ▼
Moderate	Non-CARE/FERA	6.4	2.2	536	6.4	2.3	519	-0.05	0.14	1,053	-0.37	0.712 ▼
	CARE/FERA	7.3	2.5	416	7.1	2.7	403	-0.15	0.18	817	-0.85	0.397 ▼
Cool	Non-CARE/FERA	6.3	2.2	589	6.0	2.4	577	-0.34	0.13	1,164	-2.53	0.012 ▼
	CARE/FERA	7.2	2.5	436	7.2	2.5	409	-0.03	0.17	843	-0.15	0.883 ▼

[1] Satisfaction ratings are based on an 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.
[2] T-test used, highlighted p-values indicate statistically significant difference versus Control group at p≤.05.

Table 4.5-25: Average Level of Satisfaction with Rate, Control vs. Rate 2[1,2]

Climate Region	Segment	Control Mean	Control SD	Control n	Rate 2 Mean	Rate 2 SD	Rate 2 n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	Non-CARE/FERA	5.9	2.4	1,044	5.5	2.5	524	-0.38	0.132	1566	-2.88	0.004 ▼
	CARE/FERA	7.0	2.7	566	6.6	2.8	465	-0.40	0.171	1029	-2.35	0.019 ▼
Moderate	Non-CARE/FERA	6.4	2.2	536	5.9	2.4	534	-0.48	0.140	1068	-3.44	0.001 ▼
	CARE/FERA	7.3	2.5	416	7.1	2.5	396	-0.16	0.173	810	-0.94	0.347 ▼
Cool	Non-CARE/FERA	6.3	2.2	589	6.0	2.3	592	-0.36	0.131	1179	-2.72	0.007 ▼
	CARE/FERA	7.2	2.5	436	7.1	2.6	425	-0.13	0.171	859	-0.74	0.458 ▼

[1] Satisfaction ratings are based on an 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.
[2] T-test used, highlighted p-values indicate statistically significant difference versus Control group at p≤.05.

Table 4.5-26: Average Level of Satisfaction with Rate, Control vs. Rate 3[1,2]

Climate Region	Segment	Control Mean	Control SD	Control n	Rate 3 Mean	Rate 3 SD	Rate 3 n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	Non-CARE/FERA	5.9	2.4	1,044	5.6	2.8	524	-0.33	0.138	1566	-2.42	0.016 ▼
	CARE/FERA	7.0	2.7	566	6.5	2.8	466	-0.47	0.171	1030	-2.73	0.006 ▼
Moderate	Non-CARE/FERA	6.4	2.2	536	6.1	2.4	515	-0.29	0.141	1049	-2.07	0.039 ▼
	CARE/FERA	7.3	2.5	416	7.1	2.5	439	-0.16	0.171	853	-0.95	0.341 ▼
Cool	Non-CARE/FERA	6.3	2.2	589	6.2	2.3	562	-0.18	0.133	1149	-1.39	0.165 ▼
	CARE/FERA	7.2	2.5	436	7.1	2.4	404	-0.10	0.168	838	-0.61	0.544 ▼

[1] Satisfaction ratings are based on an 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.

[2] T-test used, highlighted p-values indicate statistically significant difference versus Control group at p≤.05.

Higher Agreement Scores for TOU Customers on Several Factors

Many customer segments on TOU rates gave higher average agreement ratings compared with control customers on the OAT on statements concerning ease of understanding of the rate and the rate offering opportunities to save money.

Survey respondents were asked to rate their level of agreement with eleven aspects about their rate plan, using an 11-point scale, where 0 means 'do not agree at all' and 10 means 'completely agree'. Table 4.5-27 to Table 4.5-29 summarize the average scores for each segment, rate and climate region.

The highest average ratings among all statements concerned ease of remembering the timing of the peak (7.3 to 8.1) and off-peak rate periods and the bill helps me understand the time of day when they are spending the most on electricity (6.9 to 7.7). Customers reported slightly lower average ratings for statements about the rate (6.2-7.5) and electricity bill (6.3 to 7.3) being easy to understand, recommending the rate to family/friends (5.8 to 7.5), the rate providing opportunities to save money (5.4 to 7.3), and wanting to stay on the rate after the study (5.5 to 7.2). Respondents reported the lowest average ratings to statements about the rate being fair (5.4 to 6.7), the new rate being better than the old rate (5.0 to 6.5), the rate working with their household schedule (5.0 to 6.6), and the rate being affordable (5.2 to 6.4). However, the differences between average ratings across the statements is about three points on an 11-point scale.

On average, customers in 15 of the 21 rate/segment/region groups reported significantly higher average agreement ratings concerning ease of understanding of the rate than customers on the OAT. Similarly, customers 12 of the 21 rate/segment/region groups reported significantly higher average agreement ratings than the control group indicating that the TOU rate gave them an opportunity to save money. However, 11 of the 21 groups had slightly lower average ratings than the corresponding control group for the statement, "the rate works with my household schedule."

One to two rate/segment/climate region groups reported significantly higher average agreement ratings indicating that their bill was easier to understand, they would recommend the rate to friends/family, and that the rate is fair compared with customers on the corresponding control groups. Similarly, one to three rate/segment/region groups had statistically significantly lower average agreement ratings on statements concerning wanting to stay on the rate after the study ends and the rate being affordable. For some of these statements, rate group customers had slightly higher ratings and for others they were slightly lower. In addition, low income customers reported higher average agreement ratings across most of the aspects of their rate plan compared to non-CARE/FERA customers.

Table 4.5-27: Average Level of Agreement with Aspects of the Rate Plan (Aspects 1-4)[1,2]

Climate Region	Segment	The peak and off peak times are easy to remember[3]			Bill helps me understand time of day when spending most[3]			Rate is easy to undertand				Bill is easy to understand			
		R1	R2	R3	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	8.1	7.6	7.7	7.2	7.2	7.1	6.2	7.1	6.9	7.0	6.5	6.6	6.5	6.4
	CARE/FERA	7.9	7.5	7.7	7.3	7.7	7.5	6.7	6.9	7.0	7.1	6.9	6.9	7.1	7.1
	Below 100% FPG	7.9	-	-	7.6	-	-	6.7	6.9	-	-	7.1	7.1	-	-
	100 to 200% FPG	7.9	-	-	7.3	-	-	6.4	7.0	-	-	6.6	6.9	-	-
	Senior	8.1	-	-	7.5	-	-	6.5	7.1	-	-	7.0	6.9	-	-
Moderate	Non-CARE/FERA	8.0	7.5	7.6	7.3	7.1	7.0	6.4	7.5	6.8	7.2	6.5	7.0	6.6	6.7
	CARE/FERA	7.9	7.5	7.7	7.5	7.6	7.5	6.7	7.0	6.9	7.4	7.1	7.2	7.1	7.3
Cool	Non-CARE/FERA	7.8	7.3	7.4	7.0	6.8	6.9	6.3	7.1	6.8	6.8	6.5	6.5	6.3	6.4
	CARE/FERA	7.8	7.4	7.6	7.7	7.5	7.4	6.5	7.1	7.1	7.1	6.8	7.2	7.2	7.0

[1] Agreement ratings are based on an 11-point scale where 0 means 'do not agree at all' and 10 means 'completely agree'.
[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.
[3] Asked only to Rate groups.

Table 4.5-28: Average Level of Agreement with Aspects of the Rate Plan (Aspects 5-7)[1,2]

Climate Region	Segment	Recommend rate to friends or family				Rate gave opp. to save money				Want to stay on rate after study ends			
		C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	5.8	6.1	5.8	5.8	5.4	6.1	6.1	6.1	5.9	5.8	5.5	5.8
	CARE/FERA	7.0	6.9	7.0	7.0	6.6	6.7	6.8	6.8	6.9	6.7	6.7	6.9
	Below 100% FPG	7.2	7.3	-	-	6.8	7.0	-	-	7.2	7.0	-	-
	100 to 200% FPG	6.5	6.4	-	-	6.2	6.4	-	-	6.7	6.2	-	-
	Senior	6.5	6.8	-	-	6.2	6.6	-	-	6.8	6.6	-	-
Moderate	Non-CARE/FERA	6.2	6.7	6.0	6.5	5.6	6.7	6.2	6.5	6.1	6.4	5.6	6.4
	CARE/FERA	7.4	7.3	7.4	7.6	6.8	7.1	7.1	7.3	7.4	7.2	7.2	7.3
Cool	Non-CARE/FERA	6.1	6.3	6.0	6.3	5.5	6.2	6.3	6.3	6.0	5.9	5.9	6.2
	CARE/FERA	7.1	7.5	7.3	7.3	6.6	7.1	6.9	7.0	7.1	7.1	7.0	7.1

[1] Agreement ratings are based on an 11-point scale where 0 means 'do not agree at all' and 10 means 'completely agree'.
[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Table 4.5-29: Average Level of Agreement with Aspects of the Rate Plan (Aspects 8-11)[1,2]

Climate Region	Segment	Rate is fair				New rate is better than old rate[3]			Rate works with HH schedule				Rate is affordable			
		C	R1	R2	R3	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	5.4	5.7	5.4	5.5	5.2	5.0	5.1	5.7	5.3	5.0	5.3	5.3	5.2	5.4	5.5
	CARE/FERA	6.2	6.2	6.3	6.1	5.9	6.1	6.1	6.6	5.8	5.9	6.0	6.0	5.9	6.3	6.1
	Below 100% FPG	6.4	6.5	-	-	6.3	-	-	6.5	6.2	-	-	6.0	6.1	-	-
	100 to 200% FPG	5.9	6.0	-	-	5.6	-	-	6.3	5.6	-	-	5.8	5.6	-	-
	Senior	6.0	6.1	-	-	5.9	-	-	6.5	6.3	-	-	5.9	5.9	-	-
Moderate	Non-CARE/FERA	5.9	6.2	5.8	6.0	5.8	5.2	5.4	5.9	5.5	5.3	5.6	5.8	6.0	5.4	5.7
	CARE/FERA	6.5	6.5	6.5	6.6	6.5	6.3	6.5	6.6	6.2	6.4	6.6	6.4	6.3	6.3	6.4
Cool	Non-CARE/FERA	6.0	5.9	5.8	5.8	5.2	5.2	5.4	5.8	5.5	5.3	5.6	6.0	5.6	5.6	5.8
	CARE/FERA	6.5	6.6	6.6	6.7	6.3	6.3	6.3	6.6	6.1	6.1	6.2	6.3	6.4	6.4	6.3

[1] Agreement ratings are based on an 11-point scale where 0 means 'do not agree at all' and 10 means 'completely agree'.
[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.
[3] Asked only to Rate groups.

Perception of Bill Amount

Respondents were asked to indicate how well the amount of their electricity bill aligned with their expectations since participating in the pilot. Respondents chose from the following options: higher than you expected; about the same as you expected; lower than you expected; or did not have any expectation.

Table 4.5-30 shows the percent of respondents reporting that their bill was higher than expected. Between 19% and 24% of control customers in the moderate and cool regions, and 27% to 40% of control customers in the hot region, reported that their bills were higher than expected. A significantly greater percent of TOU rate customers reported higher than expected bills. For example, 45% to 50% of non-CARE/FERA customers in the hot climate region reported higher than expected bills, compared to 37% of control group customers. Low income customers in the hot climate region on the TOU rates did not have statistically significantly higher percentages on this question compared with control customers, except for Rate 3 CARE/FERA customers. A greater percent of customers in the hot climate region reported higher than expected bills than in the moderate or cool regions. Within each climate region, non-CARE/FERA customers were the most likely to report their bills were higher than expected.

Table 4.5-30: Percentage of Respondents Reporting That Their Electricity Bills Since June 2016 Have Been Higher Than They Expected[1]

Climate Region	Segment	C	R1	R2	R3
Hot	Non-CARE/FERA	37%	45% ▲	50% ▲	50% ▲
	CARE/FERA	36%	40% ▲	40% ▲	44% ▲
	Below 100% FPG	40%	42% ▲	-	-
	100 to 200% FPG	34%	41% ▲	-	-
	Senior	27%	37% ▲	-	-
Moderate	Non-CARE/FERA	22%	36% ▲	42% ▲	37% ▲
	CARE/FERA	19%	31% ▲	24% ▲	29% ▲
Cool	Non-CARE/FERA	24%	38% ▲	40% ▲	38% ▲
	CARE/FERA	23%	31% ▲	34% ▲	27% ▲

[1] Chi-square used, grey shading indicates statistically significant difference versus Control group at p≤.05.

Reason for Rate Change

When asked why California utilities are changing rates, respondents overwhelmingly selected "to give customers an incentive to reduce electricity at times when use is high," and "to improve the reliability of the power grid and avoid power outages" (Table 4.5-31). Respondents chose other reasons less frequently. The least likely choice selected was "to help PG&E make more money." Generally, more Rate group participants selected "to improve reliability" as a reason than their corresponding Control group participants. While there are other significant differences between Rate and Control groups for other reasons selected, no meaningful trends emerged.

Table 4.5-31: Reasons for Why CA Utilities are Changing to TOU Rates[1]

Climate Region	Segment	Help customers save money on electricity bills				Improve reliability of the electricity power grid and avoid power outages				Better align the price customers pay for electricity to the actual cost to produce and deliver it				Help reduce the need to build new power plants			
		C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	56%	53%	52%	54%	86%	89%	87%	87%	57%	55%	56%	56%	54%	47%	45%	47%
	CARE/FERA	74%	68%	66%	72%	78%	85%	85%	82%	60%	59%	65%	64%	43%	46%	44%	48%
	Below 100% FPG	78%	71%	-	-	75%	80%	-	-	59%	61%	-	-	48%	47%	-	-
	100 to 200% FPG	65%	65%	-	-	75%	84%	-	-	59%	55%	-	-	41%	46%	-	-
	Senior	67%	63%	-	-	80%	88%	-	-	55%	57%	-	-	49%	46%	-	-
Moderate	Non-CARE/FERA	68%	55%	56%	53%	82%	88%	85%	88%	55%	60%	53%	60%	34%	53%	46%	51%
	CARE/FERA	80%	73%	75%	75%	79%	78%	80%	80%	72%	55%	64%	64%	45%	47%	52%	42%
Cool	Non-CARE/FERA	64%	47%	47%	52%	79%	85%	84%	87%	56%	57%	65%	64%	46%	49%	56%	47%
	CARE/FERA	72%	69%	72%	69%	66%	74%	83%	77%	61%	60%	68%	64%	49%	47%	50%	47%

Climate Region	Segment	Balance the electric grid due to the growing amount of renewable energy				Give customers an incentive to reduce use at times when electricity use is high				Help utility make more money				Help utility keep energy costs down			
		C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	58%	50%	49%	52%	86%	94%	94%	91%	36%	26%	28%	28%	60%	62%	62%	63%
	CARE/FERA	65%	55%	58%	58%	83%	88%	89%	88%	18%	19%	22%	23%	77%	66%	70%	71%
	Below 100% FPG	62%	59%	-	-	81%	87%	-	-	21%	17%	-	-	79%	71%	-	-
	100 to 200% FPG	66%	56%	-	-	85%	90%	-	-	27%	22%	-	-	70%	65%	-	-
	Senior	55%	52%	-	-	90%	94%	-	-	22%	21%	-	-	73%	71%	-	-
Moderate	Non-CARE/FERA	48%	55%	53%	53%	93%	93%	91%	94%	25%	24%	25%	23%	59%	65%	66%	62%
	CARE/FERA	64%	57%	57%	54%	83%	91%	88%	91%	13%	17%	19%	17%	74%	72%	73%	74%
Cool	Non-CARE/FERA	46%	48%	53%	53%	82%	94%	95%	95%	31%	28%	28%	27%	62%	61%	62%	60%
	CARE/FERA	49%	59%	61%	58%	87%	93%	89%	88%	25%	24%	21%	21%	73%	70%	72%	66%

[1] Chi-square used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

Frequency of Being Uncomfortably Hot in Home

Respondents reported how frequently they had been uncomfortably hot in their home this summer due to trying to save money on electricity bills. Respondents chose from the following options: never, rarely, sometimes, most of the time, or always. Table 4.5-32 shows the percent of customers that responded either most of the time or always (summarized as "most to all of the time").

Less than 30% of each segment on each Rate reported being uncomfortably hot most to all of the time. While some Rate groups reported being hot significantly more often than the Control group, other Rate groups reported being hot significantly *less* frequently than the Control group. In the hot climate region, for example, non-CARE/FERA customers on Rate 1 reported being uncomfortably hot significantly more often than non-CARE/FERA customers in the Control group. Conversely, non-CARE/FERA customers on Rate 1 in the moderate climate region reported significantly less frequency in heat-induced discomfort.

Overall, frequency of heat-induced discomfort was higher, on average, for customers in the hot climate region, followed by customers in the moderate and cool climate regions (which did not differ significantly from each other). CARE/FERA customers across all rates and control and Non-CARE/FERA customers in the cool climate region were the least likely to report frequent heat-induced discomfort. More CARE/FERA respondents reported being uncomfortably hot compared to non-CARE/FERA respondents.

Table 4.5-32: Percentage of Respondents Reporting Being Uncomfortably Hot 'Most to All of the Time' Since June 2016 Due to Trying to Save on Electricity Bills[1]

Climate Region	Segment	C	R1		R2		R3	
Hot	Non-CARE/FERA	15%	20%	▲	16%	▲	16%	▲
	CARE/FERA	24%	29%	▲	23%	▼	22%	▼
	Below 100% FPG	27%	28%	▲	-		-	
	100 to 200% FPG	22%	25%	▲	-		-	
	Senior	14%	17%	▲	-		-	
Moderate	Non-CARE/FERA	10%	6%	▼	8%	▼	7%	▼
	CARE/FERA	21%	24%	▲	21%	▲	20%	▼
Cool	Non-CARE/FERA	2%	1%	▼	3%	▲	3%	▲
	CARE/FERA	13%	13%	▼	8%	▼	12%	▼

[1] Z-test for proportions used, grey shading indicates statistically significant difference versus Control group at p≤.05.

Understanding How Rates Work

As a test to determine the extent to which respondents understood what influences the price of electricity on their rate, respondents were asked to identify which of five factors influence their electricity price. The correct answers varied among control and rate groups. The list of factors and the groups for whom the factors are correct included:

- Time of day: a correct answer for all Rate groups,
- Day of week (weekends vs. weekdays): a correct answer for Rate 1 & 3 groups,
- Seasons: a correct answer for all Rate groups,
- Weather or temperature: an incorrect answer for all Rate and Control groups, and
- Total amount of electricity used: a correct answer for all Rate and Control groups.

Table 4.5-33 reports the percentage of customers that selected over half of the correct answers for their rate plan. Overall, between 30% and 65% of customers understood over half of the factors that influence their electricity rate. Significantly fewer Rate 1 customers in all regions and Rate 3 CARE/FERA customers in the hot and moderate regions selected over half the correct answers compared to the Control groups. However, significantly more non-CARE/FERA customers in the moderate region selected over half the correct answers compared to the Control group. On average, respondents in the low-income segments were less likely to select over half the correct answer(s) compared to the corresponding non-CARE/FERA segments. In addition, fewer Rate 1 customers selected over half the correct answers compared to Rate 1 and 2 customers.

Table 4.5-33: Percentage of Respondents Who Selected Over Half of the Correct Factors that Influence the Price of Electricity on their Rate Plan[1,2]

Climate Region	Segment	% Selected Over Half the Correct Answers: C	R1		R2		R3	
Hot	Non-CARE/FERA	48%	40%	▼	53%	▲	53%	▲
	CARE/FERA	45%	33%	▼	50%	▲	38%	▼
	Below 100% FPG	42%	33%	▼				
	100 to 200% FPG	43%	32%	▼				
	Senior	46%	37%	▼				
Moderate	Non-CARE/FERA	47%	40%	▼	55%	▲	53%	▲
	CARE/FERA	43%	26%	▼	42%	▼	33%	▼
Cool	Non-CARE/FERA	50%	38%	▼	55%	▲	51%	▲
	CARE/FERA	38%	33%	▼	39%	▲	31%	▼

[1] Z-test for proportions used, grey shading indicates statistically significant difference versus Control group at p≤.05.

[2] Factors include: Time of day, day of week, season, weather/temperature, total amount of electricity used.

Rate group customers were also asked to select the hours of the day, from 12 AM to midnight, when electricity is most expensive on their rate plan. For Rates 1 & 3, the correct hours are 4 PM to 9 PM; for Rate 2, the correct hours are 6 PM to 9 PM.

Table 4.5-34 shows the percent of customers in each segment who, on average, got none of the hours correct and who got over half of the hours correct. As shown, between 30% and 64% of customers selected over half of the correct hours for their rate plan, which for most customers is slightly better than their understanding of the general factors that influence the price of their electricity (Table 4.5-34). A much lower percentage of customers, 7% to 34%, did not select any of the correct hours. On average, respondents in the low-income segments were most likely to not select any of the correct hours of the day when electricity is most expensive, compared to the corresponding non-CARE/FERA customers.

Table 4.5-34: Percentage of Respondents Who Selected None or Over Half of the Correct Times of the Day When the Price of Electricity is Most Expensive on their Rate Plan[1]

Climate Region	Segment	% Selected No Correct Answers R1	R2	R3	% Selected Over 50% Correct Answers R1	R2	R3
Hot	Non-CARE/FERA	8%	15%	10%	60%	58%	57%
	CARE/FERA	22%	30%	22%	38%	37%	39%
	Below 100% FPG	25%	-	-	35%	-	-
	100 to 200% FPG	18%	-	-	43%	-	-
	Senior	18%	-	-	42%	-	-
Moderate	Non-CARE/FERA	7%	13%	9%	62%	64%	65%
	CARE/FERA	25%	34%	18%	30%	34%	40%
Cool	Non-CARE/FERA	7%	14%	10%	63%	62%	60%
	CARE/FERA	20%	25%	18%	42%	45%	39%

[1] Asked only to Rate groups since Control group customers' rate does not vary by time of day.

Actions Taken

Customers were asked how frequently they took ten different actions in the afternoons and evenings to reduce or shift their electricity usage. Customers could choose always, usually, sometimes, rarely, never, or not applicable. Table 4.5-35 through Table 4.5-37 report the percentage of respondents who reported taking the actions 'often,' which is a combination of 'always' and 'usually'. Customers who reported 'not applicable' were excluded.

Overall, turning off lights not in use (80% to 92%), avoiding doing laundry (46% to 85%), avoiding running the dishwasher (36% to 87%), and turning off office equipment (33% to 68%) are the most common actions respondents reported taking to reduce electricity usage in the afternoons and evenings. Some customers also reported that they 'often' avoided running their pool/spa pump (16% to 78%), turned off air-conditioning (23% to 57%), and turned off entertainment equipment (23% to 52%).The least common actions reported by respondents are increasing their thermostat temperature (11% to 56%), pre-cooling their home (10% to 44%), and avoiding cooking (8% to 38%).

Nearly all Rate group customers (vs. Control group customers) and hot region customers (vs. moderate and cool region customers) reported more frequently taking most of the actions. However, trends and significant differences varied between rates/segments/regions and were mostly unique for each action, as follows:

- **Turned off lights not in use:** no significant differences were found between rate and control groups except significantly more Rate 1 CARE/FERA customers in the moderate region reported taking action (vs. Control group customers); on average, more CARE/FERA customers in the moderate and cool regions (vs. Non-CARE/FERA customers) and hot climate region customers (vs. customers in moderate and cool regions) reported taking action (Table 4.5-35).
- **Avoided doing laundry:** significantly more customers in 15 of the 21 Rate groups reported taking action (vs. Control group customers); on average, more Non-CARE/FERA and senior customers (vs. low-income customers) and hot climate region customers (vs. customers in moderate and cool regions) reported taking action (Table 4.5-35).

- **Avoided running the dishwasher:** significantly more customers in 19 of the 21 Rate groups reported taking action (vs. Control group customers); on average more Non-CARE/FERA and senior customers (vs. low-income customers), and hot climate region customers (vs. customers in moderate and cool regions) reported taking action (Table 4.5-35).

Table 4.5-35: Percentage of Respondents Who Reported Taking Actions 'Often' to Reduce or Shift Their Electricity Usage in the Afternoons and Evenings (Actions 1-3)[1,2]

Climate Region	Segment	Turned off lights				Avoided laundry				Avoided dishwasher			
		C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	90%	90% ▼	90% ▲	92% ▲	65%	83% ▲	81% ▲	86% ▲	66%	86% ▲	82% ▲	87% ▲
	CARE/FERA	88%	88% ▼	88% ▼	88% ▼	67%	72% ▲	70% ▲	69% ▲	63%	73% ▲	73% ▲	73% ▲
	Below 100% FPG	86%	86% ▼	-	-	65%	68% ▲	-	-	59%	66% ▲	-	-
	100 to 200% FPG	86%	89% ▲	-	-	65%	77% ▲	-	-	62%	78% ▲	-	-
	Senior	91%	90% ▼	-	-	72%	82% ▲	-	-	69%	81% ▲	-	-
Moderate	Non-CARE/FERA	86%	84% ▼	84% ▼	82% ▼	46%	76% ▲	72% ▲	73% ▲	44%	79% ▲	79% ▲	74% ▲
	CARE/FERA	85%	90% ▲	87% ▲	85% ▲	51%	71% ▲	66% ▲	70% ▲	57%	75% ▲	72% ▲	67% ▲
Cool	Non-CARE/FERA	80%	81% ▲	80% ▲	82% ▲	34%	64% ▲	68% ▲	62% ▲	36%	67% ▲	70% ▲	68% ▲
	CARE/FERA	85%	84% ▼	83% ▼	85% ▼	47%	62% ▲	56% ▲	56% ▲	41%	62% ▲	55% ▲	58% ▲

[1] Z-test for proportions used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

[2] Survey responses 'usually' and 'always' combined into 'often'; 'not applicable' responses are excluded.

- **Turned off office equipment:** no significant differences were found between rate and control groups, except more non-CARE/FERA Rate groups in the hot climate region and CARE/FERA Rate 1 customers in the moderate region reported taking action (vs. Control group customers); on average, more low-income customers (vs. Non-CARE/FERA and senior customers) and hot climate region customers (vs. customers in moderate and cool regions) reported taking action (Table 4.5-36).
- **Turned off entertainment equipment:** no significant differences were found between rate and control groups, except more non-CARE/FERA Rate 2 customers in the moderate region (vs. Control group customers); on average, more low-income groups reported taking action (vs. non-CARE/FERA and senior customers) (Table 4.5-36).
- **Avoided cooking:** significantly more customers in five of the nine Rate 1 segments reported taking action (vs. Control group customers); on average, more low-income and senior customers (vs. non-CARE/FERA customers), and more hot climate region customers, followed by moderate and cool region customers, respectively, reported taking action (Table 4.5-36).

Table 4.5-36: Percentage of Respondents Who Reported Taking Actions 'Often' to Reduce or Shift Their Electricity Usage in the Afternoons and Evenings (Actions 4-6)[1,2]

Climate Region	Segment	Turned off office equipment				Turned off entertainment equipment				Avoided cooking			
		C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	44%	48% ▲	53% ▲	51% ▲	26%	29% ▲	30% ▲	29% ▲	23%	31% ▲	24% ▲	28% ▲
	CARE/FERA	63%	63% ▼	62% ▼	58% ▼	48%	43% ▼	42% ▼	42% ▼	37%	36% ▼	37% ▲	38% ▲
	Below 100% FPG	63%	63% ▲	-	-	46%	46% ▼	-	-	38%	39% ▲	-	-
	100 to 200% FPG	56%	60% ▲	-	-	37%	37% ▼	-	-	33%	33% ▲	-	-
	Senior	52%	51% ▼	-	-	25%	25% ▲	-	-	33%	38% ▲	-	-
Moderate	Non-CARE/FERA	43%	42% ▼	40% ▼	42% ▼	32%	32% ▼	24% ▼	28% ▼	14%	18% ▲	16% ▲	17% ▲
	CARE/FERA	55%	68% ▲	60% ▲	60% ▲	48%	52% ▲	44% ▼	42% ▼	29%	38% ▲	36% ▲	29% ▼
Cool	Non-CARE/FERA	37%	33% ▼	34% ▼	33% ▼	28%	25% ▼	23% ▼	29% ▲	8%	13% ▲	9% ▲	12% ▲
	CARE/FERA	54%	48% ▼	56% ▲	51% ▼	40%	45% ▲	39% ▼	38% ▼	18%	27% ▲	24% ▲	25% ▲

[1] Chi-square used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

[2] Survey responses 'usually' and 'always' combined into 'often'; 'not applicable' responses are excluded.

- **Increased temperature on the thermostat:** no significant differences were found between rate and control groups, except significantly more customers in three of the 21 Rate groups reported taking action (vs. Control group customers); on average, more non-CARE/FERA customers (vs. low-income and senior customers), and hot climate region customers, followed by moderate and cool region customers, respectively, reported taking action (Table 4.5-37).
- **Turned off air-conditioning:** no significant differences were found between rate and control groups; on average, more CARE/FERA customers in the moderate and cool regions (vs. non-CARE/FERA customers), and hot and moderate region customers (vs. cool region customers) reported taking action (Table 4.5-37).
- **Pre-cooled home earlier in the day:** significantly more non-CARE/FERA and senior customers in the hot region and CARE/FERA customers in the moderate region reported taking action (vs. Control group customers); on average, more low-income customers (vs. non-CARE/FERA and senior customers), and hot region customers, followed by moderate region customers (vs. cool region customers) reported taking action (Table 4.5-37).
- **Avoided running pool or spa pump:** significantly more non-CARE/FERA and senior customers in the hot region and moderate region customers (except Rate 3 CARE/FERA customers) reported taking action (vs. Control group customers); on average, more hot and moderate climate region customers (vs. cool region customers) reported taking action (Table 4.5-37).

Table 4.5-37: Percentage of Respondents Who Reported Taking Actions 'Often' to Reduce or Shift Their Electricity Usage in the Afternoons and Evenings (Actions 7-10)[1,2]

Climate Region	Segment	Increased thermostat temp				Turned off air-conditioning				Pre-cooled home				Avoided pool/spa pump			
		C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	49%	52% ▲	53% ▲	56% ▲	39%	38% ▼	41% ▲	42% ▲	28%	36% ▲	34% ▲	41% ▲	52%	67% ▲	68% ▲	78% ▲
	CARE/FERA	38%	39% ▲	37% ▼	43% ▲	37%	37% ▼	43% ▲	40% ▲	43%	42% ▼	44% ▲	43% ▲	53%	53% ▲	57% ▲	51% ▼
	Below 100% FPG	31%	38% ▲	-	-	38%	39% ▲	-	-	41%	44% ▲	-	-	41%	49% ▲	-	-
	100 to 200% FPG	41%	41% ▲	-	-	36%	34% ▼	-	-	36%	41% ▲	-	-	46%	51% ▲	-	-
	Senior	40%	43% ▲	-	-	35%	38% ▲	-	-	31%	37% ▲	-	-	44%	60% ▲	-	-
Moderate	Non-CARE/FERA	26%	28% ▲	35% ▲	31% ▲	44%	46% ▲	51% ▲	51% ▲	24%	27% ▲	28% ▲	21% ▼	34%	67% ▲	58% ▲	58% ▲
	CARE/FERA	24%	26% ▲	26% ▲	26% ▲	52%	55% ▲	59% ▲	57% ▲	24%	36% ▲	34% ▲	31% ▲	32%	59% ▲	54% ▲	45% ▲
Cool	Non-CARE/FERA	10%	10% ▼	14% ▲	11% ▲	23%	28% ▲	25% ▲	27% ▲	10%	13% ▲	16% ▲	14% ▲	16%	24% ▲	39% ▲	29% ▲
	CARE/FERA	13%	15% ▲	18% ▲	12% ▼	37%	35% ▼	39% ▲	41% ▲	18%	26% ▲	23% ▲	24% ▲	24%	40% ▲	31% ▲	36% ▲

[1] Z-test for proportions used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

[2] Survey responses 'usually' and 'always' combined into 'often'; 'not applicable' responses are excluded.

Respondents had the option to provide a 'Not Applicable' (NA) response to all the actions taken questions. These NA responses can serve as a rough proxy measure of whether respondents have air conditioning, laundry or dishwashers in their home. While not a perfect measure of availability in the home, these responses indicate that, when compared to non-CARE/FERA households, more low income households (CARE/FERA and below 100% FPG) indicated NA for avoiding laundry use, avoiding dishwasher use, and turning off office equipment (Table 4.5-38). A similar proportion of CARE/FERA and non-CARE/FERA households indicated NA to their ability to turn off entertainment equipment, air conditioning actions, and avoiding using spa or pool-pump.

Table 4.5-38: Not Applicable Responses for Key Actions Taken by Segment

Climate Region	Segment	Avoided laundry	Avoided dishwasher	Turned off office equipment	Turned off entertainment equipment	Increased thermostat temp	Turned off air-conditioning	Pre-cooled home	Avoided pool/spa pump
Hot	Non-CARE/FERA	3%	14%	9%	5%	10%	7%	9%	72%
	CARE/FERA	10%	37%	21%	7%	12%	8%	11%	72%
	Below 100% FPG	13%	41%	24%	8%	14%	9%	12%	68%
	100 to 200% FPG	7%	30%	20%	6%	12%	8%	12%	76%
	Senior	5%	24%	20%	8%	12%	10%	13%	75%
Moderate	Non-CARE/FERA	6%	16%	8%	6%	29%	39%	43%	80%
	CARE/FERA	16%	37%	18%	10%	28%	37%	43%	75%
Cool	Non-CARE/FERA	12%	29%	8%	9%	48%	79%	81%	85%
	CARE/FERA	22%	50%	18%	11%	37%	63%	69%	77%

Overall, surveyed customers reported that taking actions to reduce or shift their electricity usage in the afternoons and evenings were somewhat easy (Table 4.5-39). On a scale of 0 to 10, where 0 means 'not at all easy' and 10 means 'extremely easy', customers reported an average rating between 5.9 and 6.7. Rate 1 non-CARE/FERA customers in the hot and moderate regions, and 100 to 200% FPG customers in the hot region reported significantly higher average ratings than the respective Control group customers. These differences, however, are substantively small (less than one point on an 11-point scale).

Table 4.5-39: Respondents' Average Level of Ease of Taking Energy Saving Actions in the Afternoons and Evenings[1,2]

Climate Region	Segment	C	R1		R2		R3	
		Ease of taking action						
Hot	Non-CARE/FERA	6.1	6.3	▲	5.9	▼	6.2	▲
	CARE/FERA	6.2	6.4	▲	6.2	▲	6.1	▼
	Below 100% FPG	6.1	6.4	▲	-		-	
	100 to 200% FPG	6.1	6.5	▲	-		-	
	Senior	6.7	6.8	▲	-		-	
Moderate	Non-CARE/FERA	6.0	6.5	▲	6.2	▲	6.3	▲
	CARE/FERA	6.5	6.6	▲	6.6	▲	6.7	▲
Cool	Non-CARE/FERA	6.2	6.2	▲	6.3	▲	6.3	▲
	CARE/FERA	6.8	6.9	▲	6.6	▼	6.5	▼

[1] Level of ease ratings are based on an 11-point scale where 0 means 'not at all easy' and 10 means 'extremely easy'.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Respondents were also asked which of 10 barriers keep them from reducing or shifting their electricity usage in the afternoons and evenings (Table 4.5-40 to Table 4.5-42).[71] Across the climate regions and segments, the most common barriers to reducing or shifting electricity usage during the afternoons and evenings reported by customers include the respondent being home most of the day (24% to 50%) and the household already using very little electricity (24% to 46%). The least common barriers reported by customers include working from home (5% to 20%) and presence of disabled household member(s) (1% to 13%).

There were few significant differences between rate and control groups for each barrier but there is some variation between rates/segments/regions. Trends were mostly unique for each barrier, as follows:

- **Respondent at home most of the day:** no significant differences were found between rate and control groups, except significantly fewer non-CARE/FERA Rate 1 and 2 customers in the moderate region and CARE/FERA Rate 3 customers in the cool region reported the barrier (vs. Control groups customers); on average, more low-income customers (vs. non-CARE/FERA customers) reported the barrier (Table 4.5-40).

[71] The original list of barriers includes 13 but three were excluded from the report. Two of these are not 'barriers' but provide respondents an answer option: 'nothing prevents customers from reducing/shifting usage' and 'customers can afford to use as much as they want or need'. The third barrier is very similar to one included in the analysis: 'customer doesn't know what actions to take' (very similar to 'customer can't think of anything else to do').

- **Household already uses little electricity:** significantly fewer non-CARE/FERA and senior Rate 1 customers, non-CARE/FERA Rate 2 customers in the moderate and cool regions, and CARE/FERA Rate 3 customers in the cool region reported the barrier (vs. Control group customers); on average, more low-income customers (vs. non-CARE/FERA customers) reported the barrier (Table 4.5-40).
- **Home gets uncomfortable:** no significant differences were found between rate and control groups; on average, more hot region customers, followed by moderate region customers (vs. cool region customers) reported the barrier (Table 4.5-40).

Table 4.5-40: Percentage of Respondents Who Reported Barriers to Reducing or Shifting Their Electricity Use During Afternoons and Evenings (Barriers 1-3)[1,2]

		I am at home most of the day				My household already uses very little electricity				My home gets uncomfortable if I try to reduce electricity usage			
Climate Region	Segment	C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	35%	33%	37%	38%	31%	24%	25%	24%	26%	29%	30%	29%
	CARE/FERA	36%	38%	39%	40%	32%	27%	33%	27%	26%	26%	25%	30%
	Below 100% FPG	43%	42%	-	-	32%	29%	-	-	27%	29%	-	-
	100 to 200% FPG	36%	39%	-	-	29%	27%	-	-	29%	27%	-	-
	Senior	50%	48%	-	-	33%	29%	-	-	22%	23%	-	-
Moderate	Non-CARE/FERA	34%	26%	25%	29%	35%	33%	29%	32%	16%	14%	12%	14%
	CARE/FERA	34%	32%	33%	31%	41%	42%	37%	36%	13%	16%	14%	13%
Cool	Non-CARE/FERA	29%	28%	24%	27%	40%	37%	34%	38%	4%	4%	4%	5%
	CARE/FERA	37%	34%	32%	30%	44%	39%	46%	36%	8%	8%	9%	6%

[1] Z-test for proportions used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

[2] Respondents could select more than one item, and respondents who selected all items or items mutually exclusive are excluded from the results.

- **Presence of elderly household member(s):** no significant differences were found between rate and control groups except significantly fewer customers in two cool region groups reported the barrier (vs. Control group customers); on average, more low-income and senior customers (vs. non-CARE/FERA customers), and more hot climate region customers (vs. moderate and cool region customers) reported the barrier (Table 4.5-41).
- **Schedule doesn't allow it:** significantly more CARE/FERA customers in the hot and cool regions and non-CARE/FERA Rate 2 customers reported the barrier (vs. Control group customers); on average, more non-CARE/FERA customers (vs. lower-income customers and seniors), and more moderate and cool climate region customers (vs. hot region customers) reported the barrier (Table 4.5-41).
- **Children in household:** no significant differences were found between rate and control groups except significantly more CARE/FERA Rate 3 customers in the hot region reported the barrier (vs. Control group customers); on average, more low-income customers (vs. seniors and non-CARE/FERA customers) reported the barrier (Table 4.5-41).

Table 4.5-41: Percentage of Respondents Who Reported Barriers to Reducing or Shifting Their Electricity Use During Afternoons and Evenings (Barriers 4-6)[1,2]

Climate Region	Segment	Elderly household member makes it difficult to change our routines				My schedule doesn't allow me to reduce my usage				Child(ren) in household make it difficult to change our routines			
		C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	11%	9%	10%	11%	12%	12%	17%	12%	12%	13%	14%	13%
	CARE/FERA	10%	10%	13%	13%	7%	12%	13%	13%	19%	21%	18%	24%
	Below 100% FPG	17%	16%	-	-	7%	9%	-	-	18%	18%	-	-
	100 to 200% FPG	14%	11%	-	-	9%	10%	-	-	14%	19%	-	-
	Senior	21%	21%	-	-	3%	4%	-	-	3%	4%	-	-
Moderate	Non-CARE/FERA	9%	8%	10%	11%	15%	18%	21%	16%	17%	16%	17%	17%
	CARE/FERA	10%	14%	13%	13%	9%	11%	10%	11%	15%	15%	15%	15%
Cool	Non-CARE/FERA	6%	6%	6%	7%	17%	22%	23%	22%	11%	13%	12%	13%
	CARE/FERA	12%	7%	12%	10%	11%	18%	18%	13%	12%	16%	16%	15%

[1] Z-test for proportions used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

[2] Respondents could select more than one item, and respondents who selected all items or items mutually exclusive are excluded from the results.

- **Old appliances use lots of energy:** no significant differences were found between rate and control groups except significantly more CARE/FERA Rate 1 customers in the moderate region reported the barrier (vs. Control group customers); on average, more low-income customers (vs. non-CARE/FERA customers and seniors) reported the barrier (Table 4.5-42).
- **Can't think of anything else to do:** no significant differences were found between rate and control groups except significantly fewer senior customers in the hot region reported the barrier (vs. Control group customers); on average, more low-income customers (vs. non-CARE/FERA customers) in the moderate and hot climate regions reported the barrier (Table 4.5-42).
- **Working from home:** no significant differences were found between rate and control groups except significantly more CARE/FERA Rate 3 customers in the hot region reported the barrier (vs. Control group customers); on average, more non-CARE/FERA customers (vs. low-income and senior customers), and more moderate and cool climate region customers (vs. hot region customers) reported the barrier (Table 4.5-42).
- **Presence of disabled household member(s):** no significant differences were found between rate and control groups except significantly more CARE/FERA Rate 1 customers in the moderate region reported the barrier (vs. Control group customers); on average, more low-income and senior customers (vs. non-CARE/FERA customers) reported the barrier (Table 4.5-42).

Table 4.5-42: Percentage of Respondents Who Reported Barriers to Reducing or Shifting Their Electricity Use During Afternoons and Evenings (Barriers 7-10)[1,2]

Climate Region	Segment	I have old appliances that use a lot of energy				I can't think of anything else to do				Working from home makes it difficult to use less electricity				Disabled household member makes it difficult to change our routines			
		C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	11%	10%	13%	11%	13%	10%	11%	13%	11%	11%	10%	12%	4%	4%	4%	4%
Hot	CARE/FERA	18%	16%	17%	18%	15%	13%	13%	14%	6%	8%	7%	9%	10%	11%	11%	12%
Hot	Below 100% FPG	20%	19%	-	-	14%	12%	-	-	5%	5%	-	-	13%	13%	-	-
Hot	100 to 200% FPG	15%	15%	-	-	17%	13%	-	-	8%	8%	-	-	8%	12%	-	-
Hot	Senior	12%	12%	-	-	14%	11%	-	-	5%	5%	-	-	8%	8%	-	-
Moderate	Non-CARE/FERA	9%	12%	8%	10%	12%	11%	15%	12%	18%	18%	17%	17%	3%	3%	2%	2%
Moderate	CARE/FERA	12%	18%	13%	13%	15%	16%	13%	15%	9%	6%	6%	8%	6%	12%	6%	8%
Cool	Non-CARE/FERA	11%	10%	11%	11%	15%	13%	14%	13%	17%	18%	18%	20%	2%	2%	1%	3%
Cool	CARE/FERA	15%	14%	18%	14%	15%	14%	12%	13%	10%	10%	10%	9%	8%	6%	9%	8%

[1] Z-test for proportions used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

[2] Respondents could select more than one item, and respondents who selected all items or items mutually exclusive are excluded from the results.

General Attitudes and Awareness towards EE and DR

Respondents rated their agreement with six statements designed to measure respondents' attitudes towards adopting energy saving behaviors using an 11-point scale with 0 meaning "do not agree at all" and 10 meaning "completely agree" (Table 4.5-43 and Table 4.5-44).[72] The statements were designed to capture respondents' intention to conserve, responsibility to conserve, concern about the environment, and concern about their electricity bill. All significant differences were small, with differences between Control and treatment group ratings less than a point on the 11-point rating scale.

PG&E respondents provided moderate ratings, 5.7 to 7.1, to the statement "I am very concerned about how my energy use affects the environment" (Table 4.5-43). When comparing responses between Control and Rate treatment groups, the CARE/FERA segment in the moderate climate region and non-CARE/FERA segments in the cool climate region had statistically significantly lower ratings than their Control groups. Overall, responses were consistent across segments and rates.

PG&E respondents provided low to moderate ratings, 1.0 to 6.1, to the statement "it is my responsibility to use as little energy as possible to help the environment" (Table 4.5-43). Ratings for non-CARE/FERA customers in these climate regions were extremely low on this issue, ranging from a low of 1.0 to a high of 1.8 on an 11-point scale. When comparing responses between Control and Rate treatment groups, non-CARE/FERA Rate 2 customers provided significantly lower ratings than Control group customers in the moderate and cool regions. Respondents in the CARE/FARE segments provided higher agreement ratings to the statement compared to those in the non-CARE/FERA segments. Additionally, respondents in the hot climate region provided slightly higher ratings to the statement compared to similar segments in the moderate and cool climate regions.

Table 4.5-43: Average Level of Agreement with Attitudinal Statements Related to Adopting Energy Saving Behaviors (Statements 1-2)[1]

		I am very concerned about how my energy use affects the environment				It is my responsibility to use as little energy as possible to help the environment			
Climate Region	**Segment**	**C**	**R1**	**R2**	**R3**	**C**	**R1**	**R2**	**R3**
Hot	Non-CARE/FERA	5.7	5.7	5.8	5.7	2.4	2.5	2.6	2.6
	CARE/FERA	6.2	6.3	6.2	6.4	5.4	5.5	4.9	5.7
	Below 100% FPG	6.3	6.4	-	-	5.9	6.1	-	-
	100 to 200% FPG	5.9	6.2	-	-	4.7	5.0	-	-
	Senior	5.9	6.0	-	-	3.1	3.2	-	-
Moderate	Non-CARE/FERA	6.3	6.1	6.5	6.0	1.8	1.6	1.5	1.7
	CARE/FERA	6.8	6.3	6.5	6.6	4.6	4.4	4.8	4.7
Cool	Non-CARE/FERA	7.1	6.5	6.7	6.7	1.4	1.3	1.0	1.5
	CARE/FERA	6.7	6.7	6.7	6.3	4.2	4.0	4.2	4.2

[1] Used t-test, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

[72] The first statement, "I often worry whether there is enough money to pay my electricity bill," was used in the economic index and is reported in section 4.5.1.

PG&E respondents provided moderate ratings, 5.1 to 6.6, to the statement "I feel guilty if I use too much energy" (Table 4.5-44). When comparing responses between Control and Rate treatment groups the CARE/FERA and non-CARE/FERA segments in the cool climate region rated their agreement lower than their Control groups.

PG&E respondents provided moderate to high ratings, 7.0 to 7.9, to the statement "I conserved electricity in my home this summer" (Table 4.5-44). When comparing responses between Control and Rate treatment groups, the non-CARE/FERA segments in the moderate and cool regions rated their agreement higher than their corresponding Control groups.

PG&E respondents provided moderate to high ratings, 7.1 to 8.5, to the statement "if my electricity bill goes up, I feel I must do something to reduce it" (Table 4.5-44). No significant differences in ratings were found between Control and Rate treatment groups. Respondents in the CARE/FARE segments provided slightly higher agreement ratings to the statement compared to those in the non-CARE/FERA segments.

Table 4.5-44: Average Level of Agreement with Attitudinal Statements Related to Adopting Energy Saving Behaviors (Statements 3-5)[1]

		I feel guilty if I use too much energy				I conserved electricity in my home this summer				If my electricity bill goes up, I feel I must do something to reduce it			
Climate Region	Segment	C	R1	R2	R3	C	R1	R2	R3	C	R1	R2	R3
Hot	Non-CARE/FERA	5.3	5.2	5.2	5.1	7.4	7.5	7.7	7.5	7.4	7.5	7.5	7.5
	CARE/FERA	5.9	6.0	5.8	6.1	7.3	7.4	7.6	7.5	8.2	8.2	8.1	8.4
	Below 100% FPG	6.1	6.4	-	-	7.3	7.5	-	-	8.4	8.5	-	-
	100 to 200% FPG	5.7	5.9	-	-	7.4	7.5	-	-	7.9	7.8	-	-
	Senior	5.4	5.6	-	-	7.6	7.9	-	-	7.6	7.5	-	-
Moderate	Non-CARE/FERA	5.9	5.7	6.1	5.7	7.1	7.3	7.6	7.5	7.3	7.2	7.3	7.4
	CARE/FERA	6.4	6.4	6.5	6.6	7.8	7.7	7.8	7.7	8.3	8.2	8.4	8.2
Cool	Non-CARE/FERA	6.4	5.9	5.7	6.1	7.0	7.3	7.3	7.4	7.1	7.1	7.1	7.2
	CARE/FERA	6.4	6.3	6.3	5.8	7.4	7.7	7.6	7.6	8.2	8.0	8.2	8.0

[1] Used t-test, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Demographic Characteristics

This section summarizes the responses to demographic characteristics questions contained in the survey and trends in differences between segments.[73]

Respondent Age (Table 4.5-45)

- Segments with the lowest mean age were: CARE/FERA and Below 100% FPG in the hot region and non-CARE/FERA in the moderate and cool regions.
- On average, cool and moderate climate segments tended to be younger than the hot climate segments across all Rate groups.
- Although the mean age was high for most groups in the hot region, the senior segment was much older than non-senior and other segments across all Rate groups, as would be expected.

[73] Trend analyses did not include tests for statistical significance and are based on observation of the differences in values.

Table 4.5-45: Respondents' Average Age[1]

Climate Region	Segment	Mean	Inter Quartile Range Percentile 25	Median	Percentile 75
Hot	Non-CARE/FERA	59	49	62	74
	CARE/FERA	54	39	54	67
	Below 100% FPG	55	41	57	69
	100 to 200% FPG	57	44	59	71
	Senior	73	68	73	79
Moderate	Non-CARE/FERA	55	43	56	67
	CARE/FERA	58	45	59	71
Cool	Non-CARE/FERA	55	43	56	68
	CARE/FERA	57	44	59	70

[1] Results are based on weighted averages across all four RCT groups (Control, Rate 1, Rate 2, and Rate 3)

Respondent Educational Attainment (Table 4.5-46)

- Some college or less was the most commonly reported levels of education for low income segments and some college or more was most common among non-CARE/FERA and senior segments.
- Respondents in the moderate and cool non-CARE/FERA segments were the most highly educated group, with around three-quarters reporting that they had a four-year or graduate/professional degree (72% and 77%, respectively).
- CARE/FERA customers were slightly over-representative of California households with a high school diploma or less (38%) while non-CARE/FERA customers were over-representative of Californians with a graduate degree (11%) (2015 ACS 5-year estimates).

Table 4.5-46: Respondents' Educational Attainment

Climate Region	Segment	Some HS	HS Diploma	Some College	Tech. College	Two-year Degree	Four-year Degree	Grad Degree
Hot	Non-CARE/FERA	1%	9%	21%	5%	10%	27%	27%
	CARE/FERA	17%	24%	25%	9%	9%	11%	7%
	Below 100% FPG	24%	26%	24%	7%	8%	7%	6%
	100 to 200% FPG	11%	20%	29%	8%	10%	14%	9%
	Senior	8%	17%	26%	6%	10%	16%	18%
Moderate	Non-CARE/FERA	1%	5%	13%	5%	6%	32%	39%
	CARE/FERA	14%	19%	21%	7%	10%	18%	11%
Cool	Non-CARE/FERA	1%	4%	12%	2%	5%	35%	42%
	CARE/FERA	16%	17%	22%	6%	8%	19%	13%

Annual Household Income (Table 4.5-47)

- Respondents in the CARE/FERA segments had lower annual household incomes compared to non-CARE/FERA and other segments.
- More than three-quarters of respondents in the Hot, Below 100% FPG segment, had an annual household income less than $21,000 per year.
- On average, most non-CARE/FERA segments made more than $50,000/year across all Rate groups. Conversely, nearly all CARE/FERA segments made less than $50,000/year across all Rate groups.

Table 4.5-47: Annual Household Income

Climate Region	Segment	Less than $12k	$12k to < $17k	$17k to < $21k	$21k to < $25k	$25k to < $29k	$29k to < $33k	$33k to < $37k	$37k to < $41k	$41k to < $50k	$50k to < $100k	$100k or more
Hot	Non-CARE/FERA	1%	2%	2%	2%	2%	5%	4%	5%	12%	38%	26%
	CARE/FERA	20%	18%	12%	13%	8%	9%	6%	4%	4%	5%	1%
	Below 100% FPG	43%	25%	12%	8%	4%	3%	1%	1%	1%	2%	1%
	100 to 200% FPG	5%	14%	13%	17%	10%	14%	8%	6%	7%	5%	1%
	Senior	9%	13%	9%	10%	7%	7%	5%	5%	9%	20%	9%
Moderate	Non-CARE/FERA	2%	1%	1%	2%	2%	3%	2%	3%	8%	31%	48%
	CARE/FERA	17%	16%	12%	13%	10%	9%	6%	4%	7%	6%	1%
Cool	Non-CARE/FERA	1%	1%	1%	2%	2%	3%	3%	3%	8%	32%	45%
	CARE/FERA	21%	18%	13%	13%	8%	8%	5%	4%	6%	5%	1%

Respondent Employment Status (Table 4.5-48)

- Most surveyed customers were either employed full or part time, or were retired.
- Non-CARE/FERA customers in the moderate and cool climate regions were most likely to be employed full-time.
- Low-income segments were more likely be unemployed or unable to work due to a disability compared to non-CARE/FERA segments.

Table 4.5-48: Respondents' Employment Status[1]

Climate Region	Segment	Employed full-time	Employed part-time	Home-maker	Retired	Can't work (disability)	Other[2]
Hot	Non-CARE/FERA	41%	10%	5%	45%	4%	7%
	CARE/FERA	28%	15%	12%	30%	18%	24%
	Below 100% FPG	16%	16%	15%	36%	25%	30%
	100 to 200% FPG	30%	13%	8%	41%	13%	16%
	Senior	9%	8%	6%	81%	11%	7%
Moderate	Non-CARE/FERA	54%	10%	6%	30%	3%	7%
	CARE/FERA	30%	16%	9%	37%	15%	16%
Cool	Non-CARE/FERA	53%	12%	5%	31%	2%	8%
	CARE/FERA	26%	19%	8%	35%	18%	19%

[1] Allows for multiple responses, rows may not add to 100%.

[2] Includes respondents who reported being seasonally employed, unemployed but looking for work, unemployed but not looking for work, and students.

Major Life Changes during the Past Summer (Table 4.5-49)

- A majority of surveyed customers across all Rate groups and TOU segments reported not experiencing any of eight “life changes” over the past summer.
- However, customers in the CARE/FERA segments were more likely to report having experienced one of the eight “life changes” items on the survey when compared to the corresponding non-CARE/FERA segments.
- Low-income customers were more likely to report having lost a job or became unemployed, had work hours or pay reduced, or became disabled or seriously ill compared to all other segments.
- Very few respondents reported having received a foreclosure or eviction notice, got divorced, had a baby, or had a death of a household member compared to other “life changes” items.

Table 4.5-49: Life Changes During the Past Summer

Climate Region	Segment	Became unemployed	Hours or pay reduced	Became disabled or seriously ill	Cared for elderly or disabled	Had a death in household	Divorced or separated	Had a baby	Got foreclosure or eviction	None of the above
Hot	Non-CARE/FERA	7%	8%	6%	7%	2%	2%	2%	0%	73%
	CARE/FERA	16%	16%	12%	10%	4%	5%	4%	2%	51%
	Below 100% FPG	18%	16%	15%	10%	5%	6%	4%	2%	49%
	100 to 200% FPG	13%	15%	11%	10%	4%	3%	3%	2%	56%
	Senior	5%	4%	10%	10%	4%	2%	1%	1%	71%
Moderate	CARE/FERA	12%	14%	12%	10%	4%	4%	3%	1%	56%
	Non-CARE/FERA	8%	7%	4%	5%	2%	1%	3%	0%	76%
Cool	CARE/FERA	10%	14%	11%	8%	4%	4%	3%	2%	60%
	Non-CARE/FERA	7%	8%	4%	6%	2%	1%	3%	0%	76%

Households with Members Who Are Disabled (Table 4.5-50)

- Few respondents reported a household member who receives disability payments or has a serious medical condition.
- A higher proportion of respondents reported a household member having a serious disability than reported a member receiving disability payments.
- CARE/FERA and low-income segments were more likely to report a household member with a serious disability or who received disability payments than non-CARE/FERA customers across all three climate regions.
- Respondents with incomes below 100% of FPG in the hot climate region were most likely to report a household member having received disability payments.
- Respondents in the low income and senior segments in the hot climate region were most likely to report a household member having a serious disability.

Table 4.5-50: Household Member(s) with Serious Medical Condition and/or Disability Payments

Climate Region	Segment	Has serious medical condition	Receives disability payments
Hot	Non-CARE/FERA	18%	7%
	CARE/FERA	28%	22%
	Below 100% FPG	29%	26%
	100 to 200% FPG	27%	17%
	Senior	28%	12%
Moderate	Non-CARE/FERA	11%	5%
	CARE/FERA	24%	17%
Cool	Non-CARE/FERA	12%	4%
	CARE/FERA	25%	19%

Disability Requirements (Table 4.5-51)

- The most commonly reported disability requirement was the need for someone in the household to stay home for most the day, followed by the need to cool the home in the summer; very few (3%-9%) surveyed customers noted they needed to use more energy for medical equipment for disabled household members.
- CARE/FERA and low-income segments were most likely to report having disability requirements across all three climate regions.
- Respondents in the Below 100% FPG segment in the hot climate region were most likely to state they need their home to be cooled in the summer, and also reported they use electricity for medical equipment and have a member of the household who needs to stay home for most the day.

Table 4.5-51: Requirements for Households with Disabled Residents

Climate Region	Segment	Need home cooled in the summer	Need more energy for medical equip	Need to be home most of the day
Hot	Non-CARE/FERA	12%	4%	19%
	CARE/FERA	25%	7%	32%
	Below 100% FPG	28%	9%	38%
	100 to 200% FPG	23%	6%	29%
	Senior	21%	5%	29%
Moderate	Non-CARE/FERA	7%	3%	15%
	CARE/FERA	18%	6%	32%
Cool	Non-CARE/FERA	3%	3%	11%
	CARE/FERA	14%	5%	28%

Household Size (Table 4.5-52)

- On average, most surveyed customers reported a household size of around three people across all segments and climate regions.
- Respondents in the Below 100% FPG segment in the hot climate region reported the largest household size of 3.4 and an inter-quartile range from 2 to 5.
- Seniors reported having the fewest average number of people living in their home (2.4 people).

Table 4.5-52: Household Size[1]

Climate Region	Segment	Mean	Inter Quartile Range: Percentile 25	Inter Quartile Range: Median	Inter Quartile Range: Percentile 75
Hot	Non-CARE/FERA	2.9	2	3	4
	CARE/FERA	3.4	2	3	5
	Below 100% FPG	3.4	2	3	5
	100% to 200% FPG	3.2	2	3	4
	Senior	2.4	2	2	3
Moderate	Non-CARE/FERA	3.1	2	3	4
	CARE/FERA	3.2	2	3	5
Cool	Non-CARE/FERA	2.8	2	3	3
	CARE/FERA	3.0	1	2	4

[1] Results are based on weighted averages across all four RCT groups (Control, Rate 1, Rate 2, and Rate 3).

Respondent Race & Ethnicity (Table 4.5-53)

- Respondents were most to least likely to report being White, Hispanic, Other, Asian, and African American, respectively.
- CARE/FERA and low-income segments were more likely to report being non-white.
- There were fewer Asian respondents in the hot climate region compared to the moderate and cool climate regions.

Table 4.5-53: Respondents' Race and Ethnicity[1]

Climate Region	Segment	Asian	African American	Hispanic	White	Other[2]
Hot	Non-CARE/FERA	8%	3%	10%	79%	8%
	CARE/FERA	7%	8%	34%	50%	11%
	Below 100% FPG	8%	10%	38%	45%	12%
	100 to 200% FPG	7%	6%	26%	60%	11%
	Senior	5%	4%	12%	77%	8%
Moderate	Non-CARE/FERA	29%	3%	8%	62%	7%
	CARE/FERA	29%	7%	24%	37%	13%
Cool	Non-CARE/FERA	21%	4%	8%	71%	9%
	CARE/FERA	24%	12%	23%	42%	11%

[1] Allows for multiple responses, may not add up to 100%.

[2] Includes American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, Middle Eastern or North African, and Other.

Household Characteristics

This section summarizes the responses to household characteristics questions contained in the survey and trends in differences between segments.[74]

Times Home Is Occupied On Weekends & Weekdays (Table 4.5-54)

- Nearly all surveyed customers reported that there was someone home during the evening and night throughout the week.
- Fewer respondents reported their home being occupied in the mornings and afternoons, on both the weekends and weekdays, compared to evening and nights.
- Morning and afternoon occupancy is higher on weekends than on weekdays.
- Cool climate region customers reported the lowest level of occupancy throughout the morning and afternoons compared to moderate or hot region customers.

Table 4.5-54: Times of the Day When Home is Occupied on Weekdays and Weekends During the Summer Months

Climate Region	Segment	Weekday				Weekend			
		Morning	Afternoon	Evening	Night	Morning	Afternoon	Evening	Night
Hot	Non-CARE/FERA	86%	83%	97%	99%	96%	94%	97%	99%
	CARE/FERA	88%	87%	97%	98%	96%	93%	95%	97%
	Below 100% FPG	90%	91%	97%	99%	96%	93%	96%	98%
	100 to 200% FPG	89%	87%	96%	98%	96%	94%	95%	97%
	Senior	94%	93%	98%	99%	96%	94%	97%	99%
Moderate	Non-CARE/FERA	84%	78%	96%	99%	97%	93%	97%	99%
	CARE/FERA	86%	86%	96%	98%	95%	90%	95%	98%
Cool	Non-CARE/FERA	81%	72%	96%	99%	96%	88%	95%	98%
	CARE/FERA	84%	80%	96%	98%	93%	88%	94%	96%

[74] Trend analyses did not include tests for statistical significance and are based on observation of the differences in values.

Own or Rent Home (Table 4.5-55)

- Most non-CARE/FERA and senior customers reported owning their home, while CARE/FERA and low-income customers were most likely to report renting their home and receiving subsidized housing assistance, such as Section 8.
- On average, hot climate region customers were more likely to report owning their home compared to customers in the moderate or cool climate regions.

Table 4.5-55: Home Ownership Status

Climate Region	Segment	Own	Rent without	Rent with subsidies
Hot	Non-CARE/FERA	83%	16%	0%
	CARE/FERA	47%	42%	11%
	Below 100% FPG	40%	42%	20%
	100 to 200% FPG	59%	36%	5%
	Senior	78%	16%	6%
Moderate	Non-CARE/FERA	79%	21%	1%
	CARE/FERA	44%	38%	19%
Cool	Non-CARE/FERA	70%	29%	1%
	CARE/FERA	37%	43%	20%

Type of Housing (Table 4.5-56)

- Most surveyed customers reported living in a single-family detached home, followed by apartments or condos.
- On average, customers in moderate and cool climate regions were more likely to report living in an apartment or condo compared to those in the hot region, while hot region customers were more likely to live in a manufactured or mobile home compared to moderate and cool region customers.
- CARE/FERA and low-income customers were less likely to report living in a single-family detached home across all climate regions compared to non-CARE/FERA customers.

Table 4.5-56: Housing Type

Climate Region	Segment	Single-Family Detached	2- to 4- plex	Apt or condo	Town-home	Man. or mobile home, or mobile unit
Hot	Non-CARE/FERA	84%	3%	7%	1%	4%
	CARE/FERA	55%	8%	25%	4%	9%
	Below 100% FPG	48%	8%	30%	4%	11%
	100 to 200% FPG	62%	6%	19%	2%	11%
	Senior	72%	4%	13%	1%	10%
Moderate	Non-CARE/FERA	66%	4%	20%	9%	1%
	CARE/FERA	42%	8%	41%	6%	3%
Cool	Non-CARE/FERA	59%	9%	27%	4%	1%
	CARE/FERA	39%	11%	45%	5%	2%

Number of Bedrooms in Home (Table 4.5-57)

- On average, most surveyed customers across all segments reported having two to three bedrooms in their home.
- Very few respondents across all segments reported having five or more bedrooms or living in a studio.
- CARE/FERA and low-income customers were more likely to report having fewer bedrooms in their home compared to non-CARE/FERA customers.

Table 4.5-57: Number of Bedrooms in Home

Climate	Segment	Studio	One	Two	Three	Four	Five +
Hot	Non-CARE/FERA	1%	4%	22%	48%	21%	4%
	CARE/FERA	1%	13%	37%	37%	10%	2%
	Below 100% FPG	1%	19%	37%	33%	8%	2%
	100 to 200% FPG	1%	10%	37%	40%	11%	2%
	Senior	0%	10%	33%	43%	12%	2%
Moderate	Non-CARE/FERA	1%	9%	21%	40%	25%	5%
	CARE/FERA	3%	22%	34%	30%	11%	2%
Cool	Non-CARE/FERA	3%	14%	31%	37%	12%	2%
	CARE/FERA	7%	26%	36%	25%	6%	1%

Cooling Equipment in Home (Table 4.5-58)

- A large majority of surveyed customers in the hot and moderate regions reported having ceiling or portable fans in their home.
- Hot climate region customers were more likely to report having central air-conditioning or a room air-conditioning unit in their home and report using it more frequently, as compared to cool or moderate climate region segments.
- More CARE/FERA customers reported having a room air conditioning unit or evaporative/swamp cooler and fewer reported central air conditioning, heat pumps, or fans compared to non-CARE/FERA customers.
- Very few respondents reported having a heat pump in their home, and of those who did, around three-quarters reported never using it.

Table 4.5-58: Cooling Equipment in Home and Frequency of Use[1]

Item	Install & Use	Hot					Moderate		Cool	
		Non-CARE/FERA	CARE/FERA	Below 100% FPG	100 to 200% FPG	Senior	Non-CARE/FERA	CARE/FERA	Non-CARE/FERA	CARE/FERA
Central air-conditioning	Have in home	85%	68%	61%	71%	76%	49%	32%	6%	8%
	Daily	46%	42%	42%	41%	42%	14%	11%	6%	2%
	Several days a week	26%	27%	24%	28%	27%	26%	19%	6%	7%
	Several days a month	20%	17%	17%	17%	21%	40%	28%	22%	10%
	Never	7%	14%	18%	13%	11%	22%	43%	68%	83%
Room air conditioning unit	Have in home	13%	29%	35%	26%	19%	16%	27%	5%	7%
	Daily	22%	29%	34%	28%	21%	8%	14%	4%	10%
	Several days a week	16%	21%	21%	20%	19%	18%	22%	13%	14%
	Several days a month	14%	14%	14%	14%	16%	31%	26%	24%	13%
	Never	48%	35%	32%	37%	44%	45%	42%	66%	69%
Evaporative or swamp cooler	Have in home	10%	22%	27%	21%	20%	3%	7%	1%	3%
	Daily	26%	34%	36%	35%	34%	7%	8%	5%	4%
	Several days a week	11%	15%	18%	13%	17%	7%	12%	6%	5%
	Several days a month	9%	8%	9%	10%	9%	12%	12%	10%	9%
	Never	55%	44%	39%	42%	40%	80%	71%	85%	84%
Heat pump	Have in home	8%	5%	5%	5%	8%	6%	6%	4%	5%
	Daily	10%	9%	13%	7%	12%	7%	3%	8%	5%
	Several days a week	8%	6%	8%	7%	9%	9%	5%	7%	7%
	Several days a month	11%	5%	6%	6%	10%	13%	11%	15%	11%
	Never	72%	81%	77%	80%	71%	76%	82%	73%	79%
Ceiling or portable fans	Have in home	92%	81%	76%	86%	90%	75%	68%	56%	52%
	Daily	69%	62%	59%	64%	64%	39%	35%	20%	23%
	Several days a week	20%	22%	23%	21%	22%	27%	27%	20%	23%
	Several days a month	8%	10%	11%	10%	11%	26%	27%	42%	34%
	Never	3%	7%	8%	5%	3%	8%	12%	18%	22%

[1] Allows for multiple responses, columns may not add to 100%.

Thermostat for Heating and/or Cooling (Table 4.5-59)

- Hot climate region customers were more likely to report having a thermostat for both heating *and* cooling compared to cool or moderate climate region segments.
- Low-income and senior customers were more likely to report having a thermostat for heating only or not having a thermostat in their home compared to non-CARE/FERA customers.
- Very few respondents reported having a thermostat for cooling only.

Table 4.5-59: Thermostat in Home for Heating and/or Cooling

Climate Region	Segment	Thermostat for heating only	Thermostat for cooling only	Thermostat for both heating & cooling	No thermostat
Hot	Non-CARE/FERA	10%	1%	83%	6%
	CARE/FERA	18%	2%	62%	16%
	Below 100% FPG	22%	3%	54%	21%
	100 to 200% FPG	18%	2%	67%	13%
	Senior	15%	2%	73%	10%
Moderate	Non-CARE/FERA	44%	1%	48%	8%
	CARE/FERA	48%	2%	30%	20%
Cool	Non-CARE/FERA	78%	0%	7%	15%
	CARE/FERA	67%	1%	7%	26%

Thermostat Type (Table 4.5-60)

- Low-income customers were more likely to report having a standard thermostat in their home compared to non-CARE/FERA customers.
- Non-CARE/FERA customers were most likely to have a programmable or smart thermostat in their home.

Table 4.5-60: Thermostat Type in Home

Climate Region	Segment	A standard thermostat	A programmable thermostat	A smart thermostat
Hot	Non-CARE/FERA	35%	60%	5%
	CARE/FERA	58%	39%	3%
	Below 100% FPG	64%	35%	2%
	100 to 200% FPG	58%	40%	2%
	Senior	48%	49%	3%
Moderate	Non-CARE/FERA	39%	55%	7%
	CARE/FERA	69%	30%	2%
Cool	Non-CARE/FERA	53%	42%	5%
	CARE/FERA	77%	23%	1%

Thermostat Temperature Settings (Table 4.5-61)

- Cool and moderate climate region customers were more likely to report turning their thermostat to "off" in the late afternoon and evenings during the summer compared to customers in the hot region.
- Low-income customers were more likely to report setting their thermostat to "off" or setting it to a lower temperature compared to non-CARE/FERA customers.
- There was very little variation between customers' reported thermostat settings on weekdays versus weekends.

Table 4.5-61: Thermostat Settings in Late Afternoons and Evenings on Weekdays and Weekends During Summer Months

		Hot					Moderate		Cool	
Weekday / Weekend	Temperature	Non-CARE/FERA	CARE/FERA	Below 100% FPG	100 to 200% FPG	Senior	Non-CARE/FERA	CARE/FERA	Non-CARE/FERA	CARE/FERA
Weekday	Off	8%	12%	12%	12%	10%	20%	37%	50%	63%
	Below 68 F	2%	5%	7%	6%	4%	5%	11%	13%	19%
	69 F to 71 F	7%	12%	15%	11%	9%	11%	16%	15%	11%
	72 F to 74 F	13%	18%	18%	17%	14%	21%	15%	12%	7%
	75 F to 77 F	21%	19%	20%	19%	18%	20%	13%	9%	2%
	78 F to 80 F	37%	29%	25%	31%	35%	18%	9%	5%	3%
	81 F or higher	12%	6%	6%	6%	10%	6%	3%	2%	1%
Weekend	Off	7%	12%	14%	12%	11%	19%	38%	50%	62%
	Below 68 F	2%	5%	7%	5%	4%	4%	11%	14%	19%
	69 F to 71 F	7%	12%	14%	10%	9%	12%	16%	16%	12%
	72 F to 74 F	14%	18%	17%	18%	13%	22%	13%	10%	8%
	75 F to 77 F	23%	21%	22%	20%	19%	20%	13%	11%	3%
	78 F to 80 F	36%	27%	24%	30%	35%	18%	9%	5%	2%
	81 F or higher	11%	6%	6%	5%	9%	6%	3%	2%	1%

Smart Thermostats

In the web version of the survey, customers who reported having a smart thermostat installed in their home were asked about their overall satisfaction and their level of agreement with four statements regarding their smart thermostat. Due to small sample sizes, in this section only findings for non-CARE/FERA PG&E customers in the hot climate region for the Control and Rate 1 groups are presented.[75]

Few surveyed customers reported having a smart thermostat installed in their home (5% for both the Control and Rate 1 treatment group – See Table 4.5-61). Customers in the Control and Rate 1 groups who reported having a smart thermostat provided high satisfaction ratings with their smart thermostat (providing an average rating of 7.9 and 8.6 on an 11-point scale, with 0 meaning "not satisfied at all" and 10 meaning "extremely satisfied," respectively; not shown in table). Customers rated their level of agreement with four statements regarding aspects of their smart thermostat using an 11-point scale, with 0 meaning "do not agree at all" and 10 meaning "completely agree." On average, customers provided highest agreement ratings to the statement "[my thermostat] is easy to use" and the lowest agreement ratings to the statements "[my thermostat] helps me lower my electricity bill" and "my thermostat has helped me manage my electricity use during this study" (Table 4.5-62). Agreement ratings did not differ significantly between the Control and Rate 1 groups.

Table 4.5-62: Respondents' Average Level of Agreement with Aspects of Their Smart Thermostat [1,2]

Statement	Control (n=44)	Rate 1 (n=42)
Easy to use	7.5	8.2
Helps keep home at a comfortable temperature	6.0	7.8
Helps lower electricity bill	6.0	6.2
Helped manage electricity use during study	5.6	6.8

[1] Agreement ratings are based on an 11-point scale where 0 means 'do not agree at all' and 10 means 'completely agree'.

[2] Asked to web survey respondents in the Control and Rate 1 groups who reported having a smart thermostat; Rate 2 and 3 groups not asked.

[75] For this analysis, any segments or Rate treatment groups where sample sizes were too small to draw inferences (40 or fewer respondents) were excluded.

Newsletters and Websites

Nearly all web survey respondents (between 85% and 95%) reported receiving the TOU study welcome packet (Table 4.5-63). Slightly fewer respondents reported receiving the summer newsletter (between 78% and 88%) and between one-half and two-thirds (51% to 66%) reported receiving the fall newsletter. Overall, fewer respondents in the CARE/FERA segments reported receiving TOU study information compared to those in the non-CARE/FERA segments.

Table 4.5-63: Percentage of Respondents Who Received TOU Study Information[1]

Climate Region	Segment	Welcome packet R1	Welcome packet R2	Welcome packet R3	Summer newsletter R1	Summer newsletter R2	Summer newsletter R3	Fall newsletter R1	Fall newsletter R2	Fall newsletter R3
Hot	Non-CARE/FERA	93%	94%	95%	86%	88%	87%	58%	66%	61%
	CARE/FERA	89%	91%	87%	84%	84%	83%	58%	63%	54%
	Below 100% FPG	87%	90%	85%	84%	83%	79%	61%	62%	57%
	100% to 200% FPG	89%	91%	91%	84%	84%	86%	55%	63%	54%
	Senior	91%	94%	92%	85%	88%	86%	57%	64%	59%
Moderate	Non-CARE/FERA	94%	95%	94%	85%	84%	80%	51%	58%	57%
	CARE/FERA	86%	85%	87%	79%	80%	81%	51%	53%	59%
Cool	Non-CARE/FERA	94%	94%	94%	80%	83%	85%	54%	55%	59%
	CARE/FERA	86%	85%	87%	78%	80%	79%	53%	58%	56%

[1] Asked to web survey respondents in the Rate groups; Control group not asked.

Respondents who reported receiving the TOU study welcome packet or the summer/fall newsletters found the informational materials to be moderately useful (using a 11-point scale with 0 meaning "not useful at all" and 10 meaning "extremely useful";" Table 4.5-64). Respondents in the non-CARE/FARE segments found informational materials slightly less useful compared to those in the CARE/FERA segments. Usefulness ratings did not vary substantially between Rate treatment groups.

Table 4.5-64: Average Usefulness Rating for TOU Study Information[1,2]

Climate Region	Segment	Welcome packet R1	Welcome packet R2	Welcome packet R3	Summer newsletter R1	Summer newsletter R2	Summer newsletter R3	Fall newsletter R1	Fall newsletter R2	Fall newsletter R3
Hot	Non-CARE/FERA	6.7	6.9	7.1	6.1	6.3	6.5	6.1	6.5	6.6
	CARE/FERA	7.2	7.0	7.4	7.0	6.9	7.2	6.9	7.1	7.3
	Below 100% FPG	7.3	7.1	7.1	7.1	6.8	7.3	6.8	6.8	7.3
	100% to 200% FPG	7.1	7.1	7.5	6.8	6.9	7.2	7.1	7.2	7.3
	Senior	6.9	7.0	7.3	6.5	6.5	6.8	6.5	6.8	7.1
Moderate	Non-CARE/FERA	7.1	7.0	7.2	6.4	6.5	6.7	6.4	6.5	6.6
	CARE/FERA	7.3	7.6	7.7	7.3	7.6	7.3	7.2	7.8	7.3
Cool	Non-CARE/FERA	6.6	6.8	7.1	6.0	6.1	6.4	5.9	7.0	6.7
	CARE/FERA	7.3	7.1	7.3	6.9	6.7	7.0	7.0	6.8	7.0

[1] Usefulness ratings are based on an 11-point scale where 0 means 'not at all useful' and 10 means 'extremely useful'.

[2] Asked to web survey respondents in the Rate groups who reported receiving each item; Control group not asked.

Between 35% and 54% of web survey respondents reported visiting the PG&E My Account website since summer of 2016 (Table 4.5-65). Substantially fewer PG&E respondents reported visiting the rate plan study website since summer 2016 (between 12% and 23%). Overall, responses did not differ substantially between respondent segment or Rate treatment group.

Table 4.5-65: Percentage of Respondents Who Visited IOU and TOU Study Websites[1]

Climate Region	Segment	PG&E My Account website R1	R2	R3	Rate plan study website R1	R2	R3
Hot	Non-CARE/FERA	42%	45%	42%	13%	14%	15%
	CARE/FERA	46%	54%	50%	14%	19%	18%
	Below 100% FPG	49%	49%	50%	16%	16%	17%
	100% to 200% FPG	43%	53%	47%	14%	17%	18%
	Senior	35%	37%	35%	12%	13%	12%
Moderate	Non-CARE/FERA	49%	47%	43%	16%	13%	14%
	CARE/FERA	48%	43%	52%	14%	18%	18%
Cool	Non-CARE/FERA	43%	42%	46%	12%	15%	13%
	CARE/FERA	45%	47%	41%	16%	17%	23%

[1] Asked to web survey respondents in the Rate groups; Control group not asked.

Respondents who reported visiting the PG&E My Account website or the TOU rate plan study website found the websites to be moderately useful (using an 11-point scale with 0 meaning "not useful at all" and 10 meaning "extremely useful";" Table 4.5-66). Respondents in the non-CARE/FARE segments found the websites slightly less useful compared to those in the CARE/FERA segments. Usefulness ratings did not vary substantially between website type or rate groups.

Table 4.5-66: Average Usefulness Rating for IOU and TOU Study Websites[1,2]

Climate Region	Segment	PG&E My Account website R1	R2	R3	Rate plan study website R1	R2	R3
Hot	Non-CARE/FERA	7.0	6.9	7.3	6.4	6.4	6.3
	CARE/FERA	7.2	7.1	7.4	7.1	7.2	7.3
	Below 100% FPG	6.9	6.9	7.5	6.4	8.0	7.4
	100% to 200% FPG	7.6	7.1	7.5	7.8	6.7	7.6
	Senior	7.1	7.2	7.5	6.6	6.8	6.7
Moderate	Non-CARE/FERA	7.2	7.0	7.1	6.9	7.1	7.0
	CARE/FERA	7.7	7.8	7.4	7.2	8.0	7.7
Cool	Non-CARE/FERA	6.7	6.6	6.6	6.3	6.1	6.9
	CARE/FERA	7.3	7.2	7.4	7.0	7.1	6.5

[1] Usefulness ratings are based on an 11-point scale where 0 means 'not at all useful and 10 means 'extremely useful'.

[2] Asked to web survey respondents in the Rate groups who reported visiting the website(s); Control group not asked.

Web survey respondents who received TOU study information in both English and in their native language were asked about the importance of receiving information in both languages (using a 11-point scale with 0 meaning "not important at all" and 10 meaning "extremely important"). On average, these respondents found having materials available in their native language to be of high importance (Table 4.5-67). Responses were consistent across segments and Rate groups, except for the moderate climate region non-CARE/FERA segment. Due to small sample sizes, however, results should be interpreted carefully.

Table 4.5-67: Average Importance Rating for Receiving Information in Respondents' Native Language [1,2,3]

Climate Region	Segment	Rate 1		Rate 2		Rate 3	
		n	Average	n	Average	n	Average
Hot	Non-CARE/FERA	9	9.3	--	--	--	--
	CARE/FERA	94	8.9	38	9.0	40	9.4
	Below 100% FPG	59	8.9	24	9.3	23	9.6
	100% to 200% FPG	37	9.0	12	8.4	15	9.1
	Senior	29	8.5	8	9.1	--	--
Moderate	Non-CARE/FERA	9	6.8	8	7.4	14	7.7
	CARE/FERA	54	9.0	53	9.3	56	9.2
Cool	Non-CARE/FERA	8	9.8	11	7.0	8	8.3
	CARE/FERA	67	9.4	75	9.5	60	8.6

[1] Importance ratings are based on an 11-point scale where 0 means 'not at all important and 10 means 'extremely important'.

[2] Blank cells in figure indicate sample size for that segment/Rate treatment group was fewer than five.

[3] Asked only to web survey respondents who are non-English speakers in the Rate groups and who reported receiving information from PG&E.

Overall, PG&E web survey respondents provided moderate to high satisfaction ratings with TOU study outreach (using a 11-point scale with 0 meaning "not satisfied at all" and 10 meaning "extremely satisfied;" Table 4.5-68). Respondents in the non-CARE/FARE segments reported being slightly less satisfied with TOU study outreach compared to those in the CARE/FERA segments.

Table 4.5-68: Average Satisfaction Rating for All TOU Study Outreach[1,2]

Climate Region	Segment	Rate 1	Rate 2	Rate 3
Hot	Non-CARE/FERA	7.7	7.7	7.6
	CARE/FERA	8.1	8.1	7.9
	Below 100% FPG	8.1	8.2	7.9
	100% to 200% FPG	8.1	7.9	7.9
	Senior	7.9	8.0	7.8
Moderate	Non-CARE/FERA	7.9	7.6	7.7
	CARE/FERA	8.3	8.3	8.3
Cool	Non-CARE/FERA	7.5	7.5	7.7
	CARE/FERA	8.1	8.1	8.1

[1] Satisfaction ratings are based on an 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.

[2] Asked to web survey respondents in the Rate groups who reported receiving any outreach item; Control group not asked.

Smartphone App

Web survey respondents were asked if they were aware of PG&E's smartphone app for the TOU study and, of those aware, if they downloaded the app. Due to small sample sizes in some of the segments, customers were combined across the Rate groups; Control group customers were not asked the smartphone app questions. Between 28% and 41% of surveyed customers reported awareness of the app, and of those, between 12% and 21% successfully downloaded it (Table 4.5-69). Five percent to 10% tried to but could not download the app. Fewer low-income and senior customers reported awareness of and downloaded the app compared to non-CARE/FERA customers.

Table 4.5-69: Percentage of Respondents Who are Aware of and Downloaded PG&E's TOU Study Smartphone App[1]

		Aware of PG&E's App		Received App Invitation		Downloaded PG&E's App[2]		
Climate Region	Segment	Total N	% Aware	Total N	% Received Invitation	N Aware of App	% Downloaded	% Tried to download but couldn't
Hot	Non-CARE/FERA	1104	41%	955	35%	451	21%	8%
	CARE/FERA	790	35%	668	31%	273	12%	10%
	Below 100% FPG	332	33%	279	29%	108	14%	7%
	100 to 200% FPG	469	34%	396	29%	157	13%	10%
	Seniors	982	36%	800	28%	354	14%	5%
Moderate	Non-CARE/FERA	720	38%	638	35%	275	21%	10%
	CARE/FERA	463	29%	377	31%	133	17%	8%
Cool	Non-CARE/FERA	800	40%	701	38%	323	18%	9%
	CARE/FERA	471	28%	397	28%	130	15%	10%

[1] Asked to web survey respondents in the Rate groups; Control group not asked.

[2] Asked only to those who reported awareness of the app.

Respondents who downloaded the smartphone app reported their level of agreement with five aspects about PG&E's TOU study smartphone app, using a scale of 0 to 11 where 0 means 'do not agree at all' and 10 means 'completely agree' (Table 4.5-70). Respondents reported the highest to lowest average agreement with the following aspects: the app is easy to use (6.2-7.6), information in the app is useful (5.5-7.6), recommend app to friends/family (4.4-6.9), app's feedback on electricity use helps customer reduce use during peak periods (4.4-6.7), and the app does not provide enough information about the customer's usage to take action (3.9-5.9).

Table 4.5-70: Average Level of Agreement with Aspects About PG&E's TOU Study Smartphone App[1,2]

Climate Region	Segment	The app is easy to use N	The app is easy to use Average	The information provided in the app is useful N	The information provided in the app is useful Average	The feedback on my use has helped me reduce my use during peak periods N	The feedback on my use has helped me reduce my use during peak periods Average	The app does not provide enough information about my household's usage for me to take action N	The app does not provide enough information about my household's usage for me to take action Average	You would recommend this app to friends and family N	You would recommend this app to friends and family Average
Hot	Non-CARE/FERA	91	7.26	88	7.04	89	5.19	91	4.68	91	6.14
	CARE/FERA	34	7.17	32	7.13	32	6.74	33	4.57	32	6.70
	Below 100% FPG	15	6.55	14	5.91	14	6.55	15	5.00	15	6.18
	100 to 200% FPG	20	7.64	19	7.57	20	6.14	20	3.86	19	6.86
	Seniors	48	7.19	46	7.02	46	5.48	47	4.38	46	6.24
Moderate	Non-CARE/FERA	57	6.22	56	5.89	57	4.45	56	5.47	56	4.78
	CARE/FERA	19	7.27	19	6.60	20	6.07	20	5.87	20	5.93
Cool	Non-CARE/FERA	58	6.25	57	5.45	58	4.43	58	5.57	57	4.36
	CARE/FERA	18	7.40	18	7.10	18	6.70	19	4.90	18	6.70

[1] Agreement ratings are based on an 11-point scale where 0 means 'do not agree at all' and 10 means 'completely agree'.

[2] Asked to web survey respondents in the Rate groups who reported downloading the app; Control group not asked.

Surveyed customers who downloaded PG&E's TOU study smartphone app also reported whether they used four of the app's features and, if so, the extent to which the feature was helpful, using a scale of 0 to 10 where 0 means 'not at all helpful' and 10 means 'extremely helpful' (Table 4.5-71). Between 25% and 55% of surveyed customers reported using the four features. On average, more non-CARE/FERA customers (compared to CARE/FERA customers), and more customers in the hot and cool regions (compared to moderate region customers) reported using the smartphone app features. Customers who used the features rated each feature as somewhat to mostly helpful (4.5-10.0). Results should be interpreted carefully, however, due to small sample sizes in some segments.

Table 4.5-71: Percentage of Respondents Who Used PG&E's TOU Study Smartphone App Features, and the Average Helpfulness Ratings for the Features[1,2,3]

		Information about the current pricing period				Access to your monthly projected bill amount				Access to more detailed information about your household usage patterns				Information about your electricity use by "always on" and "cooling" usage			
		Used Feature		Helpfulness of Feature Rating		Used Feature		Helpfulness of Feature Rating		Used Feature		Helpfulness of Feature Rating		Used Feature		Helpfulness of Feature Rating	
Climate Region	Segment	N	%	N	Average	N	%	N	Average	N	%	N	Average	N	%	N	Average
Hot	Non-CARE/FERA	95	53%	47	7.34	96	53%	47	7.21	95	51%	44	6.68	96	38%	33	5.82
	CARE/FERA	34	53%	16	6.06	34	47%	15	6.53	34	41%	14	6.36	34	24%	6	6.00
	Below 100% FPG	15	53%	8	6.50	15	53%	8	5.63	15	53%	8	6.50	15	55%	6	7.00
	100 to 200% FPG	20	50%	9	6.89	20	40%	8	6.00	20	55%	10	6.50	20	19%	0	-
	Seniors	52	48%	20	6.25	52	44%	19	5.37	52	46%	19	5.53	52	33%	14	4.79
Moderate	Non-CARE/FERA	59	46%	24	5.12	59	47%	25	5.64	59	41%	22	4.59	59	29%	15	4.47
	CARE/FERA	22	36%	8	5.75	22	32%	7	4.86	22	27%	6	6.33	22	27%	6	5.83
Cool	Non-CARE/FERA	59	54%	31	6.10	59	58%	33	5.70	59	47%	27	5.93	59	27%	15	4.60
	CARE/FERA	19	46%	5	8.00	19	46%	5	8.00	19	31%	0	-	17	11%	0	-

[1] Helpfulness ratings are based on an 11-point scale where 0 means 'not at all helpful' and 10 means 'extremely helpful'.

[2] Asked to web survey respondents in the Rate groups who reported downloading the app; Control group not asked.

[3] Excludes helpfulness ratings with a count of less than five respondents.

4.6 Synthesis for PG&E Pilot

This section compares input from the load impact analysis, the bill impact analysis and the survey analysis. The objective of these comparisons, at least in part, is to determine if the information and conclusions observed for individual metrics are supported by findings from other metrics or, alternatively, findings for one metric contradict those for another metric. We also look for clues from the survey findings that might help explain why load or bill impacts for one rate differ from those for other rates. For example, if we find that the load impacts are significantly different across rates or across segments on a specific rate, we could turn to the survey questions concerning the level of understanding of rate features to see if there are significantly differences in customer understanding of key rate features that might explain the observed differences across rates and/or customer segments.

Before drawing any conclusions from the analysis, it is very important to keep in mind the following:

- Except for the impact of the enrollment credit, bill impacts for the period covered by this analysis, and observed differences in the economic index values between treatment and control customers, are almost certainly at the highest levels that will be found over the course of the pilots. Even if this analysis was done next summer, we would expect lower bill impacts than have been seen to date because a full summer analysis would include June for SCE and PG&E, which is typically cooler than July through September, and May and June for SDG&E, which are typically cooler than July through October. The same analysis done at almost any other three or four month period in the year would likely produce very different results and conclusions and the same analysis done across an entire year would also likely come to very different conclusions.
- As mentioned numerous times in the survey discussion, the statistical analysis of survey questions is “over powered.” That is, with such large sample sizes, even very small differences in values across segments can be statistically significant. While any decision regarding whether a statistically significant difference is meaningful from a policy perspective is inherently subjective, it nevertheless is critical. For example, reporting that there is a statistically significant difference in the satisfaction rating of one rate compared to another and concluding or recommending that the rate with the lower satisfaction rating is inferior from a customer engagement perspective would be very misleading if the satisfaction rating for one was 6.2 and the other 6.7 on an 11 point scale.

These cautions must be kept in mind at all times as the reader processes the extensive, but very early, findings from these pilots.

4.6.1 Synthesis

Tables 4.6-1 through 4.6-3 summarize some relevant findings from the load impact, bill impact and survey analysis. Before summarizing the results, we provide the following guide to the information in Table 4.6-1 as well as a map to prior tables and figures from which the information was taken for Rate 1. This way, readers can easily refer back to those more complete tables and figures.

In each cell in the tables, in addition to the reported values, there is either a colored triangle facing up or down, a (-), N/A, I/S or nothing at all. Cells containing N/A indicate that the specific segment was not included in the analysis, and cells containing I/S indicate the segment was analyzed but didn’t have sufficient sample size to warrant reporting the results. If there is a colored triangle in the cell, it means the value in the cell is statistically significantly different relative to the control group. Green triangles symbolize a desirable outcome (e.g., peak period load reductions are good) and red arrows an undesirable outcome (e.g., peak period load increases are not good). If (-) appears, the value is not statistically significant and if there is no symbol at all (as in the column labeled "Understanding TOU Pricing (None Correct)", it means a comparison to the control group is not relevant (in this example, the control group was not on a TOU rate so couldn't respond to questions about rate periods, etc.). N/A indicates that a statistical significance test was not appropriate. The content of each column and the places in the text from which the values were taken is explained below:

- **Peak Period Load Reduction**: The percent reduction in peak period electricity use on average weekdays for the months of July through September. Positive values mean customers reduced use and negative values mean customers increased use during the peak period relative to the control group (e.g., reference load). Reductions are desirable, and therefore indicated by a green triangle, and increases are undesirable, and represented by a red triangle. These values for Rate 1 can be found in Tables 4.3-4 through 4.3-6 in Section 4.3.1.[76]
- **Net Decrease in Daily Usage**: The percent reduction in daily electricity use on average weekdays for July through September. Positive values mean customers reduced use and negative values mean customers increased use. These values are also found in Tables 4.3-4 through 4.3-6.
- **Summer Monthly Average Structural Bill Impact**: The difference in the bill calculated based on post-treatment usage for the control group (the reference load) using the TOU and OAT rates (after subtracting out any pretreatment differences in bills between the control and treatment groups). This represents the bill impact customers would experience if they were on the TOU rate and did not change their usage behavior. The values are calculated based on data at the bottom of Figure 4.4-14 for Rate 1. For example, the value of $30.12 for Hot climate region non-CARE/FERA customers in Table 4.6-1 equals the difference between the value for that segment in Figure 4.4-14 in the row labeled "No Change in Behavior, Change in Tariff" ($214.55) and the value in the row labeled "No Change in Behavior or Tariff" ($184.43).
- **Average Behavioral Bill Impact**: This variable represents the change in the average bill for treatment customers due to changes in behavior. For Rate 1, these values can be found at the bottom of Figure 4.4-8. They can also be calculated from the values at the bottom of Figure 4.4-14.
- **Total Bill Impact**: This is the change in the average customer's bill on Rate 1 due to the impact of both the structural change in the tariff, holding usage constant, and the change in the bill due to changes in usage. The values in the table are calculated from the values at the bottom of Figure 4.4-14 and are equal to the difference between the numbers in the rows labeled "No Change in Behavior or Tariff" and "With Change in Behavior and Tariff."
- **Respondents Reporting Being Uncomfortably Hot:** The values in this column represent the percent of treatment customers that report being uncomfortably hot "most to all of the time" since June 2016 due to trying to save on electricity bills. The values are taken from Table 4.5-32. These values do not represent the difference in the percentage of customers reporting being uncomfortably hot between the control and treatment groups. They represent the treatment group values. However, cells with a red triangle in them indicate that the treatment group percentage is greater than the control group percentage and that this difference is statistically significant.

[76] Values for Rates 2 and 3 can be found in similar tables in Sections 4.3.2 and 4.3.3, respectively.

- **Health Index:** The values in this column represent the percent of households that require cooling for a disability and have air conditioning reporting that they required medical attention at least once due to excessive heat. The values are taken from Table 4.5-5 and represent the percent of treatment customers reporting one or more medical events, not the difference in this value between treatment and control customers. Cells with a red triangle represent ones where treatment customers had a higher percent reporting a medical event compared with control customers and the difference is statistically significant.
- **Bill Higher Than Expected:** The values in this column are taken from Table 4.5-30 and equal the percent of customers reporting that their bills since June 1 had been higher than they expected. The values do not represent the difference in the percentage between treatment and control customers. Many control customers also reported that bills were higher than expected, reflecting the usual seasonal variation in bills that occurs due to seasonal changes in rates, higher air conditioning use in the summer and the tiered structure of the rates. Cells with red triangles represent values that are higher than the percentage reported by control group customers and where that the difference is statistically significant.
- **Difficulty Paying Bills:** The values in this column are taken from Table 4.5-13 and represent the percent of customers reporting having difficulty paying bills since June 2016. Cells with red or green triangles represent values that are higher or lower than control group values, respectively, and where the differences are statistically significant.
- **Economic Index:** The values in this column represent the mean values of the economic index for each customer segment on Rate 1. They are taken from Table 4.5-4. Cells with red triangles indicate that the index mean value for the segment is higher than the mean value for the control group and the difference is statistically significant.
- **Understanding TOU Pricing:** This variable is based on a survey question asking respondents to identify the hours of the day when prices are the highest. The values in the table come from Table 4.5-34 and indicate the percent of customers that failed to correctly identify any peak period hours associated with the TOU rate. The higher this percentage, the less likely that a group of customers would make significant reductions during the peak period.
- **Satisfaction with Rate:** These values represent the average satisfaction rating for the rate plan on an 11 point scale, from 0 to 10, with higher values indicating higher satisfaction. These values are taken from Table 4.5-20. Values with red triangles represent cells where the average rating for the treatment group on the TOU rate is lower than for the control group on the OAT, and the difference is statistically significant.
- **Satisfaction with Utility:** The same 11-point scale as above was used to assess satisfaction with PG&E. The values in the column are also taken from Table 4.5-20. As above, red triangles represent statistically significant differences between average values for the control and treatment groups.

Looking across the various metrics for each customer segment and rate, we did not observe any internal inconsistencies. In fact, quite the opposite—overall, the load impact, bill impact and survey findings typically align quite well. Below is a summary by customer segment.

Non-CARE/FERA Customers

Non-CARE/FERA customers in the hot climate region have the highest percent reduction in peak period energy use among all segments, the second highest percent reduction in daily usage, the highest bill reduction due to behavior change, a statistically significant difference from the control group in the percent of respondents reporting being uncomfortably hot because of trying to save on electricity bills, the highest percent (roughly 45%) of respondents indicating that their bills were higher than expected and this percent was statistically significantly higher than the percent for control customers reporting higher than expected bills, understood the rates better than nearly any other segment (as indicated by the very low percent that failed to identify at least one peak period hour), and had the lowest satisfaction ratings for the rate plan and for PG&E compared with any other segment. All of these metrics paint an internally consistent picture of a customer segment that understood the timing of the peak period well, worked hard to reduce usage and bills, became uncomfortable in the hot climate region due to their efforts to reduce bills, were surprised when their bills were as high as they were, and as a result of all of the above, were less satisfied than any other group.

CARE/FERA Customers

Across all rates and climate regions, CARE/FERA customers had lower reductions in peak period and daily electricity use than non-CARE/FERA customers, although as reported in Sections 4.3.1 through 4.3.3, not all of the differences between CARE/FERA and non-CARE/FERA customers were statistically significant. Consistent with this finding, CARE/FERA customers on average also had very low bill reductions due to behavior change compared with non-CARE/FERA customers. Also consistent with above, there was no statistically significant increase in the percent of CARE/FERA customers reporting that they were uncomfortably hot due to trying to reduce bills, nor any increase in the health index due to the rate. All of these metrics depict a customer segment that is much less responsive to TOU rates than non-CARE/FERA customers, although they are still delivering statistically significant peak period demand reductions of roughly 3% in the hot and moderate climate regions. One potentially important driver of the limited engagement by CARE/FERA customers compared with non-CARE/FERA customers is that between roughly 18% and 34% of CARE/FERA customers were unable to identify a single hour when prices were at their peak for the day. Taking a simple average across the climate regions, only about 10% of non-CARE/FERA customers failed to identify any peak period hours for Rate 1, for example, whereas more than twice as many (24%) CARE/FERA customers fell into this category. These metrics are substantially larger for Rate 2 customers.

Table 4.6-1: Load Impacts, Bill Impacts, and Selected Survey Findings for PG&E Rate 1

Climate	Segment	Load Impacts		Bill Impacts			Survey							
		Peak Period Load Reduction	Net Decrease in Daily Usage	Summer Monthly Average Structural Bill Impact	Average Behavioral Bill Impact	Total Bill Impact	Respondents Reporting Being Uncomfortably Hot	Health Index	Bill Higher than Expected	Difficulty Paying Bills	Economic Index (Range 0-10)	Understanding TOU Pricing (None-Correct)	Satisfaction w/ Rate (11 pt. Scale)	Satisfaction w/ Utility (11 pt. Scale)
Hot	Non-CARE/FERA	8.7% ▼	3.0% ▼	$30.12	-$5.87 ▼	$24.25 ▲	20% ▲	14% -	45% ▲	30% -	2.5 -	8%	5.7 -	6.6 -
	CARE/FERA	3.2% ▼	0.9% ▼	$17.29	-$0.79 -	$16.51 ▲	29% -	24% -	40% -	74% -	4.4 -	22%	6.8 -	7.4 -
	Senior	7.0% ▼	2.3% ▼	$24.27	-$3.56 ▼	$20.71 ▲	17% ▲	16% -	37% ▲	39% -	2.8 -	18%	6.6 -	7.3 ▼
	HH < 100% FPG	-0.4% -	-1.9% ▲	$18.46	$5.32 ▲	$23.78 ▲	28% -	31% -	42% -	74% -	4.4 -	25%	6.9 -	7.5 -
	100% FPG < HH < 200% FPG	N/A	N/A	$20.62	-$4.10 ▼	$16.51 ▲	25% -	16% -	41% -	66% -	4.2 -	18%	6.7 -	7.5 -
Moderate	Non-CARE/FERA	4.7% ▼	0.5% -	$17.21	-$0.55 -	$16.65 ▲	6% ▼	I/S	36% ▲	19% -	2.0 -	7%	6.4 -	6.8 -
	CARE/FERA	3.9% ▼	3.5% ▼	$10.43	-$2.16 ▼	$8.28 ▲	24% -	I/S	31% ▲	64% -	4.0 -	25%	7.1 -	7.7 -
Cool	Non-CARE/FERA	4.6% ▼	0.6% -	$12.81	-$0.54 -	$12.27 ▲	1% -	I/S	38% ▲	17% -	1.8 -	7%	6.0 ▼	6.6 -
	CARE/FERA	1.4% ▼	-0.8% ▲	$8.74	$0.30 -	$9.04 ▲	13% -	I/S	31% ▲	60% -	3.7 -	20%	7.2 -	7.5 -

Table 4.6-2: Load Impacts, Bill Impacts, and Selected Survey Findings for PG&E Rate 2

Climate	Segment	Load Impacts		Bill Impacts			Survey							
		Peak Period Load Reduction	Net Decrease in Daily Usage	Summer Monthly Average Structural Bill Impact	Average Behavioral Bill Impact	Total Bill Impact	Respondents Reporting Being Uncomfortably Hot	Health Index	Bill Higher than Expected	Difficulty Paying Bills	Economic Index (Range 0-10)	Understanding TOU Pricing (None-Correct)	Satisfaction w/ Rate (11 pt. Scale)	Satisfaction w/ Utility (11 pt. Scale)
Hot	Non-CARE/FERA	9.0% ▼	2.2% ▼	$33.56	-$6.64 ▼	$26.92 ▲	16% -	16% -	50% ▲	33% -	2.6 -	15%	5.5 ▼	6.4 ▼
	CARE/FERA	2.8% ▼	-0.7% -	$17.69	$0.94 -	$18.63 ▲	23% -	17% -	40% -	73% -	4.4 -	30%	6.6 ▼	7.4 -
Moderate	Non-CARE/FERA	6.8% ▼	-0.8% -	$17.93	-$0.16 -	$17.77 ▲	8% -	I/S	42% ▲	16% -	2.0 -	13%	5.9 ▼	6.8 -
	CARE/FERA	2.8% ▼	0.5% -	$10.42	-$0.22 -	$10.20 ▲	21% -	I/S	24% -	63% -	4.0 -	34%	7.1 -	7.6 -
Cool	Non-CARE/FERA	4.7% ▼	-0.1% -	$12.71	-$0.31 -	$12.40 ▲	3% -	I/S	40% ▲	19% -	1.9 -	14%	6.0 ▼	6.6 -
	CARE/FERA	0.3% -	-1.1% ▲	$8.73	$0.25 -	$8.97 ▲	8% ▼	I/S	34% ▲	61% -	3.7 -	25%	7.1 -	7.6 -

Table 4.6-3: Load Impacts, Bill Impacts, and Selected Survey Findings for PG&E Rate 3

Climate	Segment	Load Impacts		Bill Impacts			Survey							
		Peak Period Load Reduction	Net Decrease in Daily Usage	Summer Monthly Average Structural Bill Impact	Average Behavioral Bill Impact	Total Bill Impact	Respondents Reporting Being Uncomfortably Hot	Health Index	Bill Higher than Expected	Difficulty Paying Bills	Economic Index (Range 0-10)	Understanding TOU Pricing (None-Correct)	Satisfaction w/ Rate (11 pt. Scale)	Satisfaction w/ Utility (11 pt. Scale)
Hot	Non-CARE/FERA	9.5% ▼	4.5% ▼	$38.57	-$10.41 ▼	$28.16 ▲	16% -	24% -	50% ▲	29% -	2.4 -	10%	5.6 ▼	6.5 ▼
	CARE/FERA	1.9% ▼	-0.8% ▲	$19.94	$0.78 -	$20.72 ▲	22% -	19% -	44% ▲	78% -	4.5 -	22%	6.5 ▼	7.3 -
Moderate	Non-CARE/FERA	4.1% ▼	-0.3% -	$20.27	-$0.56 -	$19.71 ▲	7% -	I/S	37% ▲	18% -	2.0 -	9%	6.1 ▼	6.9 -
	CARE/FERA	3.2% ▼	1.8% ▼	$10.56	-$1.08 -	$9.47 ▲	20% -	I/S	29% ▲	61% -	3.9 -	18%	7.1 -	7.7 -
Cool	Non-CARE/FERA	3.1% ▼	1.7% ▼	$13.25	-$1.55 -	$11.70 ▲	3% -	I/S	38% ▲	21% -	1.9 -	10%	6.2 -	6.6 -
	CARE/FERA	2.3% ▼	0.3% -	$8.58	-$0.48 -	$8.10 ▲	12% -	I/S	27% -	59% -	3.7 -	18%	7.1 -	7.4 -

Turning to other metrics of interest, while the average total bill increase for CARE/FERA customers was less than the increase for non-CARE/FERA customers for all rates and climate regions due to the lower average prices paid by CARE/FERA customers, between 60% and 78% of CARE/FERA customers reported having difficulty paying bills, which was three times higher on average than for non-CARE/FERA customers. The economic index for CARE/FERA customers was roughly twice as high as for non-CARE/FERA customers in all climate regions and for all rate options, including the control group. In short, CARE/FERA customers had higher economic index scores compared with non-CARE/FERA customers but the increase in the economic index scores moving from the OAT to TOU rates is not statistically significant for any of the rates.

Importantly, in spite of the above, CARE/FERA customers had higher satisfaction ratings for the TOU rates than non-CARE/FERA customers for all rates and climate regions. In the moderate and cool regions, none of the satisfaction ratings for CARE/FERA customers were statistically significantly different from control group ratings. In the hot climate region, CARE/FERA customers on Rates 2 and 3 were less satisfied than control customers but not on Rate 1, but none of these differences is large (See Table 4.5-20). The largest difference between control and treatment customers occurs for Rate 3, where CARE/FERA control customers on the OAT had an average satisfaction rating of 7.0 and CARE/FERA customers on Rate 3 had an average rating of 6.5. CARE/FERA customers also had higher ratings for satisfaction with PG&E than non-CARE/FERA customers in all climate regions for all rates. In a slight departure from satisfaction ratings for the rate plan, CARE/FERA customers in the hot climate region for Rates 2 and 3 had statistically significantly lower satisfaction ratings than control customers although, again, the differences in the average values were small.

Senior Households

Senior households in the hot climate region had load reductions in the peak period and for the average weekday that were comparable to average reductions for the overall population in the hot region, as reported for Rate 1 in Section 4.3.1. It is also noteworthy that the difference in load impacts for senior households in the hot climate region on CARE/FERA rates and those that are not on CARE/FERA was very similar to the difference in CARE/FERA and non-CARE/FERA households in general in the hot climate region.

Total bill impacts and reductions in bill impacts due to behavior change were also very similar for senior households and the hot general population. 17% of senior households on Rate 1 reported being uncomfortably hot due to behavior changes made to reduce costs. This percentage is higher than for the control group (14% as shown in Table 4.5-32) and the difference is statistically significant.

On Rate 1, seniors, along with more than half of the other customer segments, indicated that their bills were higher than expected. However, there was no statistically significant difference in the percent of seniors reporting difficulty in paying bills, or in the economic index, compared with the control group.

Senior households appear to have a higher percentage of participants that could not identify any peak period hours compared with the population as a whole in the hot region. Weighted average values for CARE/FERA and non-CARE/FERA customers for this variable for Rate 1 is 14% compared to 18% for seniors. In addition, about 55% of combined CARE/FERA and non-CARE/FERA customers selected over half of the correct peak hours compared to 42% of seniors (see Table 4.5-34).

Finally, satisfaction ratings by seniors for the rate plan (6.6) and for PG&E (7.3) were somewhat higher than the ratings for the hot climate zone population as a whole (as calculated by a weighted average for CARE/FERA and non-CARE/FERA households in the table, the ratings were 6.1 and 6.9 respectively). Seniors on TOU rates did not have statistically different average satisfaction ratings for the rate plan compared with the control group, but did have statistically significantly lower ratings for satisfaction with PG&E, although these differences are substantively small.

Households with Incomes Below 100% of FPG

Households with incomes below 100% of FPG on Rate 1 in the hot climate region did not have statistically significant peak period load reductions. This group actually had a statistically significant increase in daily electricity use equal to almost 2% in the hot climate region. Consistent with these changes, bill impacts due to behavior change actually led to higher bills over and above the structural bill impact for Rate 1. The average monthly bill increases for this segment was almost $24.

Customers with incomes below 100% of FPG had the second highest percent reporting that they were uncomfortably hot due to trying to save on their electricity bills compared with all other segments for Rate 1, but the percentage was not statistically different from that of the control group. This segment had the highest percentage on the health index metric compared to other segments on Rate 1.[77] However, the percentage was not statistically different for the treatment group compared to the control group on this metric.

74% of customers with incomes below 100% of FPG reported that they had difficulty paying bills and this segment was tied for the highest economic index score (4.4) of any segment. However, the difference in the economic index for TOU customers compared with the control group was not statistically significant for customers on Rate 1. The percentage of customers reporting difficulty paying bills was also not statistically different from the percent of control customers reporting difficulty.

Customers in this segment were tied for the highest percent of participants who could not identify any peak period hours among all segments on Rate 1. For Rate 1, this segment did not have statistically different levels of satisfaction with the rate or with PG&E. Satisfaction was not measured for this segment on Rates 2 or 3.

4.6.2 Key Findings

Key findings pertaining to load impacts from the PG&E pilots include:

1. Customers can and will respond to TOU rates with peak periods that extend well into the evening hours – peak period load reductions averaged roughly 6% for all three pilot rates across the service territory as a whole.
2. For Rate 2, which has the same prices in effect on weekends as on weekdays, the pattern of load impacts across rate periods was very similar on weekends and weekdays – that is, customers can and will reduce loads on weekends.
3. There was a small but statistically significant reduction in daily electricity use for all three rates – for Rates 1 and 3, the average reduction was 1.5% while for Rate 2, it was less than 0.5%.

[77] This metric is not reported for Rates 2 or 3.

4. Load impacts, in both absolute and percentage terms, were largest in the hot climate region, second largest in the moderate region, and lowest in the cool region (although in percentage terms, the differences were not always significant in between moderate and cool climate regions).
5. CARE/FERA customers had significantly lower peak period load reductions compared with non-CARE/FERA customers.
6. Senior households on Rate 1 in the hot climate region had load impacts very similar to the hot climate region population as a whole – this similarity was true for seniors on CARE/FERA rates as well as for non-CARE/FERA senior households.
7. Households with incomes below 100% of FPG on Rate 1 in the hot climate region had no statistically significant reduction in peak period or daily electricity use.

Key findings pertaining to bill impacts include:

1. Average monthly bills were higher under TOU rates than under the OAT for all customer segments and all climate regions – the average monthly bill increase ranged from a low of $8.10 for CARE/FERA customers in the cool climate zone on Rate 3 to a high of $28.16 for non-CARE/FERA customers on Rate 3 in the hot climate region. This is driven in part by the fact that the TOU rates are seasonally differentiated (prices are higher in the summer than in the winter), whereas PG&E’s standard rate is not.
2. These bill impacts represent the three summer months from July through September and, ignoring the enrollment credit, are the worst that is expected to occur over the course of the pilot.
3. Average bill increases due to the change in the tariff were reduced modestly by changes in usage behavior but no segment was able to come close to offsetting the summer structural bill impact by changing usage behavior.
4. Over the course of a year, many customers would expect to see a very modest increase or decrease in bills – in the moderate and cool regions, between 50% and 80% of customers would see a structural change in their average monthly bill between ±3% -- in the hot region, between 40% and 50% of customers would expect to see a bill change of ±3%.

Key findings from the survey research include the following:

1. **Hardship:** No customer segment in any climate region had significantly higher average economic index scores when compared to the control group. Similarly, there were no differences in the proportion of health events requiring care between the rate groups and the control groups for customers in any climate region.
2. **Satisfaction:** Across most groups, particularly CARE/FERA groups, satisfaction with their rate and PG&E was lower for TOU customers when compared to control group customers. These differences are substantively small. For example, hot region CARE/FERA Rate 3 customers’ average rating with their rate plan was 6.5, while control group customers’ average rating was 7.0, a difference of 0.5 (Table 4.5.20).
3. **ME&O, understanding of rates and actions taken**:
   - Fewer rate treatment customers used the tips provided in the welcome packet compared to control customers.
   - Though agreement ratings for “items were easy to understand” were high (generally between 7.4 to 7.8), customer’s understanding of their rates indicate a disconnect between customer’s rating of understandability and actual understanding (with 6% to 31% of customers unable to identify peak hours). This is especially true for CARE/FERA customers where the percent of

customers who could not identify peak hours was much higher than for non-CARE/FERA customers.

- When asked if customers agreed that peak and off peak times were easy to remember, Rate 1 customers provided higher agreement ratings than rate 2 and 3 customers. Partially corroborating this finding, Rate 2 customers were the least likely to provide "over half correct"[78] answers to the rate understanding questions, but Rate 1 and 3 customers showed little difference in rate understanding.
- Customers on TOU rates were more likely to take time-specific actions than customers in the control condition. For example, while a similar proportion of customers from control and rate groups indicated that they turned off their lights to conserve energy, a larger proportion of treatment customers indicated they shifted doing laundry, running the dishwasher, increased their thermostat setting during peak hours, and were more likely to pre-cool their homes. These findings suggest that while fewer treatment customers understood the nuances of their rates, they did know and act on actions that helped them shift use. This trend is particularly striking for non-CARE/FERA customers in the hot region, but less prominent for CARE/FERA and less than 100% FPG customers in the hot region.

Overall findings and conclusions include:

- A variety of evidence suggests that the education and outreach to low income customers (CARE/FERA and households with incomes below 100% of FPG) did not generate the same level of understanding of TOU rates as it did for non-low income customers. This could partly result from the fact that more CARE/FERA customers have English as a second language but there may be other reasons. Nexant recommends that this issue be carefully addressed and studied further in the upcoming default pilots where there is a much greater emphasis on and opportunity to test ME&O alternatives for all segments.
- A variety of evidence suggests that the more complex, three-period TOU rate (Rate 2) was harder for all customers to fully understand and this was especially true for low income customers. While peak period reductions are roughly the same for all three rates, the reduction in daily electricity use for Rate 2 was significantly less than for Rates 1 and 3. There is no evidence that Rate 2 has other advantages to offset the disadvantages summarized above although it may be possible with better education and outreach to overcome some of these shortcomings.
- There is no evidence indicating that senior households as a group in PG&E's service territory fare better or worse than the general population as a whole. Generally speaking, metrics such as load and bill impacts, and the scores on nearly all survey questions—including those related to hardship—were in between the scores for CARE/FERA and non-CARE/FERA customers in the same climate region, and is reflective of the composition of CARE/FERA and non-CARE/FERA customers within the Senior Segment.

For households with incomes below 100% of FPG, there was no statistically significant increase in economic index scores on Rate 1 (the only rate where measurements are reported for this segment).

[78] These survey items were coded much like a test with partial credit; customers would get 50% right if they could identify half of the peak hours for their test rate.

5 SCE Evaluation

This report section summarizes the design and evaluation of the SCE pilot. It begins with a summary of the rate and other treatments that were tested in the pilot. This is followed by a brief overview of the pilot implementation process, which includes a discussion of enrollment rates and customer attrition. Section 5.3 presents the load impact estimates for each rate and complementary treatment and Section 5.4 summarizes the bill impacts. Section 5.5 presents the survey results, including key findings regarding hardship for selected customer segments. The final section contains a high level summary and synthesis of the survey and impact findings.

5.1 Pilot Treatments

SCE filed its Time-of-Use (TOU) Pilot Plan advice letter on December 24, 2015, later to be approved with modifications on March 30, 2016.[79] SCE's pilot plan involves testing three tariffs, which vary with respect to the number and timing of rate periods and prices in each period, as summarized in Table 5.1-1 and Figures 5.1-1 through 5.1-3.

Emphasis on Evening Peak Periods

All three of SCE's pilot tariffs have three rate periods during the week and share a common set of peak hours between 4 and 8 PM. Shoulder periods cover much of the morning, afternoon and late evening hours.

Table 5.1-1: Summary of SCE's TOU Rates

Rate Description		Rate 1	Rate 2	Rate 3
Rate Periods	Summer	3	3	4
	Winter	3	3	3
	Spring	N/A	N/A	4
Highest Price Differential (¢/kWh)	Summer	11.5	35.9	20.6
	Winter	4.58	10.5	10.6
	Spring	N/A	N/A	14.9
Peak Period[80]		2-8 PM	5-8 PM	4-9 PM
Duration of Peak		6 Hours	3 Hours	5 Hours
Super Off-Peak?		Yes	Yes	Yes
Super On-Peak?		No	No	Yes

[79] Adoption of residential time-of-use pricing pilots pursuant to Decision 15-07-001, Resolution E-4769 (Public Utilities Commission of the State of California March 17, 2016).

Adoption of time-of-use (TOU) pricing pilots pursuant to Decision (D.) 15-07-001, Resolution E-4761 (Public Utilities Commission of the State of California February 25, 2016).

[80] The figures use a nomenclature that SCE used in its education and outreach material. However, in this table, "peak period" refers to the highest priced period on a particular day type regardless of whether it is called on-peak, super-on-peak, or mid-peak.

Figure 5.1-1: SCE Pilot Rate 1[81]

Rate 1	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Super Off-Peak (23.0₵)								Off-Peak (27.61₵)						On-Peak (34.51₵)									
	Winter	Super Off-Peak (22.91₵)								Off-Peak (22.91₵)						On-Peak (27.49₵)									
Weekend	Summer	Super Off-Peak (23.0₵)								Off-Peak (27.61₵)															
	Winter	Super Off-Peak (22.91₵)								Off-Peak (22.91₵)															

Figure 5.1-2: SCE Pilot Rate 2

Rate 2	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Super Off-Peak (17.33₵)								Off-Peak (29.32₵)									On-Peak (53.26₵)						
	Winter	Super Off-Peak (17.41₵)								Off-Peak (26.03₵)									On-Peak (27.91₵)						
Weekend	Summer	Super Off-Peak (17.33₵)								Off-Peak (29.32₵)															
	Winter	Super Off-Peak (17.41₵)								Off-Peak (26.03₵)															

Figure 5.1-3: SCE Pilot Rate 3

Rate 3	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Off-Peak (16.39₵)											On-Peak (22.64₵)					Super On-Peak (37.03₵)							
	Winter	Off-Peak (18.24₵)																Mid-Peak (20.96₵)							
	Spring	Off-Peak (18.24₵)											Super Off-Peak (9.94₵)					On-Peak (24.86₵)							
Weekend	Summer	Off-Peak (16.39₵)																Mid-Peak (18.77₵)							
	Winter	Off-Peak (18.24₵)											Super Off-Peak (10.39₵)					Mid-Peak (20.96₵)							
	Spring	Off-Peak (18.24₵)											Super Off-Peak (9.94₵)					Mid-Peak (20.96₵)							

The prices shown in the above figures for Rates 1 and 2 do not reflect the credit of 9.87¢/kWh for usage below the baseline quantity in each climate zone. This credit significantly reduces average prices, especially for lower usage customers. Rate 3 does not include a baseline credit. Given this difference in baseline credits between Rates 1 and 2 and Rate 3, it is not possible to directly compare prices in each rate period from the above figures.

Rate 1 has three rate periods on summer weekdays and two on winter weekdays. The peak period on Rate 1 is the same all year long and runs from 2 to 8 PM. The peak to super-off-peak price ratio (ignoring the baseline credit) is 1.5 to 1 in summer. Customers on SCE's Rate 1 will pay off-peak prices on weekends in the winter. In summer, off-peak prices are in effect on weekends from 8 AM to 10 PM, which is the time period covered by the combination of peak and off-peak prices on weekdays.

SCE's Rate 2 has three rate periods on weekdays all year long. Compared with Rate 1, it has a much shorter peak period on weekdays and has significantly, higher, tier 2 peak period prices in summer. The peak period runs from 5 to 8 PM. Rate 2 also features a super off-peak price of roughly 17¢/kWh between 10 PM and 8 AM on weekdays all year long. The ratio of peak to super-off-peak prices in the summer is roughly 3 to 1. In winter, the peak-to-super off-peak price ratio is roughly 1.6 to 1. On weekends, customers pay the off-peak price between 8 AM and 10 PM and the super off-peak price during the same overnight hours as on weekdays, from 10 PM to 8 AM.

Rate 3 has a peak-period length of five hours, which is in between the peak-period length for Rates 1 and 2. In addition, the peak period starts later in the day compared with Rate 1, and extends further into

[81] The values shown in these figures were taken from the filings. Prices will change over the course of the pilot in conjunction with normal changes in the control group tariff.

the evening (until 9 PM) than either of the other pilot rates. The weekday peak-to-super-off-peak price ratio in the summer on Rate 3 is roughly 2.3 to 1. Another difference between Rate 3 and the other rates is the presence of super off-peak pricing between 11 AM and 4 PM in spring, when excess supply conditions may exist in California. On weekends, Rate 3 has two rate periods in summer and three in spring and winter. The peak period on weekends shown in Figure 5.1-3 has a different color compared with weekday peak periods because the prices on weekends don't match any of the prices during peak, partial, off-peak, or super-off-peak periods on weekdays. Finally, as mentioned above, a very important difference is the lack of a baseline credit in Rate 3.

In addition to assessing the rate treatments summarized above based on customers recruited from the general, eligible residential population, SCE also recruited customers who were known to have purchased and installed a smart thermostat. The objective of this treatment group was to estimate load impacts for smart thermostat owners on TOU rates. The pilot plan called for SCE to partner with a smart thermostat vendor (in this case, Nest) to recruit smart thermostat owners into the study using the same "pay-to-play" recruitment strategy as was used for the general population. However, because Nest does not know the names or addresses of Nest thermostat owners, recruitment was done via email only (the same communication channel that Nest uses to send out monthly reports to each online Nest owner summarizing equipment run time and other behavioral information) rather than through the direct mail solicitation that was employed for the rate treatment groups. Target enrollment for the technology treatment was 3,750 customers and participants were to be randomly assigned to Rates 1 and 3 or to the control condition. In reality, enrollment fell well short of this target and those who enrolled were randomly assigned only to Rate 1 and to the control group.

SCE also varied the education and outreach provided to participants who were on the three TOU rates. The majority of customers (75%) on each of the three TOU rates received what SCE describes as enhanced education and outreach while the remainder received fewer contacts during the post enrollment phase.

5.2 Implementation Summary

As discussed in the TOU Pilot Design Report and in the IOU Advice Letters, enrollment on each treatment for selected customer segments was designed to address multiple objectives and to provide statistically valid estimates of impacts associated with several different metrics, including load impacts and bill impacts, assessment of hardship and other survey based information such as reported changes in usage behavior. The enrollment plan called for oversampling low income and senior households in SCE's hot climate zone for assignment to Rate 2 and oversampling CARE/FERA customers in all climate regions. The enrollment targets were based on an assumed attrition rate (driven mainly by customer churn) of 25% over the course of the pilot and desired levels of accuracy and precision for the various metrics of interest.[82] Table 5.2-1 shows the target level of enrollment for targeted segments and treatments in SCE's hot climate region and Table 5.2-2 shows the target for all rate treatments across the three climate regions.

[82] For further discussion of sample sizes and target precision for each metric, see Section 3.3 of The Pilot Design Report and Appendices E, F and G of Appendix Volume I.

Table 5.2-1: Target Enrollment for Rate 2 in SCE's Hot Climate Region

Climate Zone	Customer Segment	Sample Size	Non-CARE/FERA	CARE / FERA	Senior	SR < 100% of FPG	CARE / FERA < 100% FPG	<100% FPG	101 to 200% FPG	200 to 250% FPG	> 250% of FPG	Control Group
Hot	SR < 100% FPG	313	152	161	313	313	161	313	0	0	0	313
	Non-SR CARE < 100% FPG	156	0	156	0	0	156	156	0	0	0	156
	SR > 100% FPG	313	232	81	313	0	0	0	65	46	201	313
	Non-SR CARE > 100% FPG	231	0	231	0	0	0	0	89	43	100	231
	General	1,875	1,150	725	502	89	219	374	410	228	862	1,875
	All	2,888	1,533	1,354	1,127	402	536	843	564	317	1,164	2,888
	% In Sample	100%	53%	47%	39%	14%	19%	29%	20%	11%	40%	n/a
	% In Population	100%	61%	39%	27%	5%	12%	20%	22%	12%	46%	n/a

Table 5.2-2: Target Enrollment by Rate Type, Climate Region, and Customer Segment

Climate Zone	Segment	Rate 1	Rate 2	Rate 3	Control	Total
Hot	CARE / FERA	625	1,354	625	1,354	3,958
	Non-CARE / FERA	625	1,533	625	1,533	4,317
	Total	1,250	2,888	1,250	2,888	8,275
Moderate	CARE / FERA	625	625	625	625	2,500
	Non-CARE / FERA	625	625	625	625	2,500
	Total	1,250	1,250	1,250	1,250	5,000
Cool	CARE / FERA	625	625	625	625	2,500
	Non-CARE / FERA	625	625	625	625	2,500
	Total	1,250	1,250	1,250	1,250	5,000
All	CARE / FERA	1,875	2,604	1,875	2,604	8,958
	Non-CARE / FERA	1,875	2,783	1,875	2,783	9,317
	Total	3,750	5,388	3,750	5,388	18,275

Prior to pulling the recruitment sample, selected customers were screened out from participating in the pilot. A detailed accounting of all exclusion criteria is contained in Section 2.1 of Appendix Volume I. Importantly, SCE excluded customers with less than 12 months of usage history, since these customers will not be defaulted to TOU rates in the future.[83] After applying all exclusion criteria to SCE's population of roughly 4.3 million residential customers, the eligible population was approximately 3.3 million.

5.2.1 Customer Recruitment

In order to avoid significant over or under recruitment and to better manage recruitment costs, SCE conducted a small pretest in January, 2016 to determine how response rates vary across selected customer segments, delivery channels, incentive payments and with and without the offer of bill protection. Based on these pretest results and those of PG&E and SDG&E, SCE decided to offer a "pay-to-play" incentive of $200 to each participant to be paid in three installments—$100 at the time of enrollment and $50 upon completion of each of two surveys that were to be conducted over the course of the pilot. Even though the pretest results did not show a significant uptake in customer acceptance tied to the offer of bill protection, bill protection was included in the offer based on input from the TOU WG.

With input on acceptance rates from the pretest, SCE decided to make offers[84] to a sample of roughly 197,000 customers distributed across rates and customer segments as shown in the first row of Table 5.2-3. SCE sent out direct mail offers in the first week of March 2016. Customers for whom SCE had email addresses (approximately 33% of the sample) also received an email solicitation that contained a link to the enrollment website.[85] The solicitation emphasized the importance of the study, the financial

[83] PG&E and SDG&E elected not to exclude customers from pilot eligibility based on having fewer than 12 months of usage date.

[84] Copies of the solicitation letter and all educational and outreach materials are contained in Section 2 of Appendix Volume 1.

[85] Customers with a valid email received an email invitation as a second touch. Emails were available for approximate 33% of the targeted customers.

incentive participants would receive, what was expected from participants and what they could expect to occur over the course of the pilot, and the fact that participation was risk free in terms of bill impacts due to bill protection. TOU rates were described in very general terms but the specific rates included in the pilot were not described in detail as customers were to be randomly assigned to the rate options after agreeing to be in the study. Participants could enroll online, through a business reply card, or by calling a toll free number. Upon enrollment, customers were asked to complete a brief survey that gathered important data about income, age of household members, email addresses and a few other variables.

Table 5.2-3: SCE Offers and Acceptances by Partition and Strata

Category	Hot Climate Region						
	General	CARE[86]	Non-CARE	Non-Senior CARE		Senior	
				Below 100% of FPL	Above 100% of FPL	Below 100% of FPL	Above 100% of FPL
Offers	37,500	11,458	11,458	5,200	7,700	14,433	10,433
Acceptances	4,769	1,690	1,371	713	1,045	1,458	1,764
Acceptance Rate	13%	15%	12%	14%	14%	10%	17%

Category	Moderate Climate Region		Cool Climate Region		Pre-Test	Total for TOU Rates	Technology
	CARE	Non-CARE	CARE	Non-CARE			
Offers	23,958	23,958	23,958	23,958	3,200	197,214	51,381
Acceptances	3,381	2,609	3,929	3,264	498	27,429	938
Acceptance Rate	14%	11%	16%	14%	16%	14%	2%

As seen in Table 5.2-3, the overall acceptance rate for the non-smart thermostat treatment groups was 14%. Acceptance rates for the tariff treatments varied from a low of 10% for seniors below 100% of the FPG to a high of 17% for seniors above 100% of FPG. In each climate region, CARE customers enrolled at a somewhat higher rate than non-CARE customers but the difference was not large.

The final column in Table 5.2-3 shows the offer and acceptance rates for customers that already had Nest smart thermostats. As mentioned previously, since Nest does not have names or addresses of households that own Nest thermostats, these solicitations were necessarily done via email. Nest regularly communicates with customers via email when it sends out monthly reports to each online Nest owner summarizing equipment run time and other behavioral information. Nest sent recruitment emails to a little over 51,000 Nest owners. The initial email contained significantly less information than the solicitation letter sent to the general population but recipients could click on a “Learn More” button in the email to connect to a microsite where more information could be found and through which customers could enroll online.

[86] In this table and throughout this report, unless explicitly state otherwise, the CARE designation is meant to include participants in both the CARE and FERA programs.

As seen in Table 5.2-3, the acceptance rate was much lower among Nest owners, at about 2% of total offers made. 938 accepted the offer to enroll but fewer were actually enrolled for reasons discussed in Section 5.2.2. There are several possible explanations for the much lower acceptance rate for smart thermostat owners. First, Nest reports that the email open rate for the solicitation was only about 31%. As such, of the roughly 51,000 who were sent an email, only about 16,000 actually read the solicitation. Given this, one could argue that the acceptance rate is actually closer to 6% (938/15,928). Of those who opened the email, 2,548 (or 16%) clicked through to the microsite to learn more and to consider more carefully whether or not to enroll in the pilot. Of those who clicked through, more than a third actually completed the enrollment process.

Another possible reason why the overall acceptance rate was lower for this customer segment is that they had already been solicited twice to participate in SCE’s Save Power Days demand response program and had declined to do so. As such, this group may be less interested in TOU rates than the general population by virtue of the fact that they had twice declined to participate in a dynamic rate program.

5.2.2 Rate Assignment and Enrollment

Not all customers who agreed to participate in the pilot were actually placed on a TOU tariff or assigned to the control group. There were several reasons why not all customers were enrolled. First, their eligibility might have changed between the time they were selected into the recruitment sample and when they accepted the offer, or between the time they were assigned to a treatment condition and when enrollment was scheduled to occur, which was on the first billing cycle date to occur after June 1.[87] For example, a customer might have closed their account, become a NEM customer, or enrolled into the medical baseline program during this period, all of which would lead to being declared ineligible for the study after acceptance occurred.

Another reason why some customers who accepted the offer were not enrolled was because of over recruitment. As indicated previously in Table 5.2-2, SCE targeted to enroll 18,275 customers (not counting the Nest treatment group) but more than 27,000 customers accepted the pilot offer. In most cells, SCE accepted more than the targeted level of enrollees. Prior to enrollment, SCE set a maximum recruitment level for each test cell of 20% over and above the minimum goal (including attrition), for Rates 1 and 2. Due to the fact that Rate 3 had to be billed manually, no such over-recruitment for Rate 3 was allowed. Roughly 4,800 customers were declined participation due to over-enrollment. For each oversubscribed cell, customers who were declined were chosen at random in order to avoid any bias from only accepting early enrollees. Customers deemed ineligible, or who were declined, received a letter that thanked them for their interest in the TOU study.

Table 5.2-3 shows the progression of customers from acceptance to enrollment. Once ineligible customers were eliminated and those who were declined due to over recruitment were purged from the population, the remaining customers were randomly assigned to treatment or control conditions. Another change that occurred during this process was that some customers were reassigned to different segments based on data gathered through the enrollment survey. The original sample for targeted

[87] All Rate 3 and FERA customers were transitioned to their pilot rate starting on June 23. As a result, it was July 23 before all Rate 3 customers were on the TOU tariff.

segments such as seniors above and below the poverty level was based on information on income and age of the head of household contained in a third party database (purchased from Acxiom). However, data on these key variables was collected from the vast majority of customers at the time of enrollment. If data from the enrollment survey differed from data in the Acxiom database, the enrollment survey data was used to reclassify customers. In addition, customers were reclassified using an alternative definition of senior households from the one used to draw the original sample. The original sample was based on a definition of seniors tied to the age of the customer of record on the account. Subsequently, the Commission directed the IOUs to define senior households as any household where one or more people were aged 65 or older. This change increased the number of senior households in the sample by about 10 percent.

As seen in Table 5.2-4, 1,113 customers, or about 4 percent, were determined to be ineligible after accepting the pilot offer. Roughly 18 percent of those accepting the offer were turned down due to over subscription. No one dropped out after accepting the offer but prior to receiving a Welcome Kit and learning what rate they were assigned to. Of the 938 Nest customers who agreed to participate, 250 were deemed ineligible primarily because they were participants in SCE's Save Power Days program (a peak time rebate program) and the smart thermostats were used to adjust settings on event days. SCE assigned 20,846[88] customers to one of the three treatments or the control group. The number assigned to Rate 2 was significantly larger than the other rate assignments because Rate 2 was the one chosen to be oversampled in order to assess whether TOU rates cause hardship for targeted customer segments in hot climate zones.

Following rate assignment, study participants began receiving Welcome Kits in June, 2016. The control group received a welcome letter informing them that they were to remain on their current tiered rate along with a timeline of the study that included dates for incentive payments and surveys/bill credits. Treated participants received a similar letter, which included information concerning bill protection. They also received a TOU rate plan information sheet, TOU time period reference cling film, cling for individual appliances, conservation reminder stickers, door hangers with recommended seasonal thermostat settings, as well as a pen and notepad. Examples of Welcome Kit information can be found in Section 2.4 of Appendix Volume I.

[88] This count does not include the Smart Thermostat customers as they are considered a separate experiment.

Table 5.2-4: Distribution of SCE Customers from Acceptance to Enrollment

Category	Hot Climate Zones, General	Hot Climate Zones, CARE Customers	Hot Climate Zones, Non-CARE Customers	Hot Climate Zones, Non-Senior CARE Customers below FPL	Hot Climate Zones, Non-Senior CARE Customers above FPL	Hot Climate Zones, Seniors below FPL	Hot Climate Zones, Seniors above FPL	Moderate Climate Zones, CARE Customers	Moderate Climate Zones, Non-CARE Customers	Cool Climate Zones, CARE Customers	Cool Climate Zones, Non-CARE Customers	Technology	Pre-Test	Total
Offers	37,500	11,458	11,458	5,200	7,700	14,433	10,433	23,958	23,958	23,958	23,958	0	3,200	197,214
Acceptances	4,769	1,690	1,371	713	1,045	1,458	1,764	3,381	2,609	3,929	3,264	938	498	27,429
Acceptance Rate	13%	15%	12%	14%	14%	10%	17%	14%	11%	16%	14%	#DIV/0!	16%	14%
Ineligible Prior to Rate Assignment	154	65	53	29	45	70	73	63	68	111	90	250	42	1,113
Moved	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medical	0	1	0	2	1	0	0	2	2	4	2	0	0	14
NEM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Participation in Rate Program	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	154	64	53	27	44	70	73	61	66	107	88	250	42	1,099
Opt-Out Prior to Rate Assignment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Random Over Enrollment Declines	448	268	46	339	415	454	800	557	67	961	429	0	7	4,791
Assignments	4,166	1,358	1,272	347	586	932	891	2,763	2,476	2,861	2,747	688	447	21,534
Customers Assigned to a Pilot Rate	**4,491**	**1,371**	**1,321**	**338**	**493**	**767**	**809**	**2,874**	**2,637**	**2,871**	**2,874**	**688**		**21,534**
Rate 1	0	750	696	0	0	0	0	749	671	749	750	344		4,709
Rate 2	2,245	0	0	170	238	382	412	750	671	748	749	0		6,365
Rate 3	0	621	625	0	0	0	0	625	625	625	625	0		3,746
Control	2,246	0	0	168	255	385	397	750	670	749	750	344		6,714
Target Enrollment	3,750	1,250	1,250	312	462	626	626	2,500	2,500	2,500	2,500			18,276
% of Target Achieved	120%	110%	106%	108%	107%	123%	129%	115%	105%	115%	115%			13
Customers Transitioned to a Pilot Rate	**4,410**	**1,315**	**1,263**	**325**	**477**	**755**	**792**	**2,797**	**2,576**	**2,800**	**2,812**	**673**		**20,995**
Difference from Target Enrollment	**660**	**65**	**13**	**13**	**15**	**129**	**166**	**297**	**76**	**300**	**312**	**673**		**2,719**

** Other reasons for ineligibility (as described in dataset from SCE) include: welcome kit delivery failure, SCE employee, Green Rate, Level Pay Plan, PTR with DLC, as well as "Verification Failures"

5.2.3 Customer Attrition

Opt-Out Rates Were Quite Low

Only about 2.3% of customers dropped off the pilot rates over the roughly six month period from enrollment in June through the end of December. Opt-out rates were higher in the hot climate region compared with the moderate and cool regions. Opt-out rates were highest for Rate 3 and lowest for Rate 1. In the hot climate region, more than 10% of CARE/FERA customers on Rate 3 dropped off the pilot tariff.

Table 5.2-5 shows customer attrition from the pilot between when customers were assigned to a rate and when the most recent data update was received by Nexant in December, 2016. Attrition over that period was the result of changes in eligibility, customers closing their account due to moving, and customers dropping out of the pilot. Attrition is divided into three periods: the time between rate assignment and when customers were notified of their rate assignment through the Welcome Letter and Information Sheets summarized above; the time between notification and being transferred onto the new rate according to each customer’s next billing cycle; and the time between transfer onto the rate and December 31.

Over this period, 2,787 customers left the pilot due either to ineligibility, moving or proactively dropping out. Of this total, roughly half left because they moved location. Given that this period of time covered roughly seven months, this equates to approximately 186 customers moving each month, or an annual churn rate of 2,237, or about 11%. The underlying churn rate suggests that there should be sufficiently large samples in the second summer to meet the design requirements upon which the initial sample sizes were determined.

Nearly 1,000 customers actively dropped out of the pilot over this period. As would be expected, the vast majority of these (95%) dropped out after being provided with their rate assignment and the specific information about the peak periods, price ratios and other rate characteristics associated with the rate to which they were assigned. Most of these dropped out after being transferred onto the rate. It is not known at this time how many of those who dropped off after the rate change left after receiving their first bill under the new rates. Dropout rates may be higher in the future once customers have received several summer bills.

Table 5.2-5: Customer Attrition

Attrition Reason	Hot Climate Zones, General	Hot Climate Zones, CARE Customers	Hot Climate Zones, Non-CARE Customers	Hot Climate Zones, Non-Senior CARE Customers below FPL	Hot Climate Zones, Non-Senior CARE Customers above FPL	Hot Climate Zones, Seniors below FPL	Hot Climate Zones, Seniors above FPL	Moderate Climate Zones, CARE Customers	Moderate Climate Zones, Non-CARE Customers	Cool Climate Zones, CARE Customers	Cool Climate Zones, Non-CARE Customers	Technology	Total
Customers assigned to rate treatment or control	4,491	1,371	1,321	338	493	767	809	2,874	2,637	2,871	2,874	688	21,534
Customers enrolled as of 12-31-2016	3,862	1,125	1,094	273	419	691	711	2,440	2,346	2,568	2,611	607	18,747
Customers transitioned to pilot rate (or control customers)	4,409	1,315	1,263	325	477	755	792	2,796	2,575	2,800	2,812	672	20,991
Ineligible Post-Rate Assignment	**227**	**78**	**87**	**17**	**29**	**29**	**36**	**165**	**120**	**93**	**77**	**40**	**998**
Ineligibles, Pre-Notification	4	2	5	0	3	2	4	6	6	7	0	6	45
Ineligibles, Pre-Rate Change	15	12	24	1	2	2	3	18	29	12	27	6	151
Ineligibles, Post-Rate Change	208	64	58	16	24	25	29	141	85	74	50	28	802
Moved Post-Rate assignment	**300**	**99**	**73**	**40**	**36**	**32**	**27**	**204**	**121**	**183**	**156**	**34**	**1,305**
Moves, Pre-Notification	39	8	7	7	5	6	3	22	12	21	13	1	144
Moves, Pre-Rate Change	12	23	16	4	3	1	2	25	10	18	13	1	128
Moves, Post-Rate Change	249	68	50	29	28	25	22	157	99	144	130	32	1,033
Opt-Out Post-Rate Assignment	**102**	**69**	**67**	**8**	**9**	**15**	**35**	**65**	**50**	**27**	**30**	**7**	**484**
Opt-Outs, Pre-Notification	3	0	2	0	3	0	2	1	2	0	2	1	16
Opt-Outs, Pre-Rate Change	9	5	4	1	0	1	3	2	3	5	6	1	40
Opt-Outs, Post-Rate Change	90	64	61	7	6	14	30	62	45	22	22	5	428
Total	**629**	**246**	**227**	**65**	**74**	**76**	**98**	**434**	**291**	**303**	**263**	**81**	**2,787**
Attrition rate	12%	14%	13%	15%	12%	8%	10%	13%	9%	8%	7%	9%	11%

Figures 5.2-1 through 5.2-3 show the cumulative opt-out rates over time for each test cell and climate region. The cumulative number of opt-outs is highest in the hot region, second highest in the moderate region and lowest in the cool region. The number of control customers dropping out is very low in all climate regions. The cumulative opt-out rate in the moderate and regions is below 4% and the cumulative opt-out rate in the cool regions is below 2%. The opt-out rates in the hot climate zones increase between July and August for Rates 1 and 2, and a bit later for Rate 3. This is likely due to the fact that enrollment in Rate 3 occurred later than it did for the other two rates. CARE/FERA customers in the hot climate region on Rate 1 had the greatest opt-out rate, reaching over 10% by the end of 2016. The opt-out rates generally level off after the summer season.

Figure 5.2-1: SCE Opt Outs by Month – Hot Climate Region

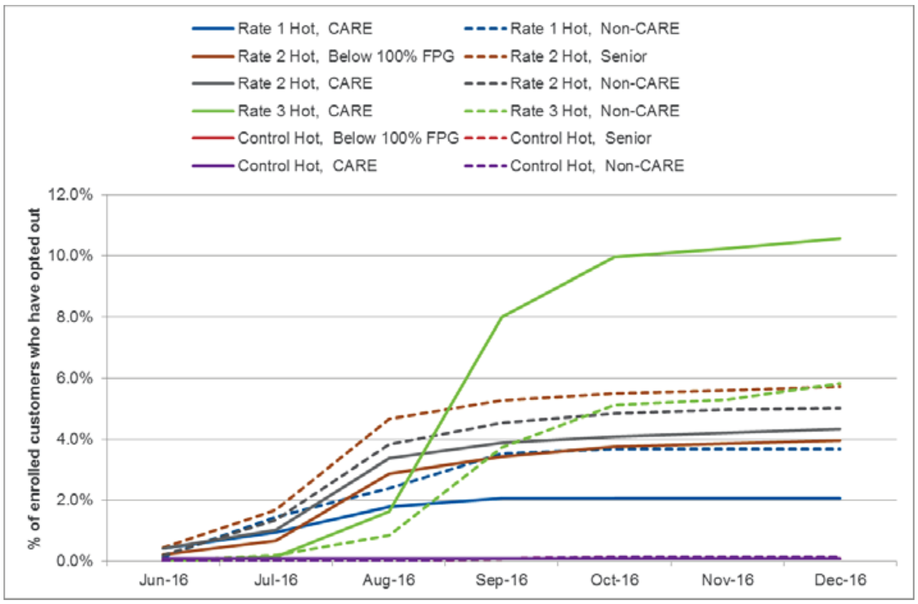


Figure 5.2-2: SCE Opt Outs by Month – Moderate Climate Region

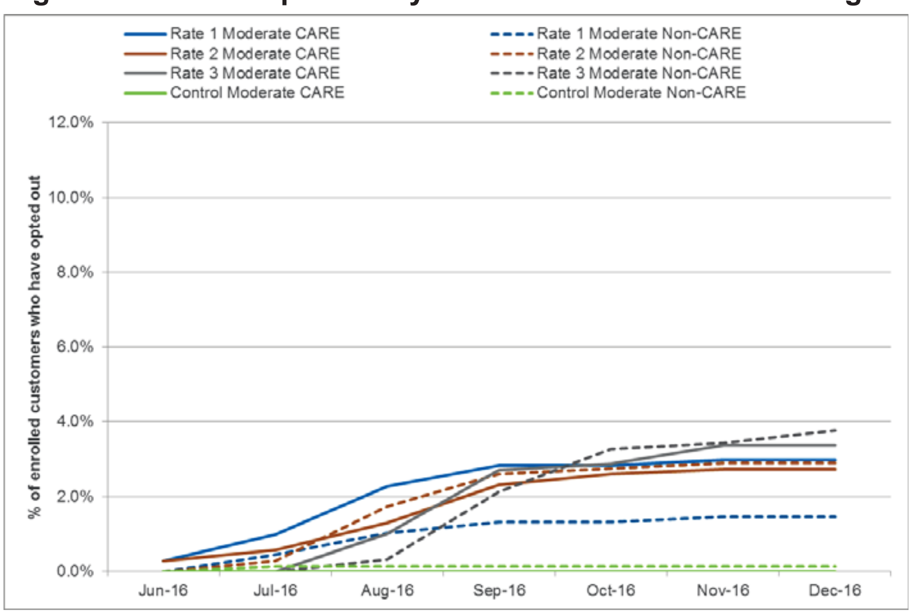


Figure 5.2-3: SCE Opt Outs by Month – Cool Climate Region

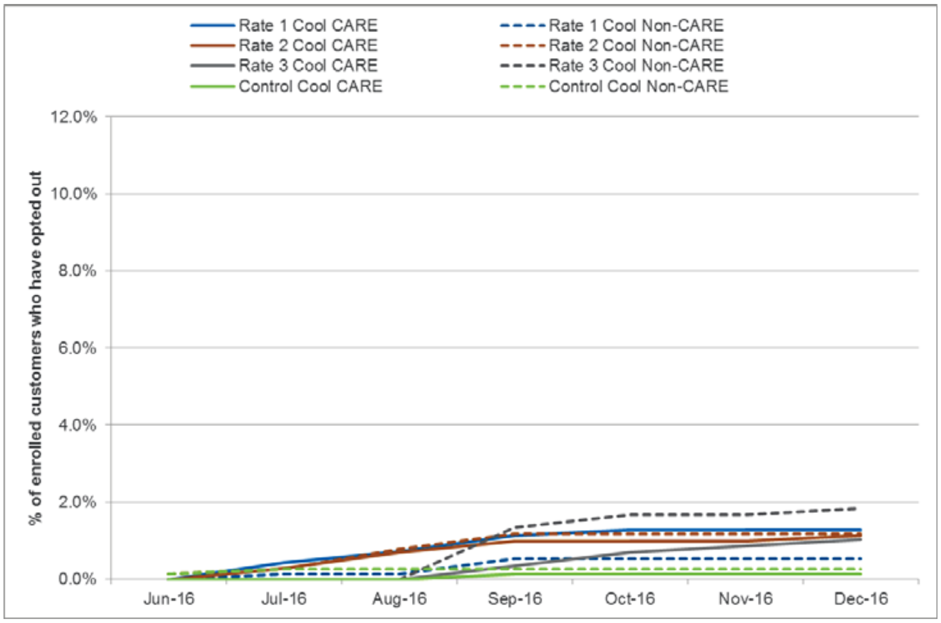
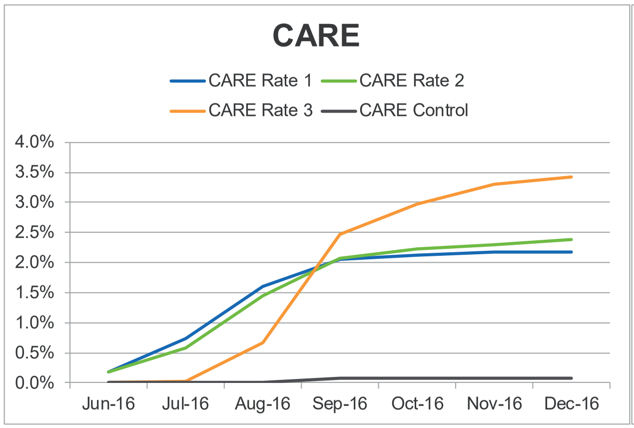
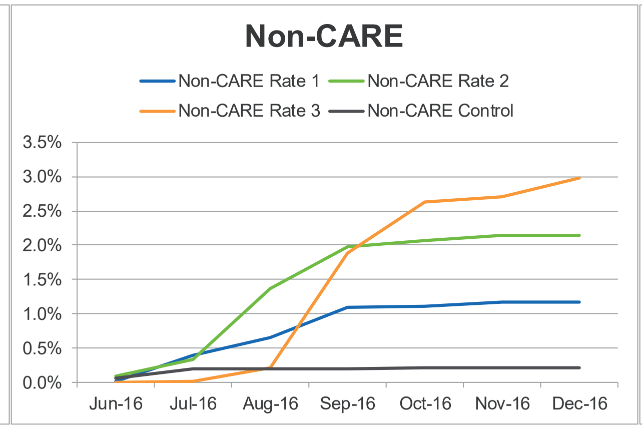
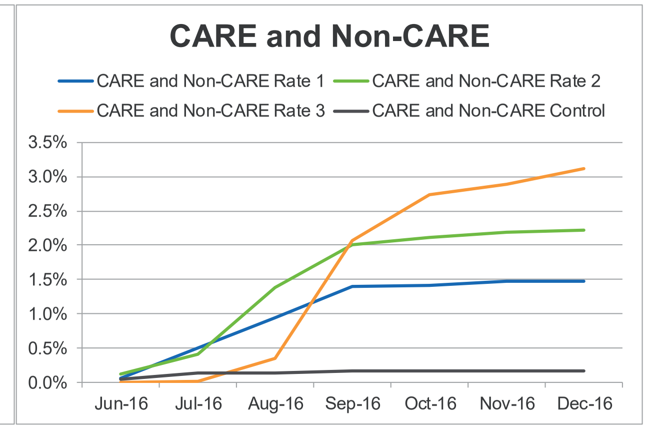


Figure 5.2-4 shows the cumulative percent of customers that opted out of each tariff for the CARE/FERA, non-CARE/FERA segments and for the total population across SCE's service territory as a whole. As seen, the cumulative percent of customers opting out was quite low for all rates and segments. The lowest cumulative percent opt out was for non-CARE/FARE customers on Rate 1 and the highest was for CARE/FERA customers on Rate 3. The opt out percentage was highest for Rate 3 for both CARE/FERA and non-CARE/FERA customers and for the population as a whole. Recall that this is the rate with no baseline credit. The cumulative opt-out rate also showed a very rapid increase once bills began to be issued. Nevertheless, even for this rate, the cumulative opt out percentage over the entire period was only roughly 3%.

Figure 5.2-4: Opt Outs by Rate and Customer Segment for the SCE Service Territory







Figures 5.2-5 thorugh 5.2-7 show the overall attrition rate over time for each climate region, customer segment, and TOU rate. As seen in the figures, the cumulative attrition is quite constant over time in the moderate and cool climate regions, but not in the hot climate region. Much of the attrition among CARE/FERA Rate 3 customers in the hot climate region is attributable to opt-outs, and overall attrition rates for this group reach nearly 18% by the end of 2016. This is concerning, as this segment and rate had fewer than 600 participants at the start of the pilot period. Enrollment forecasting of Rate 3 customers indicates that CARE/FERA and non-CARE/FERA customers in the hot climate region may drop below the originally designed optimal enrollment levels for the billing impact analysis. However, more recent power analysis has shown that slightly lower numbers may still be acceptable. Therefore, it is likely there won't be issues in estimating statistically significant billing impacts for those segments.

Overall attrition rates are below 14% for the moderate climate region and 10% for the cool climate region. As seen in Table 5.2-5, most attrition in these segments is attributable to account closures rather than opt-outs and ineligibilty.

Figure 5.2-5: SCE Attrition by Month – Hot Climate Region

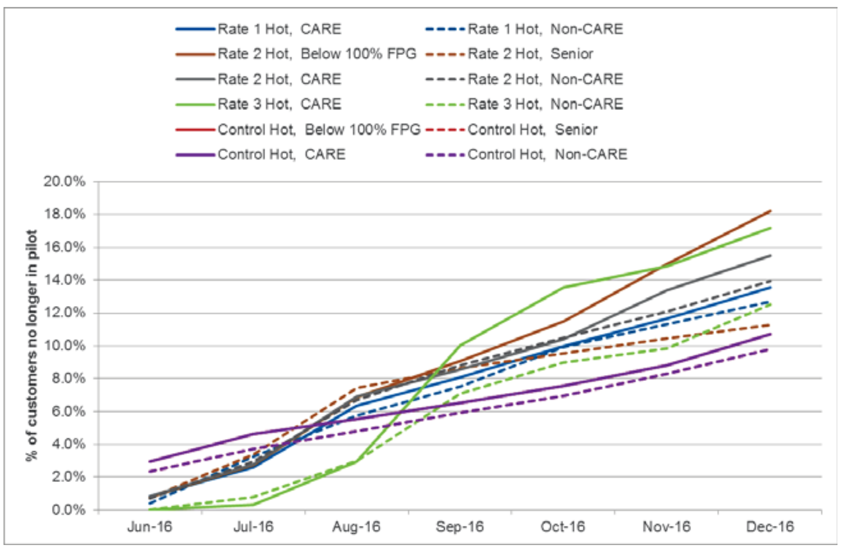


Figure 5.2-6: SCE Attrition by Month – Moderate Climate Region

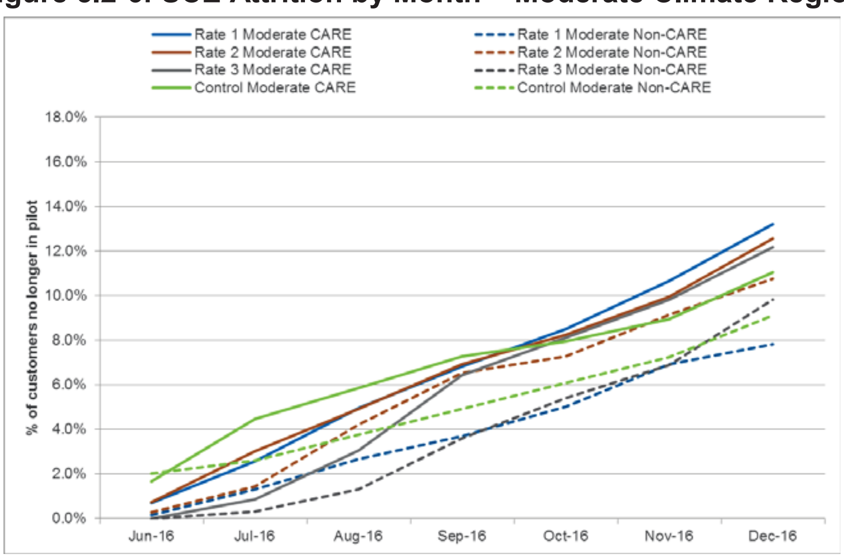
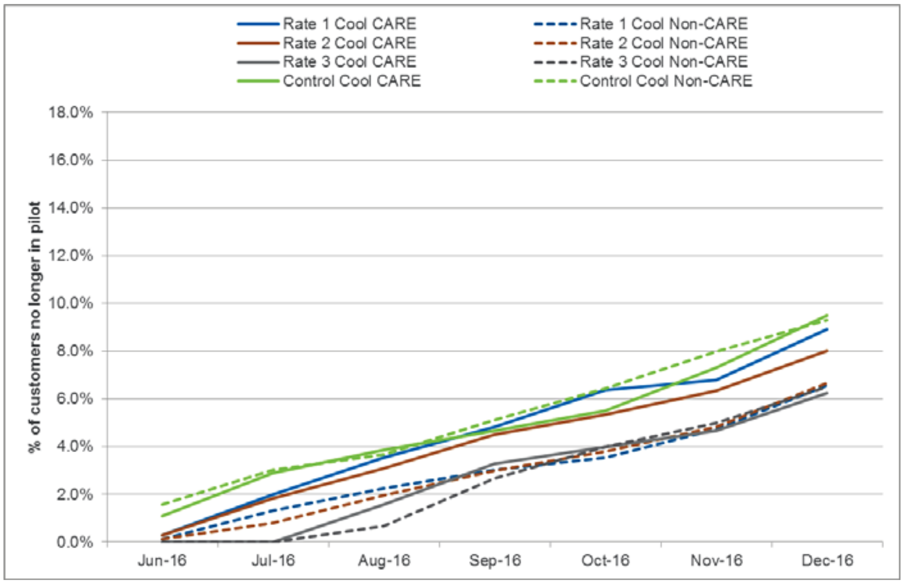


Figure 5.2-7: SCE Attrition by Month – Cool Climate Region



5.2.4 Pilot Outreach and Education

In late July, 2016, all TOU rate customers received a Seasonal Newsletter[89] tailored to their individual TOU rate plan, as well as to their household psychographic designation. "Green elites" and "connected" customers[90] received a postcard with a link to the online version of the Newsletter. The newsletters included a welcome message, timeline for the TOU Pilot, On-Peak, Off-Peak, and Super-Off-Peak definitions, as well as tips for reducing electricity usage and bills. All newsletters included customer profiles, stories and frequently asked questions that were tailored to the household's persona. Customers assigned to Rate 1 and 2 were provided with additional information on the baseline credit while Rate 3 customers were provided with more information on how to manage a three season TOU rate.

In addition, the 75% of customers chosen at random to receive the enhanced education treatment for each rate received a postcard at the end of August containing tips and reminders about their rate. Starting in Late September, the roughly 19% of participants in the enhanced education group who indicated at the time of enrollment that they were willing to receive information via text messages were sent additional reminders and tips via text message. So far, through early January, this group has been sent eight text messages but nearly all of these messages were sent too late to influence behavior during the summer evaluation period.

[89] A second seasonal newsletter was sent in October indicating that winter rates were going into effect and providing additional tips for managing usage in the fall and winter periods. A third letter will be sent in March. The October newsletter was not sent in time to influence behavior in the summer period.

[90] SCE segmented pilot participants using Acxiom's Energy Customer Dynamics (ECD) segmentation, as well as household demographic, usage, payment, and program behavior data. The ECD assigns households to one of 13 segments based on critical household energy buyer capacities, attitudes, and behaviors. SCE used 5 possible segments to categorize residential customers into three combined personas: Green Elites/Connected, Pragmatists/Disengaged, and Constrained. More details about these segments is contained in Appendix Volume I, Section 2.6.

Finally, in October, a social media event was conducted through Facebook encouraging customers to interact regarding their experiences on the rate and tips for managing usage. This social media event was rate specific and lasted for one week for each rate. Approximately 10% of customers in the enhanced education group were contacted about this event.

5.2.5 Operational Challenges and Lessons Learned

SCE was asked to share insights regarding operational lessons learned from implementing the pilot. These insights are summarized below.

Learning 1: Sufficient Time to Fully Build and Automate New Rates within SCE's Billing Systems Is Key for Optimal Customer Outcome

SCE implemented three rates for the opt-in TOU pilot. Rates 1 and 2 had similar tariff structures to existing SCE TOU rates (2 seasons and 3 peak periods) which enabled the Company to implement those pilot rates in the billing system in a timely manner.

However, Rate 3 includes three seasons (spring, summer, and winter) and five peak periods. This meant that SCE did not already have a tariff structure in place to facilitate implementation of Rate 3 into the billing system. As such, due to the limited timeframe available between developing Rate 3 and its implementation, SCE did not have sufficient time to build Rate 3 into the billing system and, instead, had to implement a manual process for billing customers. Due to insufficient time to completely test out the process, during the implementation of Rate 3 billing for customers, SCE experienced factor errors when merging current systems and the manual processes. The new billing process for Rate 3 also required hiring temporary staff to manually calculate, print, and mail Rate 3 bills. The significant learning curve for staff training and using SCE's billing system for the new staff resulted in additional delays and billing errors. All these operational challenges for Rate 3 had significant impacts on SCE's call center resulting in an increase in long and escalated calls.

Learning 2: Pretesting Helped Streamline and Reduce Costs in the Pilot

As part of recruitment pretesting, SCE tested response rates to two enrollment incentive amounts, $200 vs $300. Acceptance rates were also tested for recruitment letters sent via FedEx and standard U.S. post. The pretesting showed that the higher incentive and FedEx delivery did not generate sufficiently higher acceptance rates to justify the incremental cost. Hence, for the full rollout, SCE decided that the lower incentive and regular mail were sufficient. Ultimately, pretesting helped reduce costs significantly in the pilot and simplified the mailing process.

Learning 3: Payment History Is a Clue to Future Customer Behavior

Customers with a prior history of payment/credit issues required significantly more processing and handling times for SCE. When payments are past due, pilot participants are given a 60-day extension in order to bring their account current and remain on the pilot. These customers are contacted directly by billing representatives to provide this information. As part of the pilot, SCE has determined that customers with a prior history of payment issues have consistently required multiple issuances of 60-day extensions and therefore multiple direct handlings by billing representatives.

Learning 4: Improve Initial Customer Experience by Staggering Surveys for Future Rollouts

The opt-in TOU survey has had very high response rates, typically not seen in surveys conducted by utilities. However, due to this extremely high volume of customer participation on the survey, the survey site experienced significant bandwidth issues when initially launched. With 400-500 survey completes per hour being received in the launch week, this meant that some customers were unable to access and/or complete their surveys when the survey was initially launched. The bandwidth issues were resolved within days. However, SCE experienced significant impact to its customer call center with customers frustrated at not being able to complete the surveys right away. Hence, the initial survey experience was a challenging “customer experience”. Given these findings, it will be optimal for the second survey roll out to be staggered so that not all customers in the survey log-in at once.

Learning 5: We Need to Communicate effectively and Not Overwhelm Customers with Survey Communications

When customers filled out the survey online, information on survey completes was transmitted quickly to the company implementing the survey. However, there was some lag in the time between customers completing the survey online, and the time the paper surveys were mailed out. This was because there was additional time required for paper surveys to be printed and put into mailers for customers.

This meant that between the time that it took for the paper surveys to be prepared, mailed and received by customers, some customers had already filled out the survey online. While most customers were not affected by this lag, some customers who completed the online survey also received notification that a paper survey was forthcoming. Despite notification in the paper survey informing recipients that the paper survey was not required if the online survey had already been completed, this additional mail-out generated confusion for customers. As a result, SCE experienced impact to its call center.

For future roll outs and survey communication, SCE will be able to use customer preference data to tailor the survey communication to the mode preferred by customers.

Learning 6: ME&O Materials in Spanish Language had the Greatest Need Among Other In-Languages

Many of the ME&O materials were made available to customers in Spanish, Mandarin, Korean, and Vietnamese languages. The demand for Spanish-language materials was 11% while those for Mandarin, Korean and Vietnamese languages all combined was less than 6%. SCE learned that the in-language materials in Spanish were much more relevant to the Company’s customer base than the other language materials.

Learning 7: Engaging Customers through Social Media Was Not Effective

The three Facebook events held for the advanced treatment group did not generate significant customer engagement either with SCE or with other pilot participants. Rather, customers used this method primarily to vent their frustrations with the pilot. Thus far, it appears that social media is not a productive medium to engage customers in a meaningful dialogue with SCE.

Learning 8: More ME&O on Bill Protection is Necessary for Customers

SCE received feedback through its call centers that some customers don't fully understand the details of bill protection program. In future roll outs, SCE plans to take this into consideration and provide additional information regarding this topic so that customers are fully aware of what bill protection entails.

5.3 Load Impacts

This section summarizes the load impact estimates for the three rate treatments tested by SCE. The CPUC resolution approving SCE's pilot requires that load impacts be estimated for the peak and off-peak periods and for daily energy use for the following rates, customer segments, and climate regions:

- Seniors, CARE/FERA customers, non-CARE/FERA customers and households with incomes below 100% of FPG in SCE's hot climate region for Rate 2;
- For all three rates for all customers in SCE's service territory as a whole and for all customers in SCE's hot and moderate climate regions; and
- For CARE/FERA and non-CARE/FERA customers on each rate across SCE's service territory as a whole.

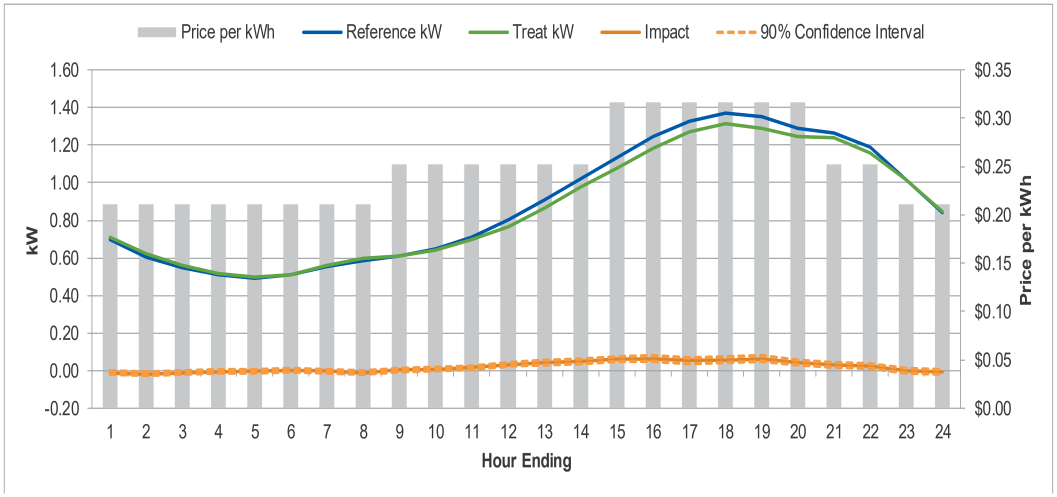
In addition to these required segments, Nexant estimated load impacts for CARE/FERA and non-CARE/FERA customers for each rate for each climate region. Load impacts are reported here for each rate period for the average weekday, average weekend and for the average monthly peak day for the summer months of July, August and September[91] for Rate 1 and Rate 2 and for August and September for Rate 3 (because of late enrollment for Rate 3), climate zone and customer segment summarized above. Underlying the values presented in the report are electronic tables that contain estimates for each hour of the day for each day type, segment and climate zone and for each month separately. These values are contained in Excel spreadsheets that are available upon request through the CPUC. Figure 5.3-1 shows an example of the content of these tables for SCE Rate 1 for all eligible customers in the service territory. Pull down menus in the upper left hand cover allow users to select different customer segments, climate regions, day types (e.g., weekdays, weekends, monthly peak day) and time period (individual months or the average of July, August and September).

[91] Estimates were not produced for the month of June for all three rates because enrollment changed dramatically from the beginning to the end of the month and the estimates would not be comparable to those for other months. July was excluded for Rate 3 for the same reason.

Figure 5.3-1: Example of Content of Electronic Tables Underlying Load Impacts Summarized in this Report (SCE Rate 1, Average Summer Weekday, All Customers)

Segment	All
Rate	Rate 1
Month	Summer 2016
Day Type	Average Weekday
Treated Customers	4,204

Period	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval	
Super On Peak	N/A	N/A	N/A	N/A	N/A	N/A
Peak	1.29	1.23	0.06	4.4%	0.05	0.06
Mid Peak	N/A	N/A	N/A	N/A	N/A	N/A
Off Peak	0.90	0.87	0.02	2.8%	0.02	0.03
Super Off Peak	0.64	0.64	-0.01	-1.2%	-0.01	0.00
Daily kWh	21.24	20.78	0.46	2.2%	0.40	0.52



Hour Ending	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval		Price	Period
1	0.70	0.71	-0.01	-1.7%	-0.02	0.00	$0.21	Super Off Peak
2	0.60	0.62	-0.02	-2.9%	-0.03	-0.01	$0.21	Super Off Peak
3	0.55	0.56	-0.01	-2.0%	-0.02	0.00	$0.21	Super Off Peak
4	0.51	0.52	-0.01	-1.1%	-0.01	0.00	$0.21	Super Off Peak
5	0.49	0.50	0.00	-0.9%	-0.01	0.00	$0.21	Super Off Peak
6	0.51	0.51	0.00	0.3%	-0.01	0.01	$0.21	Super Off Peak
7	0.55	0.56	0.00	-0.8%	-0.01	0.00	$0.21	Super Off Peak
8	0.58	0.60	-0.01	-2.2%	-0.02	0.00	$0.21	Super Off Peak
9	0.61	0.61	0.00	0.5%	-0.01	0.01	$0.25	Off Peak
10	0.65	0.64	0.01	1.0%	0.00	0.02	$0.25	Off Peak
11	0.71	0.70	0.02	2.2%	0.01	0.03	$0.25	Off Peak
12	0.80	0.77	0.03	4.0%	0.02	0.04	$0.25	Off Peak
13	0.91	0.87	0.04	4.5%	0.03	0.05	$0.25	Off Peak
14	1.02	0.98	0.05	4.7%	0.03	0.06	$0.25	Off Peak
15	1.14	1.08	0.06	5.4%	0.05	0.08	$0.32	Peak
16	1.25	1.19	0.06	5.0%	0.05	0.08	$0.32	Peak
17	1.32	1.27	0.05	4.0%	0.04	0.07	$0.32	Peak
18	1.37	1.31	0.06	4.1%	0.04	0.07	$0.32	Peak
19	1.35	1.29	0.06	4.6%	0.05	0.08	$0.32	Peak
20	1.29	1.25	0.04	3.2%	0.03	0.06	$0.32	Peak
21	1.27	1.24	0.03	2.3%	0.01	0.04	$0.25	Off Peak
22	1.19	1.16	0.03	2.1%	0.01	0.04	$0.25	Off Peak
23	1.02	1.02	0.00	-0.1%	-0.01	0.01	$0.21	Super Off Peak
24	0.84	0.85	-0.01	-1.0%	-0.02	0.00	$0.21	Super Off Peak
Daily kWh	**21.24**	**20.78**	**0.46**	**2.2%**	**0.40**	**0.52**	**N/A**	**N/A**

Because of the targeting and oversampling that was done for selected subpopulations in the hot climate region for Rate 2 and for CARE/FERA customers in all climate regions for all rates, as described in Tables 5.2-1 and 5.2-2 above, when aggregating to higher segment levels, it is necessary to weight the data. For example, when presenting load impact estimates for each climate zone, it is necessary to apply weights to the enrolled population of CARE/FERA and non-CARE/FERA customers because CARE/FERA customers were oversampled in each climate region. Similarly, when reporting estimates at the service territory level, it is necessary to apply weights to the climate region level estimates because roughly equal sized samples were drawn in each climate region. And in the hot climate region for Rate 2 in SCE's service territory, customers with incomes below 100% of FPG, with incomes between 100 and 200% of FPG and senior households were all oversampled. As such, when reporting load impacts for CARE/FERA and non-CARE/FERA households in the hot region for Rate 2, it is necessary to apply weights to the subpopulations so that, for example, households with incomes below 100% of FPG are not over represented in the CARE/FERA segment.

Table 5.3-1 shows the weights used when aggregating CARE/FERA and non-CARE/FERA customers within each climate region and when aggregating across climate regions to produce estimates at the service territory as a whole. The weights are based on the eligible population contained in each customer segment and climate region.

Table 5.3-1: Weights Used for Aggregating up to Climate Region and Service Territory for SCE

Segment		Eligible for Pilot Participation	Population Weight	Climate Region Weight
Hot	CARE	149,365	4%	39%
	Non-CARE	238,306	7%	61%
Moderate	CARE	449,100	13%	33%
	Non-CARE	899,164	27%	67%
Cool	CARE	430,815	13%	27%
	Non-CARE	1,191,502	35%	73%
Total		3,358,252	100%	n/a

Table 5.3-2 shows the weights that were used to aggregate up from the customer subpopulations to the CARE/FERA populations in the hot climate region for each group of customers assigned to rate and control conditions. These weights are based on the number of customers that were enrolled into the study from the general population recruitment category in the hot climate region. Since customers in the sub-segments (e.g., below 100% of FPG, 100 to 200% of FPG, seniors) contained in this general population group were not over or under sampled, the shares of each sub-segment in this group are conceptually analogous to the shares in the CARE/FERA and non-CARE/FERA segments contained in other climate regions.

The remainder of this section is organized by rate treatment—load impacts are presented for each relevant customer segment and climate region for each of the three rates. Following the summary for each rate, load impacts are compared across rates. This comparison is made only for the hours within each peak period that are common across all three rates (5 to 8 PM). Because the rates differ with respect to the length and timing of peak and off-peak periods, differences in load impacts across rates for any particular rate period may be due not only to differences in prices within the rate period but also due to differences in the length or timing of the rate periods.

As discussed at the outset of Section 5, in addition to the three rate treatments, SCE also recruited customers who were known to have purchased and installed a smart thermostat. The objective of this treatment group was to estimate load impacts for smart thermostat owners on TOU rates. Those who enrolled were randomly assigned only to Rate 1 and to the control group. Load impacts for these customers are presented in Section 5.3.1.

Table 5.3-2: Weights Used to Aggregate Sub-segments into CARE/FERA and Non-CARE/FERA Segments in SCE's Hot Climate Region

Assignment	FPG	Senior	CARE	Sample Proportion (SP)	Proportion in "General Population" (GP)	Weight (GP/SP)	Assignment	FPG	Senior	CARE	Sample Proportion (SP)	Proportion in "General Population" (GP)	Weight (GP/SP)
C	<100%	N	N	3.9%	5.7%	1.45	R2	<100%	N	N	3.9%	5.7%	1.46
			Y	15.2%	16.8%	1.10				Y	15.9%	16.8%	1.05
		Y	N	4.6%	2.5%	0.55			Y	N	4.6%	2.5%	0.55
			Y	12.0%	5.7%	0.48				Y	11.9%	5.7%	0.48
	100-200%	N	N	4.3%	5.8%	1.36		100-200%	N	N	3.9%	5.8%	1.48
			Y	11.6%	9.9%	0.85				Y	11.7%	9.9%	0.85
		Y	N	4.8%	4.9%	1.01			Y	N	5.1%	4.9%	0.96
			Y	9.0%	7.3%	0.81				Y	8.9%	7.3%	0.82
	200-250%	N	N	12.9%	19.8%	1.53		200-250%	N	N	13.4%	19.8%	1.48
			Y	3.2%	2.6%	0.82				Y	3.0%	2.6%	0.89
		Y	N	16.4%	16.8%	1.03			Y	N	15.0%	16.8%	1.12
			Y	2.0%	2.1%	1.05				Y	2.6%	2.1%	0.79
	>250%	N	N	12.9%	19.8%	1.53		>250%	N	N	13.4%	19.8%	1.48
			Y	3.2%	2.6%	0.82				Y	3.0%	2.6%	0.89
		Y	N	16.4%	16.8%	1.03			Y	N	15.0%	16.8%	1.12
			Y	2.0%	2.1%	1.05				Y	2.6%	2.1%	0.79
R1	<100%	N	N	4.2%	5.7%	1.37	R3	<100%	N	N	4.5%	5.7%	1.27
			Y	17.9%	16.8%	0.94				Y	19.0%	16.8%	0.88
		Y	N	2.4%	2.5%	1.04			Y	N	3.0%	2.5%	0.83
			Y	8.0%	5.7%	0.71				Y	8.0%	5.7%	0.72
	100-200%	N	N	6.3%	5.8%	0.92		100-200%	N	N	5.5%	5.8%	1.07
			Y	10.5%	9.9%	0.95				Y	9.7%	9.9%	1.02
		Y	N	3.7%	4.9%	1.31			Y	N	3.5%	4.9%	1.41
			Y	8.0%	7.3%	0.92				Y	7.4%	7.3%	0.99
	200-250%	N	N	16.6%	19.8%	1.19		200-250%	N	N	19.0%	19.8%	1.04
			Y	4.0%	2.6%	0.66				Y	2.9%	2.6%	0.92
		Y	N	16.1%	16.8%	1.05			Y	N	14.6%	16.8%	1.15
			Y	2.4%	2.1%	0.88				Y	3.0%	2.1%	0.69
	>250%	N	N	16.6%	19.8%	1.19		>250%	N	N	19.0%	19.8%	1.04
			Y	4.0%	2.6%	0.66				Y	2.9%	2.6%	0.92
		Y	N	16.1%	16.8%	1.05			Y	N	14.6%	16.8%	1.15
			Y	2.4%	2.1%	0.88				Y	3.0%	2.1%	0.69

5.3.1 Rate 1

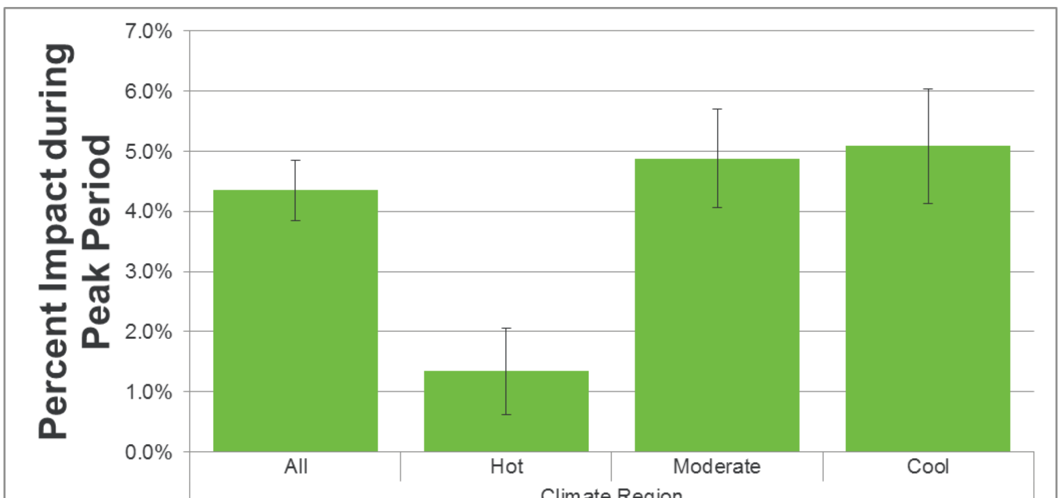
Key Findings for SCE Rate 1

On average, customers on Rate 1 reduced peak period usage by 4.4%. The average percent load reduction was lowest in the hot climate region and comparable in the modest and cool regions. The absolute load reduction was significantly higher in the moderate region compared with both the hot and cool regions. For the service territory as a whole, CARE/FERA customers had lower average load reductions than non-CARE/FERA customers.

SCE's Rate 1 is a three-period rate with a peak-period from 2 to 8 PM on weekdays. In summer, for electricity usage above the baseline quantity, prices equal roughly 34.5 ¢/kWh in the peak period, 27.6 ¢/kWh in the off-peak period and 23.0 ¢/kWh in the super off-peak period. Usage on the weekends is priced at the off-peak price from 8 AM to 10 PM and the super off-peak price from 10 PM to 8 AM. For usage below the baseline quantify, a credit of 9.9 ¢/kWh is applied.

Figure 5.3-2 shows the average peak period load reduction in percentage terms for Rate 1 for SCE's service territory as a whole and for each climate region. Figure 5.3.-3 shows the absolute load impacts for each region. The lines bisecting the top of each bar in the figures show the 90% confidence band for each estimate. If the confidence band includes 0, it means that the estimated load impacts are not statistically different from 0 at the 90% level of confidence. If they do overlap, it does not necessarily mean that the difference is not statistically significant.[92] In these cases, t-tests were calculated to determine whether the difference is statistically significant.[93]

Figure 5.3-2: Average Percent Load Impacts for Peak Period for SCE Rate 1[94]
(Positive values represent load reductions)



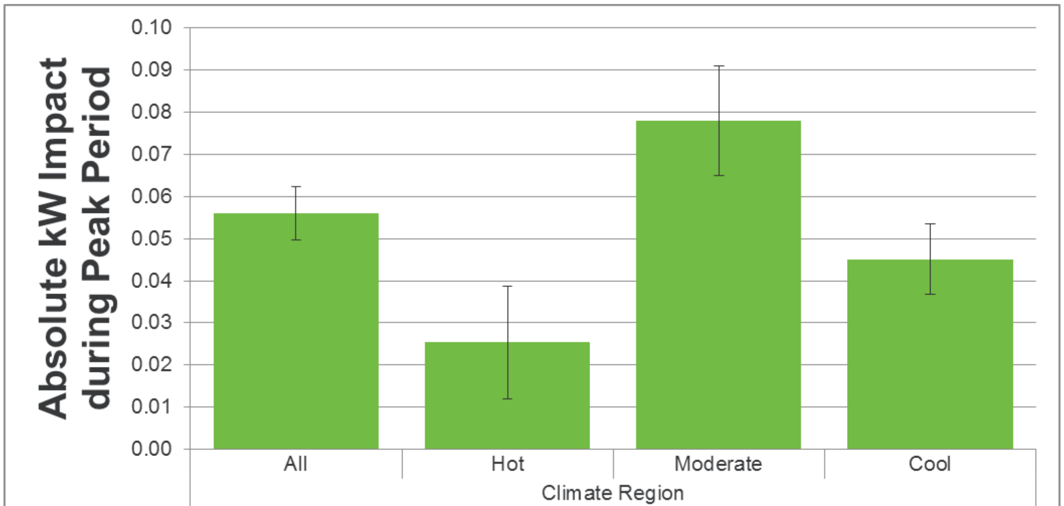
	All	Hot	Moderate	Cool
Percent Impact	4.4%	1.3%	4.9%	5.1%
kW Impact	0.06	0.03	0.08	0.05

[92] For further discussion of this topic, see https://www.cscu.cornell.edu/news/statnews/stnews73.pdf.

[93] The test was applied at the 90% confidence level which means that a t-value exceeding 1.65 indicates statistical significance.

[94] SCE Rate 1 summer impacts represent July through September 2016

Figure 5.3-3: Average Absolute Load Impacts for Peak Period for SCE Rate 1 (Positive values represent load reductions)



	All	Hot	Moderate	Cool
Percent Impact	4.4%	1.3%	4.9%	5.1%
kW Impact	0.06	0.03	0.08	0.05

As seen in the figures, all of the average peak-period load impacts for the service territory as a whole and for each climate region are statistically significant at the 90% level of confidence. On average, pilot participants across SCE's service territory on Rate 1 reduced peak-period electricity usage by 4.4%, or 0.06 kW, across the six-hour peak period from 2 to 8 PM. The average peak-period load reductions range from a high of 4.9% and 0.08 kW in the moderate climate region to a low of 1.3% and 0.03 kW in the hot climate region. In the cool climate region, load reductions equal 5.1% or 0.05 kW. The variation in absolute impacts across climate regions is much greater than the variation in percent impacts due in part to variation in electricity usage (e.g., the reference load) across regions.

There is a very significant difference in the pattern of load reductions across climate regions in SCE's service territory compared with PG&E's service territory. As discussed in Section 4.1, both the percentage and absolute impacts are significantly greater for customers in PG&E's hot climate region than in the moderate and cool regions. Indeed, the absolute load impacts during the peak period on weekdays in PG&E's hot region for Rate 1, for example, are nearly three times larger than in the moderate region. In contrast, SCE's peak period load reductions in the hot region are roughly one third as large as in the moderate region. The difference in absolute impacts between the moderate and cool regions is also large and statistically significant but the percentage impacts across the moderate and cool regions are the same. The difference between the absolute impacts in the hot and cool regions is also statistically significant and the impact in the hot regions is less than in the cool region.

A possible explanation for this strong contrast between the PG&E and SCE results may be the fact that SCE's Rate 1 is a three-period rate with the peak and shoulder periods spanning the hours from 8 AM until 10 PM, whereas PG&E's Rate 1 has the lowest prices in effect for 9 of those 14 hours. It is also the case that SCE's hot region is significantly hotter than PG&E's hot region. A population-weighted, three-year (2012, 2013 and 2014) average of the number of days with maximum temperatures above 98 degrees shows that SCE averaged 38.4 days a year with temperatures above this threshold while PG&E

averaged 28.6 days, a 34% difference. Additional evidence comes from a comparison of reference loads for the two regions. SCE households in the hot climate region in the three months from July through September had an average load from 8 AM to 10 PM equal to 1.54 kW and an average from 2 to 8 PM (the peak period in SCE's Rate 1) equal to 1.84 kW. The reference values for PG&E's hot region for the same hours are 1.19 kW and 1.52 kW, respectively. SCE's reference loads are roughly 25% higher in the hot region compared with PG&E's reference loads. The higher loads combined with many more hot days suggest greater use of air conditioning in SCE's hot region compared with PG&E's hot region. The need for greater air conditioning use combined with the fact that higher prices are in effect from 8 AM until 10 PM might mean that SCE's Rate 1 customers weren't willing to adjust their thermostats to a higher level over such a long time period as PG&E's customers were willing to do for the much shorter, high-priced period.

Table 5.3-3 shows the average percent and absolute load impacts for each rate period for weekdays and weekends and for the average monthly system peak day for the SCE service territory as a whole and for the participant population in each climate region. The percent reduction equals the load impact in absolute terms (kW) divided by the reference load. Shaded cells in the table contain load impact estimates that are not statistically significant at the 90% confidence level. The percentage and absolute values in the first row of Table 5.3-3, which represent the load impacts in the peak period on the average weekday, equal the values shown in Figures 5.3-2 and 5.3-3, discussed above.

The reference loads shown in Table 5.3-3 represent estimates of what customers on the TOU rate would have used if they had not responded to the price signals contained in the TOU tariff. As seen in the table, average hourly usage during the peak period is roughly 1.29 kW for the service territory as a whole, and around 0.88 kW over the 24 hour average weekday. In the hot climate region, average usage in the peak period is nearly 50% larger at 1.89 kW. Average usage in the moderate climate region is 1.60 kW and in the cool region it is 0.89 kW.

As discussed in Section 4.7.1, when examining the change in usage across rate periods, it is important to keep in mind that a change in any period could be the result of an overall decrease or increase in end-use consumption or due to shifting usage from one rate period to another (or both). As seen in the Table 5.3-3, on the average weekday, there were small but statistically significant load increases in the super off-peak period in the service territory as a whole and in the hot and moderate climate regions. In the cool climate region, there was no statistically significant change in average electricity use in the super off-peak period. All three climate regions and the territory as a whole saw statistically significant demand reductions in the off-peak period during all three day types.

A reduction in daily electricity use (depicted by positive values in the row labeled Day in the table) means that the combination of changes in use across all rate periods resulted in less electricity use for the day as a whole. As seen in Table 5.3-3, for the service territory as a whole, there was a 2.2% reduction in daily electricity use on the average weekday. In the moderate and cool climate regions, the estimated conservation effect equals 2.6%. In the hot climate region, increase in use in the super off-peak period offsets the reduction in electricity use in the peak and off-peak periods, so that the estimated daily reduction in electricity use is essentially zero and is not statistically significant.

While the daily reduction in electricity use for Rate 1 is small in percentage and absolute terms, this average is spread over 24 hours each day, so the average reduction in electricity use on weekdays equals roughly 0.46 kWh. Over three months, this adds up to about 28 kWh per customer. This is significantly greater than the PG&E estimate of roughly 16 kWh per household for the summer season. If this average conservation effect was provided under default conditions and, say, 90% of the eligible population of roughly 3.3 million customers in SCE's service territory remained on the rate, the total reduction in electricity use over the three month period would equal more than 95 GWh.

The reduction in electricity use in the off-peak period[95] was roughly half what it was during the peak period in percentage terms and approximately two-thirds less than the peak period reduction in absolute terms. This change was statistically significant for the service territory as a whole and in each climate region. The reductions in average usage between 8 AM and 10 PM on weekends, which is priced at the same rate as the weekday off-peak period, are similar to the weekday off-peak reductions.

The monthly system peak day estimates represent the average across the three weekdays, one each in July, August, and September, when SCE's system peaked in 2016. Reference loads are higher on these days than on the average weekday. For the service territory as a whole, the percent reduction in peak period loads, 4.5%, is similar to that on the average weekday (4.4%) and the absolute load reduction, 0.08, kW is greater than on the average weekday (0.06 kW).

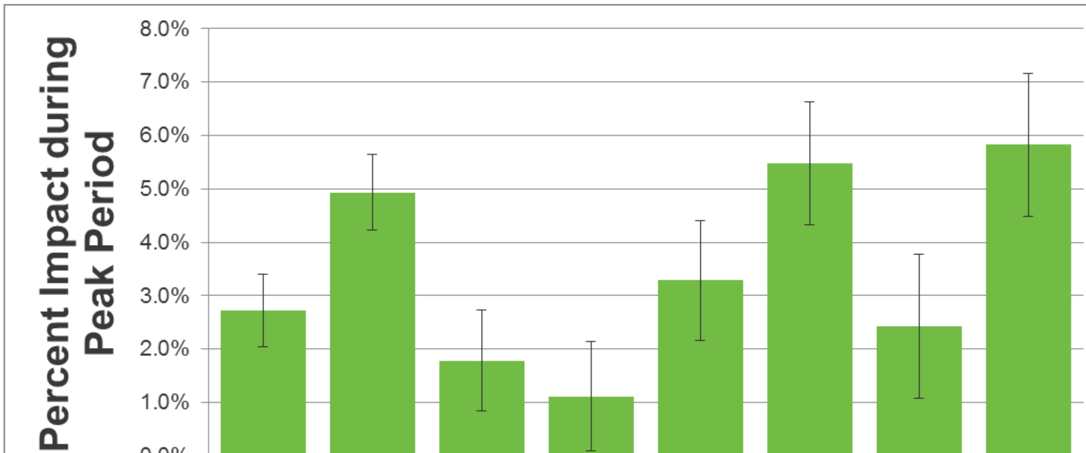
[95] Note that what SCE calls the off-peak period is the partial period in PG&E's three period rate and what SCE calls the super off-peak period is equivalent to PG&E's off-peak period.

Table 5.3-3: Rate 1 Load Impacts by Rate Period and Day Type (Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 1											
			All			Hot			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	2 PM to 8 PM	1.29	0.06	4.4%	1.89	0.03	1.3%	1.60	0.08	4.9%	0.89	0.05	5.1%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	0.90	0.02	2.8%	1.29	0.01	0.9%	1.02	0.04	3.7%	0.70	0.02	2.6%
	Super Off Peak	10 PM to 8 AM	0.64	-0.01	-1.2%	0.86	-0.03	-3.2%	0.71	-0.01	-1.5%	0.52	0.00	0.0%
	Day	All Hours	0.88	0.02	2.2%	1.26	0.00	-0.1%	1.04	0.03	2.6%	0.67	0.02	2.6%
Average Weekend	Off Peak	8 AM to 10 PM	1.09	0.03	2.5%	1.62	0.01	0.9%	1.29	0.05	4.0%	0.80	0.01	1.2%
	Super Off Peak	10 PM to 8 AM	0.62	0.00	-0.6%	0.88	-0.02	-1.8%	0.70	0.00	0.0%	0.50	0.00	-0.6%
	Day	All Hours	0.90	0.01	1.6%	1.31	0.00	0.1%	1.04	0.03	2.9%	0.67	0.00	0.6%
Monthly System Peak Day	Peak	2 PM to 8 PM	1.74	0.08	4.5%	2.04	0.09	4.5%	2.24	0.09	4.0%	1.25	0.07	5.3%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	1.17	0.04	3.4%	1.41	0.04	3.1%	1.43	0.03	2.3%	0.90	0.04	5.0%
	Super Off Peak	10 PM to 8 AM	0.75	-0.01	-0.7%	0.92	-0.03	-3.1%	0.88	-0.02	-1.9%	0.60	0.01	1.5%
	Day	All Hours	1.14	0.03	2.7%	1.36	0.03	1.9%	1.40	0.03	1.9%	0.86	0.04	4.1%

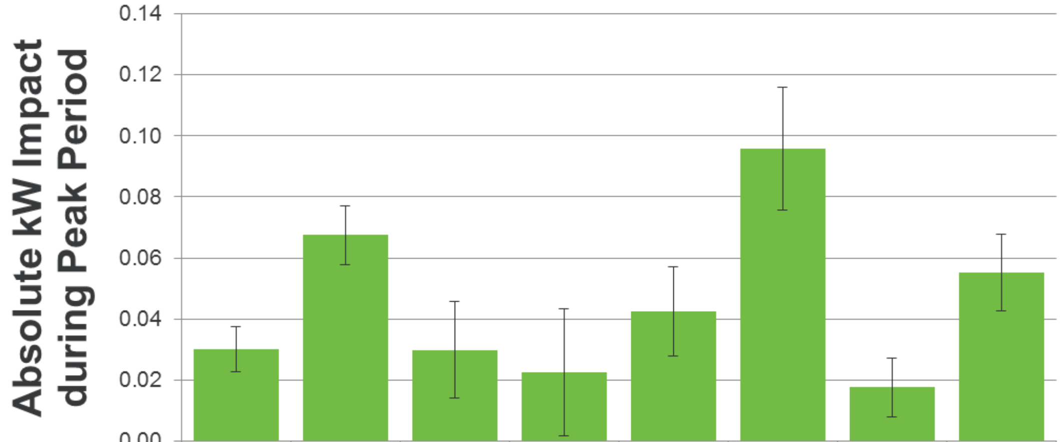
Figures 5.3-4 and 5.3-5, respectively, show the percentage and absolute peak period load impacts for Rate 1 for CARE/FERA and non-CARE/FERA customers for the service territory as a whole and for each climate region. In the moderate and cool climate regions, and the service territory as a whole, both the percent and absolute load impacts in the peak period are greater for non-CARE/FERA customers than for CARE/FERA customers. For example, in the cool climate region, the average weekday peak period reduction is 5.8% and 0.06 kW for non-CARE/FERA customers whereas for CARE/FERA customers, the average reduction is 2.4% or 0.02 kW, which is only about one third as much as for non-CARE/FERA customers. Load reductions in the hot climate region do not follow the same pattern and are much smaller than those in the cool and moderate climate regions, especially among non-CARE/FERA customers, with load reductions of 1.1% or 0.02 kW. In the hot region, there is no statistically significant difference in peak-period load reductions between CARE/FERA and non-CARE/FERA customers. Once again, this finding is quite different from what was seen in PG&E's service territory, where the contrast in load reductions between CARE/FERA and non-CARE/FERA customers was greatest in the hot climate region.

Figure 5.3-4: Average Percent Load Impacts for Peak Period for SCE Rate 1 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	2.7%	4.9%	1.8%	1.1%	3.3%	5.5%	2.4%	5.8%
Absolute Impact	0.03	0.07	0.03	0.02	0.04	0.10	0.02	0.06

Figure 5.3-5: Average Absolute Load Impacts for Peak Period for SCE Rate 1 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	2.7%	4.9%	1.8%	1.1%	3.3%	5.5%	2.4%	5.8%
Absolute Impact	0.03	0.07	0.03	0.02	0.04	0.10	0.02	0.06

Table 5.3-4 shows the estimated load impacts for each rate period and day type by climate zone and for the service territory as a whole for non-CARE/FERA customers and Table 5.3-5 shows the estimated values for CARE/FERA customers. For the service territory as a whole, non-CARE/FERA customers have average peak period loads that are larger than CARE/FERA customers (1.37 kW for non-CARE/FERA and 1.11 kW for CARE/FERA). This pattern is consistent across all three climate regions and for daily electricity usage on average summer weekdays.

For the service territory as a whole, both customer segments reduced average daily usage on weekdays. Non-CARE/FERA customers reduced their average daily electricity use by 2.7% while CARE/FERA reduced it by 0.6%. On weekends, non-CARE/FERA customers reduced electricity use by 2.1%, but CARE/FERA did not reduce their overall usage at all. Both groups of customers in the cool climate region reduced their average daily usage on average weekdays and the monthly system peak day. In the hot climate region, both non-CARE/FERA and CARE/FERA customers did not make statistically significant reductions in their average weekday energy use.

Table 5.3-4: Rate 1 Load Impacts by Rate Period and Day Type – Non-CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

Rate 1														
Day Type	Period	Hours	All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	2 PM to 8 PM	1.37	0.07	4.9%	2.03	0.02	1.1%	1.75	0.10	5.5%	0.95	0.06	5.8%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	0.95	0.03	3.5%	1.39	0.02	1.5%	1.11	0.05	4.6%	0.75	0.02	3.2%
	Super Off Peak	10 PM to 8 AM	0.67	-0.01	-0.9%	0.91	-0.04	-4.3%	0.76	0.00	-0.6%	0.54	0.00	-0.2%
	Day	All Hours	0.94	0.03	2.7%	1.35	0.00	-0.3%	1.13	0.04	3.5%	0.71	0.02	3.0%
Average Weekend	Off Peak	8 AM to 10 PM	1.17	0.03	2.9%	1.76	0.01	0.8%	1.42	0.07	4.6%	0.86	0.01	1.7%
	Super Off Peak	10 PM to 8 AM	0.65	0.00	0.0%	0.94	-0.02	-2.3%	0.75	0.01	1.5%	0.52	0.00	-0.8%
	Day	All Hours	0.95	0.02	2.1%	1.42	0.00	-0.1%	1.14	0.04	3.8%	0.72	0.01	0.9%
Monthly System Peak Day	Peak	2 PM to 8 PM	1.89	0.09	4.7%	2.19	0.11	5.0%	2.50	0.10	4.2%	1.36	0.07	5.4%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	1.26	0.05	4.3%	1.54	0.05	3.2%	1.58	0.05	3.1%	0.97	0.06	6.0%
	Super Off Peak	10 PM to 8 AM	0.79	0.00	0.0%	0.98	-0.04	-4.3%	0.95	0.00	-0.5%	0.63	0.01	1.9%
	Day	All Hours	1.22	0.04	3.3%	1.47	0.03	1.8%	1.55	0.04	2.6%	0.93	0.04	4.6%

Table 5.3-5: Rate 1 Load Impacts by Rate Period and Day Type – CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

Rate 1														
Day Type	Period	Hours	All, CARE			Hot, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	2 PM to 8 PM	1.11	0.03	2.7%	1.67	0.03	1.8%	1.29	0.04	3.3%	0.72	0.02	2.4%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	0.77	0.00	0.6%	1.12	0.00	-0.3%	0.84	0.01	1.2%	0.57	0.00	0.4%
	Super Off Peak	10 PM to 8 AM	0.56	-0.01	-1.8%	0.76	-0.01	-1.2%	0.61	-0.02	-3.8%	0.45	0.00	0.5%
	Day	All Hours	0.77	0.00	0.6%	1.11	0.00	0.2%	0.86	0.00	0.5%	0.56	0.01	1.1%
Average Weekend	Off Peak	8 AM to 10 PM	0.92	0.01	1.2%	1.40	0.02	1.2%	1.04	0.02	2.3%	0.63	0.00	-0.8%
	Super Off Peak	10 PM to 8 AM	0.55	-0.01	-2.0%	0.78	-0.01	-0.9%	0.59	-0.02	-4.0%	0.43	0.00	0.0%
	Day	All Hours	0.77	0.00	0.0%	1.14	0.01	0.6%	0.85	0.00	0.5%	0.55	0.00	-0.5%
Monthly System Peak Day	Peak	2 PM to 8 PM	1.40	0.05	3.8%	1.80	0.07	3.7%	1.72	0.06	3.5%	0.94	0.04	4.5%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	0.96	0.01	0.9%	1.21	0.04	2.9%	1.14	0.00	0.1%	0.70	0.01	1.2%
	Super Off Peak	10 PM to 8 AM	0.66	-0.02	-2.8%	0.81	-0.01	-0.8%	0.74	-0.04	-5.5%	0.51	0.00	0.2%
	Day	All Hours	0.95	0.01	0.9%	1.19	0.03	2.2%	1.12	0.00	-0.2%	0.68	0.01	2.1%

Table 5.3-6 shows the estimated load impacts for smart thermostat customers who were enrolled on Rate 1. As a reminder, these load reductions represent the total reduction for customers who had previously purchased smart thermostats and are on Rate 1 relative a control group of smart thermostat owners who are on the OAT. The impacts are not the incremental load impact of a smart thermostat for customers on a TOU rate relative to customers on a TOU rate who do not have a smart thermostat. These customers are distributed throughout the service territory and the vast majority are non-CARE/FERA customers. The average peak-period reference load for these households (1.98 kW) is more than 50% higher than the average for households in the service territory as a whole (1.29 kW). In spite of this much higher reference load, the average load reduction for smart thermostat households during the peak period, 3% or 0.06 kW, was very similar to the average for all households in the service territory (4.4% or 0.06 kW). Smart thermostat households reduced average daily use by 1.4%, or 0.02 kW, and had comparable reductions in daily usage on weekends. Load reductions on the monthly system peak day were comparable to weekday reductions but were not statistically significant, primarily because of the much larger standard errors resulting from the small sample size combined with the small number of observations per customer for the monthly peak day. Nest and SCE plan to work together in the upcoming summer season to offer Nest's Time of Savings support service which is designed to help customers on TOU rates to optimize their energy use.

Table 5.3-6: Rate 1 Load Impacts by Rate Period and Day Type – Technology Customers (Positive values represent load reductions, negative values represent load increases)

Rate 1					
Day Type	Period	Hours	Technology		
			Ref. kW	Impact kW	% Impact
Average Weekday	Peak	2 PM to 8 PM	1.98	0.06	3.0%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	1.31	0.04	3.1%
	Super Off Peak	10 PM to 8 AM	0.92	-0.02	-2.6%
	Day	All Hours	1.32	0.02	1.4%
Average Weekend	Off Peak	8 AM to 10 PM	1.66	0.04	2.5%
	Super Off Peak	10 PM to 8 AM	0.89	-0.01	-0.7%
	Day	All Hours	1.34	0.02	1.6%
Monthly System Peak Day	Peak	2 PM to 8 PM	2.84	0.04	1.3%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	1.75	0.03	2.6%
	Super Off Peak	10 PM to 8 AM	1.10	-0.02	-1.7%
	Day	All Hours	1.75	0.01	0.6%

5.3.2 Rate 2

Key Findings for SCE Rate 2

On average, customers on Rate 2 reduced peak period usage by 4.2%. Percentage and absolute load impacts are more similar across climate regions than for Rate 1. In the hot and cool climate regions, there were no statistically significant difference in load reductions between CARE/FERA and non-CARE/FERA customers but in the moderate region, non-CARE/FERA load reductions were significantly greater than CARE/FERA load reductions. Senior households and households with incomes below 100% of FPG in the hot climate region had load reductions similar to those of the general population in the hot climate region.

SCE's Rate 2 differs from Rate 1 in several important ways. While both rates have three rate periods on summer weekdays, the Rate 2 peak period is only three hours long, from 5 to 8 PM, compared to the six-hour peak period for Rate 1. The Rate 2 peak period price is 53.3 ¢/kWh, which is much greater than the Rate 1 peak price of 34.5 ¢/kWh. The structures of Rate 1 and Rate 2 are identical on weekends, but Rate 2 has a lower super off-peak price at 17.3 ¢/kWh (compared to 23.0 ¢/kWh for Rate 1). The off-peak prices are similar between the two rates, 27.6 ¢/kWh for Rate 1 and 29.3 ¢/kWh for Rate 2. For usage below the baseline quantify, a credit of 9.9 ¢/kWh is applied in both cases.

Figures 5.3-6 and 5.3-7 show the percent and absolute load impacts for the weekday peak period for Rate 2 for SCE's service territory as a whole and for each climate region. Percent and absolute impacts for the service territory as a whole, 4.2% and 0.06 kW, are very similar to those for Rate 1 (4.4% and 0.6 kW) despite the fact that the Rate 2 peak period is half that of Rate 1. The average weekday peak-period load reduction for customers in the hot climate region on Rate 2, 3.1% and 0.06 kW, are over twice that for Rate 1. A possible explanation for this difference is that customers in this hot region are more willing to adjust their air conditioning usage during the shorter, Rate 2 peak period than in the longer Rate 1 peak period. Customers in the moderate and cool climate regions reduced their electricity usage by slightly less than their counterparts on Rate 1.

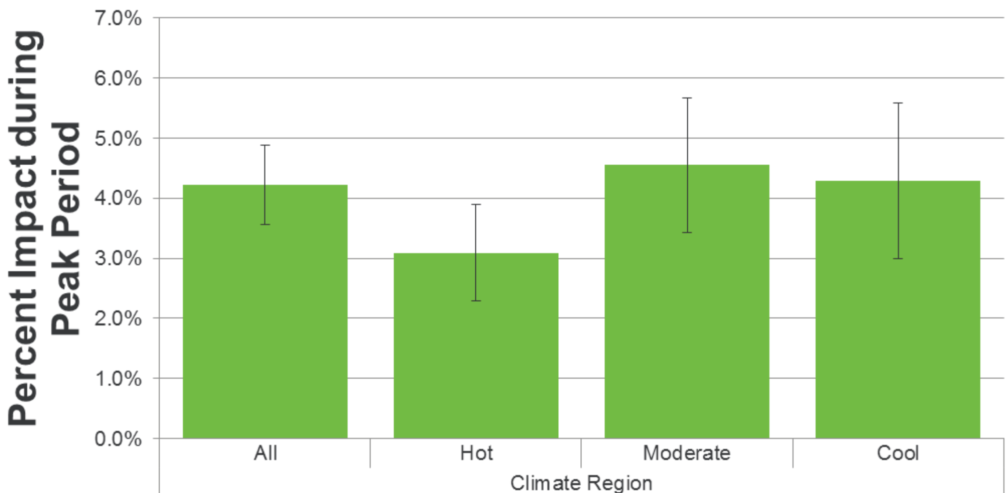
Looking at the pattern of load impacts across climate regions for customers on Rate 2, the difference in percentage impacts in the hot and moderate regions is statistically significant and the moderate impact percentage is greater than the hot percentage impact. None of the other pairwise comparisons are statistically different. For absolute load impacts, the average impacts in the hot and moderate regions are not statistically different, nor is the difference in impacts between the hot and cool regions. However, the different between the moderate and cool regions is statistically significant.

Table 5.3-7 contains load impact estimates for each rate period and day type for Rate 2. For the service territory as a whole, daily electricity usage was similar on average summer weekdays and weekends, 0.88 kW and 0.90 kW. Reductions in daily electricity use were quite similar on weekdays and weekends. Electricity use and impacts were the largest on monthly system peak days, with load reductions of about 2.4% or 0.03 kW.

When the daily reduction in electricity use for Rate 2 is spread over 24 hours each day, the average reduction in electricity use on weekdays equals roughly 0.24 kWh. Over three months, this adds up to about 14 kWh per customer. This is slightly less than the PG&E estimate of roughly 16 kWh per household for the summer season. If this average conservation effect was provided under default conditions and, say, 90% of the eligible population of roughly 3.3 million customers in SCE's service territory remained on the rate, the total reduction in electricity use over the three month period would equal more than 47 GWh.

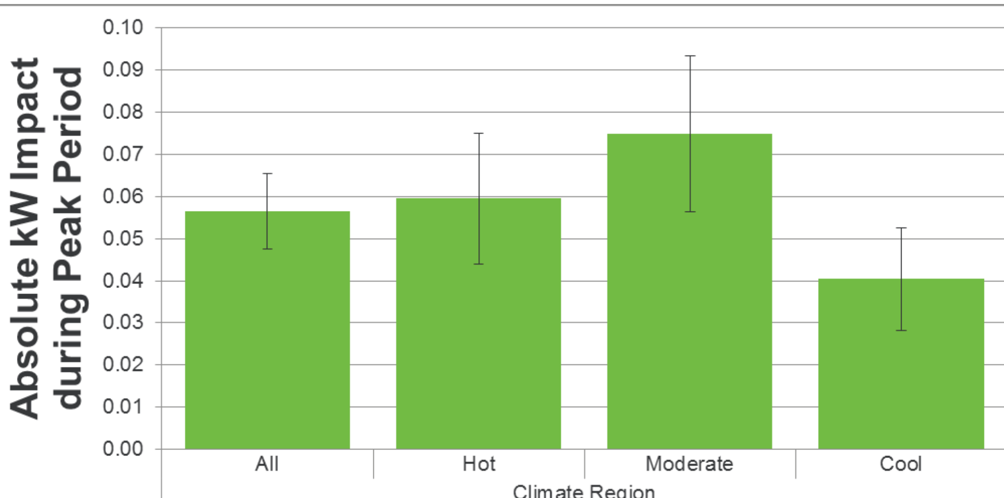
Customers in every climate region provided statistically significant peak and off-peak demand reductions for Rate 2 during all three day types. Customers in the hot and moderate climate regions increased their electricity use during the super off-peak period on weekdays and weekends, which could indicate load shifting or increased consumption of selected end uses during the lower priced period.

Figure 5.3-6: Average Percent Load Impacts for Peak Period for SCE Rate 2[96] (Positive values represent load reductions)



	All	Hot	Moderate	Cool
Percent Impact	4.2%	3.1%	4.5%	4.3%
kW Impact	0.06	0.06	0.07	0.04

Figure 5.3-7: Average Absolute Load Impacts for Peak Period for SCE Rate 2 (Positive values represent load reductions)



	All	Hot	Moderate	Cool
Percent Impact	4.2%	3.1%	4.5%	4.3%
kW Impact	0.06	0.06	0.07	0.04

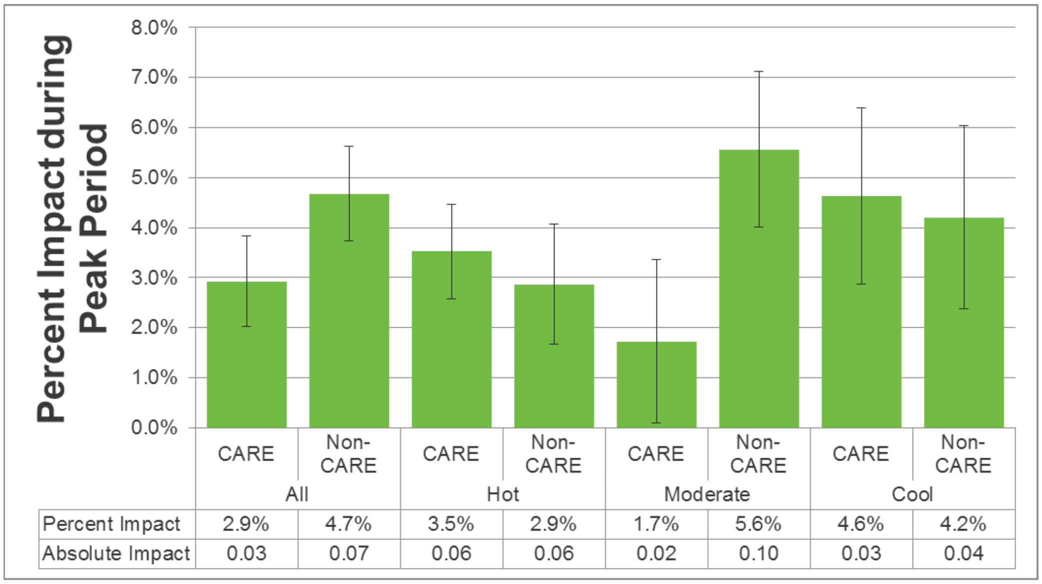
96 SCE Rate 2 summer impacts represent July through September 2016

Table 5.3-7: Rate 2 Load Impacts by Rate Period and Day Type (Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 2											
			All			Hot			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	5 PM to 8 PM	1.34	0.06	4.2%	1.93	0.06	3.1%	1.65	0.07	4.5%	0.94	0.04	4.3%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	0.99	0.03	2.6%	1.44	0.03	1.8%	1.16	0.04	3.0%	0.73	0.02	2.3%
	Super Off Peak	10 PM to 8 AM	0.64	-0.01	-1.9%	0.86	-0.01	-1.7%	0.71	-0.03	-3.7%	0.52	0.00	0.0%
	Day	All Hours	0.88	0.01	1.5%	1.26	0.01	1.0%	1.04	0.01	1.4%	0.67	0.01	1.9%
Average Weekend	Off Peak	8 AM to 10 PM	1.09	0.03	2.4%	1.62	0.02	1.2%	1.29	0.03	2.6%	0.80	0.02	2.8%
	Super Off Peak	10 PM to 8 AM	0.62	-0.01	-1.6%	0.88	-0.01	-1.2%	0.70	-0.02	-2.9%	0.50	0.00	-0.3%
	Day	All Hours	0.90	0.01	1.3%	1.31	0.01	0.5%	1.04	0.01	1.1%	0.67	0.01	1.8%
Monthly System Peak Day	Peak	5 PM to 8 PM	1.78	0.09	5.0%	2.08	0.09	4.2%	2.27	0.12	5.2%	1.31	0.07	5.1%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	1.31	0.04	3.0%	1.57	0.04	2.4%	1.64	0.05	2.8%	0.98	0.03	3.5%
	Super Off Peak	10 PM to 8 AM	0.75	-0.01	-0.7%	0.92	-0.01	-1.6%	0.88	-0.03	-2.9%	0.60	0.01	2.3%
	Day	All Hours	1.14	0.03	2.4%	1.36	0.02	1.6%	1.40	0.03	1.8%	0.86	0.03	3.4%

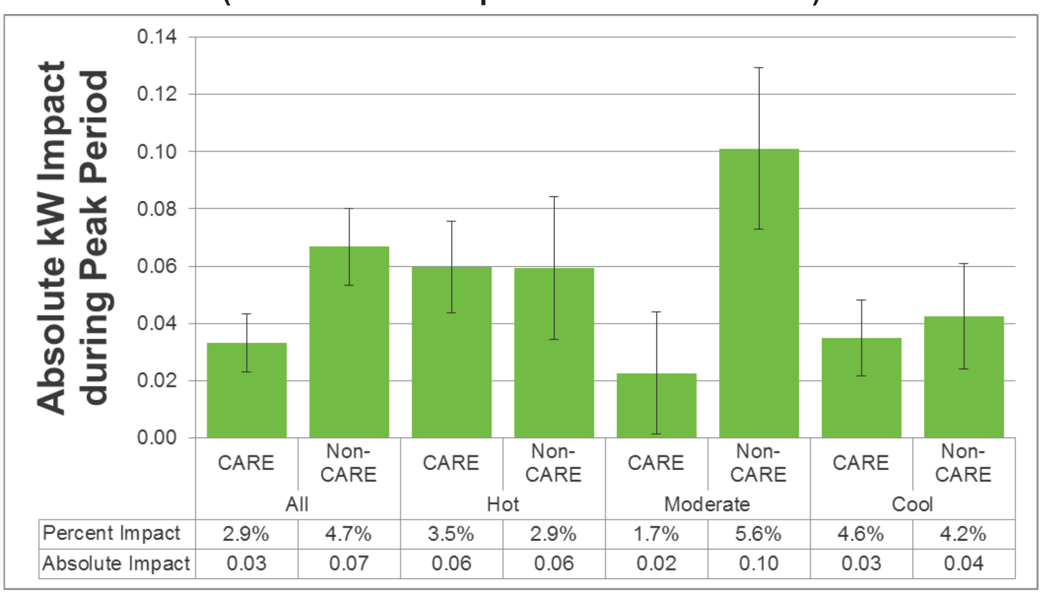
Figures 5.3-8 and 5.3-9 show the estimated peak period load impacts for Rate 2 for CARE/FERA and non-CARE/FERA households for the service territory as a whole and for each climate region. Except in the moderate climate region, there were no significant differences in load reductions between CARE/FERA and non-CARE/FERA customers. In the moderate climate region, non-CARE/FERA customers had the greatest reduction in peak-period energy use at 5.6% and 0.10 kW.

Figure 5.3-8: Average Percent Load Impacts for Peak Period for SCE Rate 2 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	2.9%	4.7%	3.5%	2.9%	1.7%	5.6%	4.6%	4.2%
Absolute Impact	0.03	0.07	0.06	0.06	0.02	0.10	0.03	0.04

Figure 5.3-9: Average Absolute Load Impacts for Peak Period for SCE Rate 2 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	2.9%	4.7%	3.5%	2.9%	1.7%	5.6%	4.6%	4.2%
Absolute Impact	0.03	0.07	0.06	0.06	0.02	0.10	0.03	0.04

Tables 5.3-8 and 5.3-9 show the load impacts for non-CARE/FERA and CARE/FERA customers, respectively, for each rate period and day-type. Once again, the values in the first row of each table are the same as those found in Figures 5.3-8 and 5.3-9. For the service territory as a whole, non-CARE/FERA customers have higher peak period usage, 1.43 kW, than CARE/FERA customers, 1.13 kW. Daily consumption is also greater for non-CARE/FERA customers than for CARE/FERA customers on Rate 2. However, both groups were able to reduce their average daily energy use by about 1% or more on weekends and weekdays. Both groups in each climate region were also able to reduce usage during the off-peak (e.g., shoulder) period and both increased usage during the super off-peak period.

Table 5.3-8: Rate 2 Load Impacts by Rate Period and Day Type – Non-CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

			Rate 2											
			All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
Day Type	Period	Hours	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	5 PM to 8 PM	1.43	0.07	4.7%	2.07	0.06	2.9%	1.82	0.10	5.6%	1.01	0.04	4.2%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	1.05	0.03	2.6%	1.55	0.02	1.4%	1.27	0.04	3.3%	0.78	0.02	2.3%
	Super Off Peak	10 PM to 8 AM	0.67	-0.01	-1.8%	0.91	-0.02	-2.5%	0.76	-0.03	-3.5%	0.54	0.00	0.3%
	Day	All Hours	0.94	0.02	1.7%	1.35	0.01	0.6%	1.13	0.02	1.8%	0.71	0.01	2.0%
Average Weekend	Off Peak	8 AM to 10 PM	1.17	0.03	2.6%	1.76	0.01	0.7%	1.42	0.04	2.9%	0.86	0.03	2.9%
	Super Off Peak	10 PM to 8 AM	0.65	-0.01	-1.6%	0.94	-0.02	-1.9%	0.75	-0.02	-2.9%	0.52	0.00	-0.2%
	Day	All Hours	0.95	0.01	1.4%	1.42	0.00	0.0%	1.14	0.01	1.3%	0.72	0.01	2.0%
Monthly System Peak Day	Peak	5 PM to 8 PM	1.95	0.11	5.5%	2.23	0.09	4.2%	2.56	0.16	6.4%	1.43	0.07	4.8%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	1.42	0.04	3.0%	1.70	0.04	2.6%	1.81	0.05	2.6%	1.06	0.04	3.6%
	Super Off Peak	10 PM to 8 AM	0.79	0.00	-0.5%	0.98	-0.03	-2.8%	0.95	-0.03	-3.2%	0.63	0.02	3.1%
	Day	All Hours	1.22	0.03	2.5%	1.47	0.02	1.4%	1.55	0.03	1.9%	0.93	0.03	3.7%

Table 5.3-9: Rate 2 Load Impacts by Rate Period and Day Type – CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

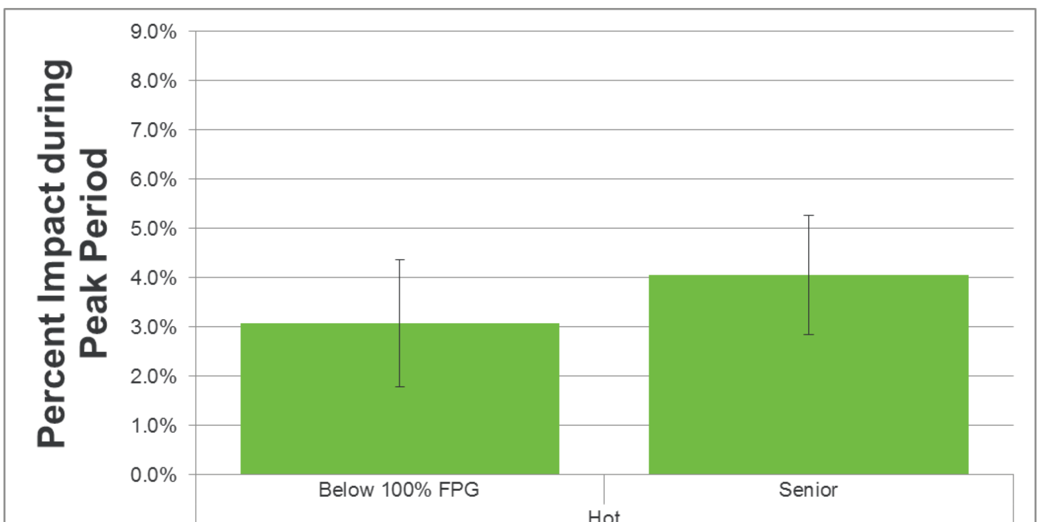
			Rate 2											
Day Type	Period	Hours	All, CARE			Hot, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	5 PM to 8 PM	1.13	0.03	2.9%	1.70	0.06	3.5%	1.30	0.02	1.7%	0.75	0.03	4.6%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	0.85	0.02	2.4%	1.26	0.03	2.4%	0.96	0.02	2.4%	0.60	0.01	2.4%
	Super Off Peak	10 PM to 8 AM	0.56	-0.01	-2.2%	0.76	0.00	0.0%	0.61	-0.02	-4.0%	0.45	0.00	-0.9%
	Day	All Hours	0.77	0.01	1.1%	1.11	0.02	1.9%	0.86	0.00	0.4%	0.56	0.01	1.7%
Average Weekend	Off Peak	8 AM to 10 PM	0.92	0.02	2.0%	1.40	0.03	2.2%	1.04	0.02	1.8%	0.63	0.01	2.2%
	Super Off Peak	10 PM to 8 AM	0.55	-0.01	-1.5%	0.78	0.00	0.3%	0.59	-0.02	-3.0%	0.43	0.00	-0.5%
	Day	All Hours	0.77	0.01	0.9%	1.14	0.02	1.6%	0.85	0.00	0.4%	0.55	0.01	1.3%
Monthly System Peak Day	Peak	5 PM to 8 PM	1.41	0.05	3.4%	1.84	0.07	4.0%	1.69	0.02	1.4%	0.97	0.06	6.6%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	1.08	0.03	3.1%	1.36	0.03	2.0%	1.30	0.05	3.5%	0.75	0.02	3.1%
	Super Off Peak	10 PM to 8 AM	0.66	-0.01	-1.2%	0.81	0.01	0.9%	0.74	-0.02	-2.1%	0.51	0.00	-0.8%
	Day	All Hours	0.95	0.02	1.9%	1.19	0.02	2.1%	1.12	0.02	1.5%	0.68	0.02	2.5%

As discussed earlier in this section, certain groups were oversampled and assigned to Rate 2 in SCE's service territory. The Commission's Resolution approving SCE's pilots required that load impacts be estimated for Rate 2 in the hot climate region for senior households and for households with average incomes below 100% of FPG. Figure 5.3-10 shows the load reduction during the peak period on average weekdays for each of these customer segments and Figure 5.3-11 shows the load impacts in absolute terms. Table 5.3-9 shows the estimated values for other rate periods and day types for each segment.

The reduction in peak-period electricity use was similar for these two segments and the observed differences were not statistically significant even though, in absolute terms, seniors reduced load by 0.08 kW and the low income group reduced load by 0.05 kW. Load impacts for customers with incomes below 100% of FPG, 3.1% or 0.05 kW, were similar to those for the hot climate region population as a whole, 3.1% or 0.06 kW, as were the load reductions for senior households. Senior CARE/FERA and non-CARE/FERA had very similar percentage load reductions (3.9% and 4.2% respectively). The absolute load reductions for CARE/FERA and non-CARE/FERA senior households were 0.06 and 0.09, respectively, although this difference was not statistically significant. It is worth noting in Table 5.3-10 that senior households had average peak period usage of 1.91 kW, which is nearly identical to the average usage for the population as a whole in the hot climate region (1.93 kW as seen in Table 5.3-6). Low income household reference loads during the peak period averaged 1.62 kW.

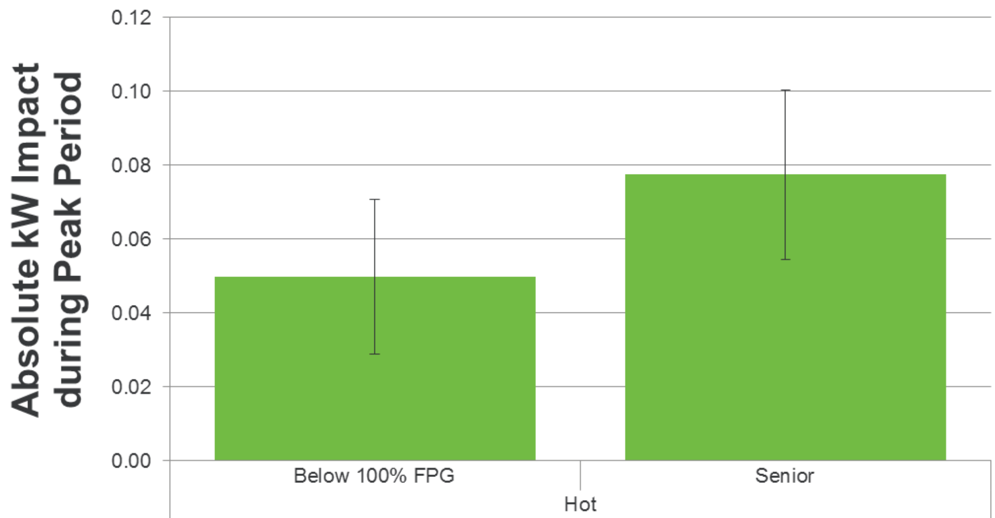
Senior households and households with incomes below 100% of FPG were both able to reduce weekday energy consumption by over 1%. Senior households have average daily demand (1.23 kW) on weekdays compared to customers with incomes below 100% of FPG (1.08 kW). Load reductions were significant in the off-peak periods on average weekdays and monthly system peak days for both groups. On the average weekend, customers with incomes below 100% of FPG did not significantly reduce their daily energy consumption due to their increased demand in the super off-peak period.

Figure 5.3-10: Average Percent Load Impacts in the Peak Period on Weekdays for SCE Rate 2 for Senior Households and Households with Incomes Below 100% of FPG (Positive values represent load reductions)



	Below 100% FPG	Senior
Percent Impact	3.1%	4.1%
Absolute Impact	0.05	0.08

Figure 5.3-11: Average Absolute Load Impacts in the Peak Period on Weekdays for SCE Rate 2 for Senior Households and Households with Incomes Below 100% of FPG (Positive values represent load reductions)



	Below 100% FPG	Senior
Percent Impact	3.1%	4.1%
Absolute Impact	0.05	0.08

Table 5.3-10: Rate 2 Load Impacts by Rate Period and Day Type for Senior Households and Households with Incomes Below 100% of FPG (Positive values represent load reductions, negative values represent load increases)

Rate 2								
Day Type	Period	Hours	Hot, Below 100% FPG			Hot, Senior		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	5 PM to 8 PM	1.62	0.05	3.1%	1.91	0.08	4.1%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	1.22	0.03	2.3%	1.46	0.02	1.4%
	Super Off Peak	10 PM to 8 AM	0.77	-0.01	-1.6%	0.78	-0.01	-0.8%
	Day	All Hours	1.08	0.01	1.3%	1.23	0.02	1.4%
Average Weekend	Off Peak	8 AM to 10 PM	1.35	0.02	1.4%	1.60	0.02	1.4%
	Super Off Peak	10 PM to 8 AM	0.79	-0.01	-1.8%	0.80	0.00	0.0%
	Day	All Hours	1.12	0.00	0.4%	1.27	0.01	1.0%
Monthly System Peak Day	Peak	5 PM to 8 PM	1.74	0.07	4.1%	2.05	0.10	5.1%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	1.31	0.04	3.4%	1.60	0.02	1.4%
	Super Off Peak	10 PM to 8 AM	0.82	-0.01	-0.6%	0.85	-0.01	-1.4%
	Day	All Hours	1.16	0.03	2.4%	1.34	0.02	1.4%

5.3.3 Rate 3

Key Findings for SCE Rate 3

SCE's Rate 3 differs from Rates 1 and 2 in that it does not include a baseline credit. Average peak period load reductions, at 2.7%, were lower than for the other two rates. Because Rate 3 customers were enrolled later, average load impacts represent only the months of August and September rather than July through September. Percent load reductions were highest in the cool climate region and lowest in the moderate region. Absolute load reductions were similar in the hot and cool regions. For the service territory as a whole, there was no statistically significant difference in percent load reductions between CARE/FERA and non-CARE/FERA customers but absolute load reductions for CARE/FERA customers were lower than for non-CARE/FERA customers.

SCE's Rate 3 also has three rate periods on summer weekdays, and two rate periods on summer weekends. For this tariff, SCE refers to the highest price period during weekdays as the super peak period, which is five hours long, from 4 to 9 PM, with a price of 37.0 ¢/kWh for non-CARE/FERA customers. While this price is greater than the Tier 2 peak price for Rate 1 and smaller than the Tier 2 price for Rate 2 but these prices are not directly comparable because Rate 3 does not include a baseline credit like Rates 1 and 2. As such, average prices for Rate 3 may be higher for low use customers and lower for high use customers than Rate 1 and 2 average prices. The Rate 3 peak period (or shoulder period in this instance) runs from 11 AM to 4 PM and 9 to 11 PM, which is significantly shorter than the Rate 2 shoulder period and is the same length as the Rate 1 shoulder period but covers different hours.

It should be noted that the load impacts for Rate 3 represent the average for the months of August and September only, not the July through September period underlying the Rate 1 and 2 analyses. This is because Rate 3 customers were enrolled roughly a month later than those assigned to Rates 1 and 2 due to the manual billing process required to produce bills for the more complex Rate 3. The shorter estimation period also means that the confidence bands around the load impact estimates are wider for Rate 3 than for the other rates. As such, it is harder to tell whether the estimate impacts, or the difference in impacts across climate regions and customer segments, are statistically significant.

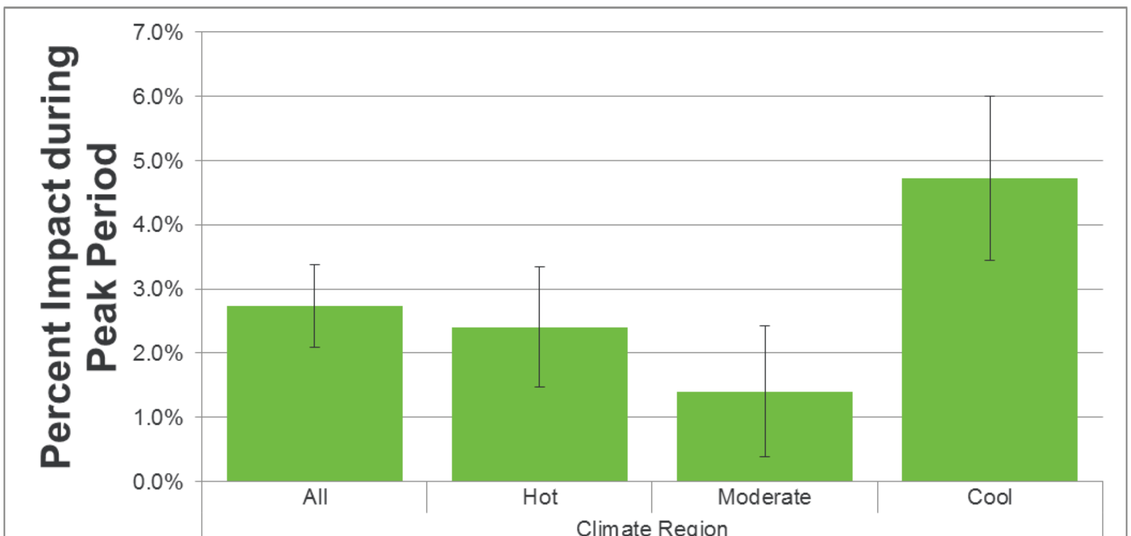
Figures 5.3-12 and 5.3-13 show the super peak period load reductions on average weekdays for Rate 3. The load reductions for the SCE territory as a whole, 2.7% or 0.03 kW, are roughly half what they were for Rate 1 or Rate 2 even though average demand during the peak period was similar across the three rates (around 1.3 kW). Load impacts for customers in the hot and cool climate regions were identical in absolute terms (0.04 kW), but percentage reductions in the cool region were nearly double what they were in the hot region in percentage terms (4.7% versus 2.4%). Load reductions were smallest among customers in the moderate climate region, with impacts of only 1.4% or 0.02 kW. The difference in the absolute load impacts in the super peak period in the moderate and cool regions was statistically significant.

Table 5.3-11 contains estimates of load impacts for all relevant rate periods and day types. Super on peak demand was the smallest among customers in the cool climate region at 0.92 kW, but percent impacts were the greatest. The same was true on the average weekend in the summer period. Generally, customers did not reduce electricity use in the super peak period on the average monthly system peak day except in the cool climate region where the average reduction in daily electricity use equaled 3.4%, or 0.04 kW. As mentioned above, the lack of statistical significance could be due, in part, to the fact that July was excluded from the Rate 3 load impact analysis, limiting the number of observations, combined with the fact that Rate 3 had the smallest overall sample sizes for the test cells.

On weekdays, the average reduction in daily electricity use was statistically significant overall and in all three climate regions, ranging from a low of 0.6% in the moderate climate region to a high of 2.9% in the cool region. Reductions in daily usage were similar on weekends as on weekdays, except that the estimate for the moderate climate region was not statistically significant.

Similarly to Rate 2, when the daily reduction in electricity use for Rate 3 is spread over 24 hours each day, the average reduction in electricity use on weekdays equals roughly 0.24 kWh. Over three months, this adds up to about 14 kWh per customer. If this average conservation effect was provided under default conditions and, say, 90% of the eligible population of roughly 3.3 million customers in SCE's service territory remained on the rate, the total reduction in electricity use over the three month period would equal more than 47 GWh.

Figure 5.3-12: Average Percent Load Impacts for Super Peak Period for SCE Rate 3[97] (Positive values represent load reductions)



	All	Hot	Moderate	Cool
Percent Impact	2.7%	2.4%	1.4%	4.7%
kW Impact	0.03	0.04	0.02	0.04

[97] SCE Rate 3 summer impacts represent August through September 2016

Figure 5.3-13: Average Absolute Load Impacts for Super Peak Period for SCE Rate 3 (Positive values represent load reductions)

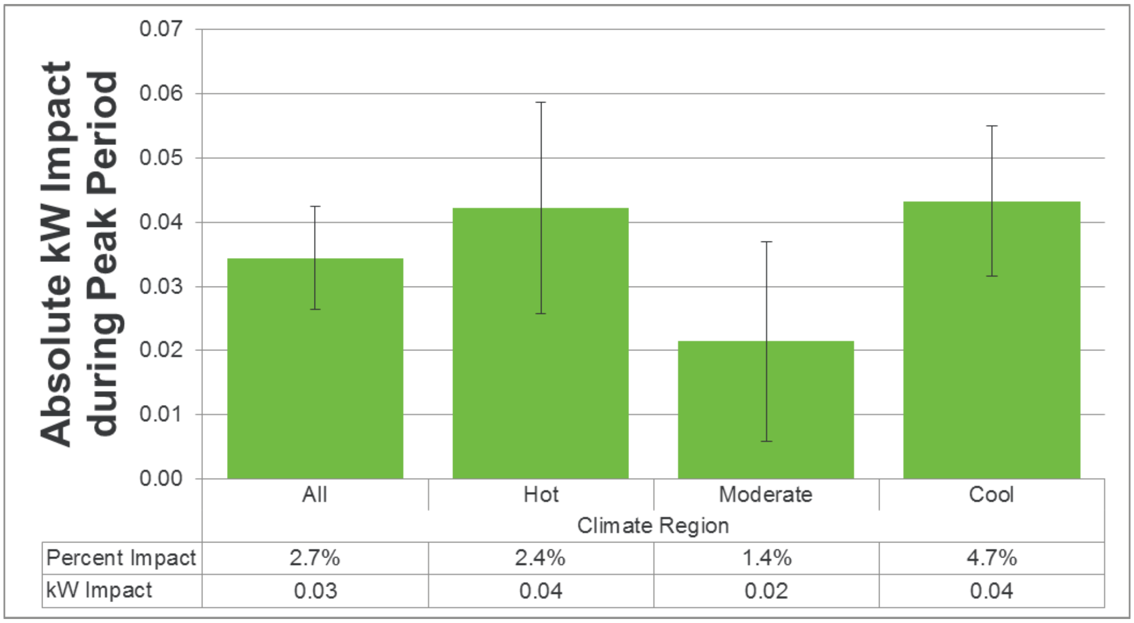


Table 5.3-11: Rate 3 Load Impacts by Rate Period and Day Type (Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 3											
			All			Hot			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Super On Peak	4 PM to 9 PM	1.26	0.03	2.7%	1.76	0.04	2.4%	1.53	0.02	1.4%	0.92	0.04	4.7%
	Peak	11 AM to 4 PM, 9 PM to 11 PM	0.99	0.03	2.8%	1.40	0.03	1.9%	1.16	0.03	2.3%	0.74	0.03	3.8%
	Off Peak	11 PM to 11 AM	0.59	0.00	-0.7%	0.79	-0.01	-0.7%	0.64	-0.01	-2.0%	0.50	0.00	0.6%
	Day	All Hours	0.84	0.01	1.5%	1.17	0.01	1.2%	0.98	0.01	0.6%	0.66	0.02	2.9%
Average Weekend	Mid Peak	4 PM to 9 PM	1.25	0.03	2.3%	1.78	0.03	1.7%	1.51	0.03	2.0%	0.90	0.03	3.1%
	Off Peak	9 PM to 4 PM	0.74	0.01	1.0%	1.05	0.01	0.7%	0.83	0.00	-0.4%	0.59	0.02	2.7%
	Day	All Hours	0.84	0.01	1.4%	1.20	0.01	1.0%	0.97	0.00	0.4%	0.65	0.02	2.8%
Monthly System Peak Day	Super On Peak	4 PM to 9 PM	1.71	0.02	1.1%	1.90	0.00	0.2%	2.18	-0.01	-0.4%	1.27	0.04	3.4%
	Peak	11 AM to 4 PM, 9 PM to 11 PM	1.34	0.05	3.5%	1.50	0.02	1.4%	1.66	0.06	3.4%	1.03	0.05	4.4%
	Off Peak	11 PM to 11 AM	0.68	-0.01	-1.4%	0.84	-0.01	-1.1%	0.77	-0.03	-3.4%	0.56	0.00	0.7%
	Day	All Hours	1.09	0.01	1.2%	1.25	0.00	0.2%	1.32	0.00	0.2%	0.85	0.02	2.9%

Figures 5.3-14 and 5.3.3-15 show the super peak period load reductions on weekdays for non-CARE/FERA and CARE/FERA customers, respectively, and Tables 5.3-12 and 5.3-13 show the load impacts for each rate period and day type for the two segments. Load reductions were statistically significant for all customer segments and climate regions except for non-CARE/FERA customers in the moderate climate region. There was no statistically significant difference in percentage impacts between CARE/FERA and non-CARE/FERA customers in any climate region or in the service territory as a whole. The differences in absolute impacts were statistically significant for the service territory as a whole as well as in the hot and cool climate regions in spite of the overlapping confidence bands shown in the figure.

As seen in Tables 5.3-12 and 5.3-13, there are significant average weekday load reductions for both CARE/FERA and non-CARE/FERA customers in the SCE territory as a whole. Load reductions were also significant, and over 1%, for non-CARE/FERA customers on average weekends and monthly system peak days.

Figure 5.3-14: Average Percent Load Impacts for Super Peak Period for SCE Rate 3 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)

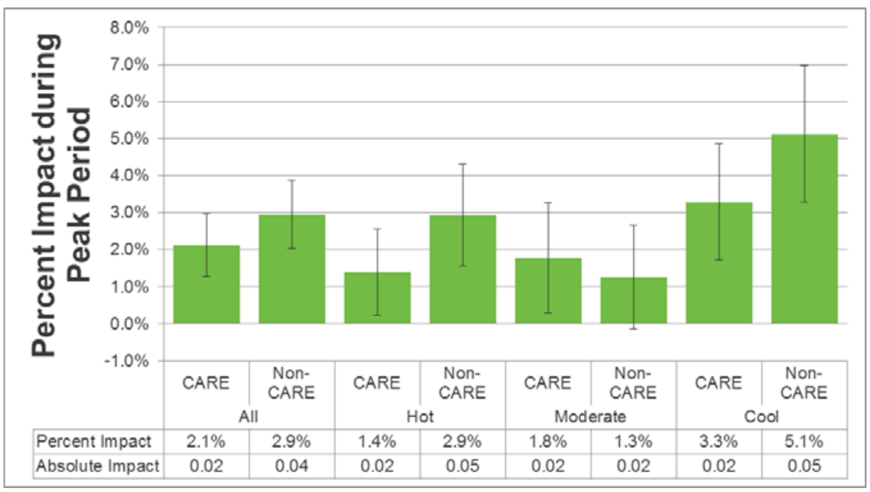


Figure 5.3-15: Average Absolute Load Impacts for Super Peak Period for SCE Rate 3 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)

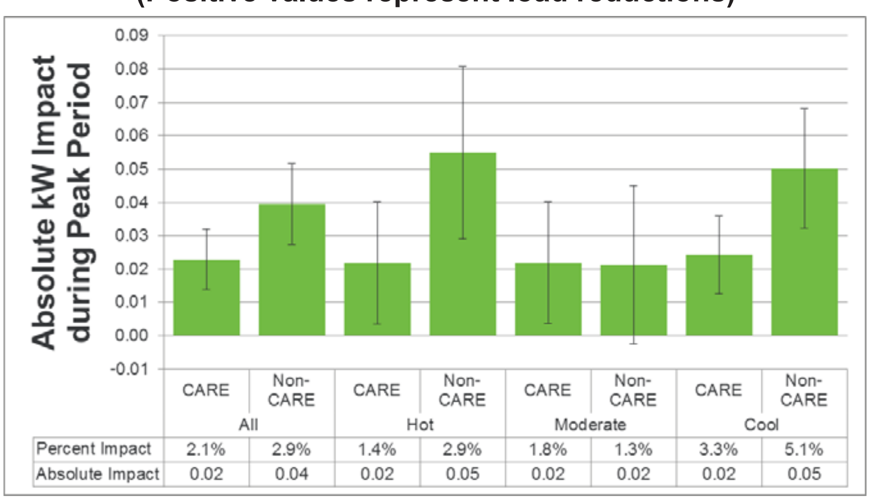


Table 5.3-12: Rate 3 Load Impacts by Rate Period and Day Type – non-CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

Rate 3														
Day Type	Period	Hours	All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Super On Peak	4 PM to 9 PM	1.34	0.04	2.9%	1.88	0.05	2.9%	1.68	0.02	1.3%	0.98	0.05	5.1%
	Peak	11 AM to 4 PM, 9 PM to 11 PM	1.04	0.03	2.7%	1.49	0.04	3.0%	1.26	0.02	1.4%	0.79	0.03	4.3%
	Off Peak	11 PM to 11 AM	0.62	0.00	-0.6%	0.85	0.00	-0.6%	0.69	-0.02	-2.4%	0.52	0.01	1.2%
	Day	All Hours	0.89	0.01	1.6%	1.25	0.02	1.8%	1.06	0.00	0.1%	0.70	0.02	3.4%
Average Weekend	Mid Peak	4 PM to 9 PM	1.34	0.03	2.5%	1.92	0.04	2.3%	1.66	0.03	1.6%	0.97	0.04	3.6%
	Off Peak	9 PM to 4 PM	0.78	0.01	1.6%	1.13	0.01	1.0%	0.90	0.00	-0.5%	0.63	0.02	4.0%
	Day	All Hours	0.90	0.02	1.8%	1.30	0.02	1.4%	1.06	0.00	0.2%	0.70	0.03	3.9%
Monthly System Peak Day	Super On Peak	4 PM to 9 PM	1.85	0.01	0.6%	2.00	-0.02	-1.0%	2.43	-0.02	-1.0%	1.38	0.04	3.2%
	Peak	11 AM to 4 PM, 9 PM to 11 PM	1.44	0.05	3.3%	1.59	0.05	3.1%	1.83	0.05	2.6%	1.11	0.05	4.2%
	Off Peak	11 PM to 11 AM	0.72	-0.01	-1.1%	0.90	-0.01	-1.1%	0.83	-0.03	-3.6%	0.60	0.01	1.6%
	Day	All Hours	1.17	0.01	1.1%	1.33	0.00	0.4%	1.46	-0.01	-0.4%	0.91	0.03	3.0%

Table 5.3-13: Rate 3 Load Impacts by Rate Period and Day Type –CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 3											
			All, CARE			Hot, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Super On Peak	4 PM to 9 PM	1.07	0.02	2.1%	1.57	0.02	1.4%	1.23	0.02	1.8%	0.74	0.02	3.3%
	Peak	11 AM to 4 PM, 9 PM to 11 PM	0.86	0.03	2.9%	1.24	0.00	-0.1%	0.97	0.05	4.8%	0.61	0.01	2.0%
	Off Peak	11 PM to 11 AM	0.51	-0.01	-1.0%	0.69	-0.01	-1.0%	0.55	0.00	-0.8%	0.42	-0.01	-1.3%
	Day	All Hours	0.73	0.01	1.3%	1.03	0.00	0.1%	0.81	0.02	1.9%	0.54	0.01	1.1%
Average Weekend	Mid Peak	4 PM to 9 PM	1.04	0.02	2.0%	1.56	0.01	0.4%	1.19	0.04	3.0%	0.70	0.01	1.4%
	Off Peak	9 PM to 4 PM	0.64	0.00	-0.7%	0.92	0.00	-0.1%	0.69	0.00	0.0%	0.48	-0.01	-2.1%
	Day	All Hours	0.72	0.00	0.1%	1.05	0.00	0.0%	0.80	0.01	0.9%	0.53	-0.01	-1.1%
Monthly System Peak Day	Super On Peak	4 PM to 9 PM	1.39	0.03	2.4%	1.74	0.04	2.6%	1.67	0.02	1.3%	0.97	0.04	4.1%
	Peak	11 AM to 4 PM, 9 PM to 11 PM	1.11	0.05	4.3%	1.34	-0.02	-1.8%	1.33	0.08	5.7%	0.79	0.04	5.4%
	Off Peak	11 PM to 11 AM	0.59	-0.01	-2.2%	0.74	-0.01	-1.0%	0.65	-0.02	-2.7%	0.47	-0.01	-2.3%
	Day	All Hours	0.91	0.01	1.6%	1.12	0.00	-0.1%	1.06	0.02	1.7%	0.67	0.02	2.3%

5.3.4 Comparison Across Rates

Comparison Across Rates

Using a common set of hours from 5 to 8 PM, for the SCE service territory as a whole, there are no statistically significant differences in absolute or percentage peak period load reductions across SCE's three pilot tariffs. However, there are some statistically significant differences in the load impacts across the tariffs within some climate regions but not others.

Figures 5.3-16 and 5.3-17 show the absolute and percent load reductions for each of SCE's three pilot rates for the hours from 5 to 8 PM. These are the three hours that are common across all three tariffs. Using a common set of hours reduces differences in impacts across rates that might be due to differences in the number of hours included in the peak period or the timing of those hours. The hours from 5 to 8 PM define the peak period for SCE's Rate 2. Rate 1 has a six hour peak period, from 2 to 8 PM and Rate 3 has a five hour peak period from 4 to 9 PM. All three tariffs have three rate periods in summer. The peak and shoulder periods combined cover the same hours for Rates 1 and 2 (8 AM to 10 PM) while the two periods combined for Rate 3 cover fewer hours, from 11 Am to 11 PM. Recall that Rate 3 also differs from Rates 1 and 2 in that Rate 3 does not provide a baseline credit while Rates 1 and 2 do.

With a shorter peak period and a much higher Tier 2, peak period price (and lower Tier 2 super off-peak price), one might expect the peak period load reductions for Rate 2 to be higher than for Rate 1. As seen in the figures, for the service territory as a whole and for the moderate and cool climate regions, there are no statistically significant differences in the load reductions between Rates 1 and 2 in either percentage or absolute terms. However, in the hot climate region, the load reduction between 5 and 8 PM is significantly greater for Rate 2 compared with Rate 1. In percentage terms, the load reduction for Rate 2 is more than three times greater than for Rate 1. The difference between Rate 3 impacts and the other two rates is statistically significant in the moderate climate region but not in the other regions or in the service territory as a whole.

Figure 5.3-16: Average Percent Impacts from 5 to 8 PM Across Rates

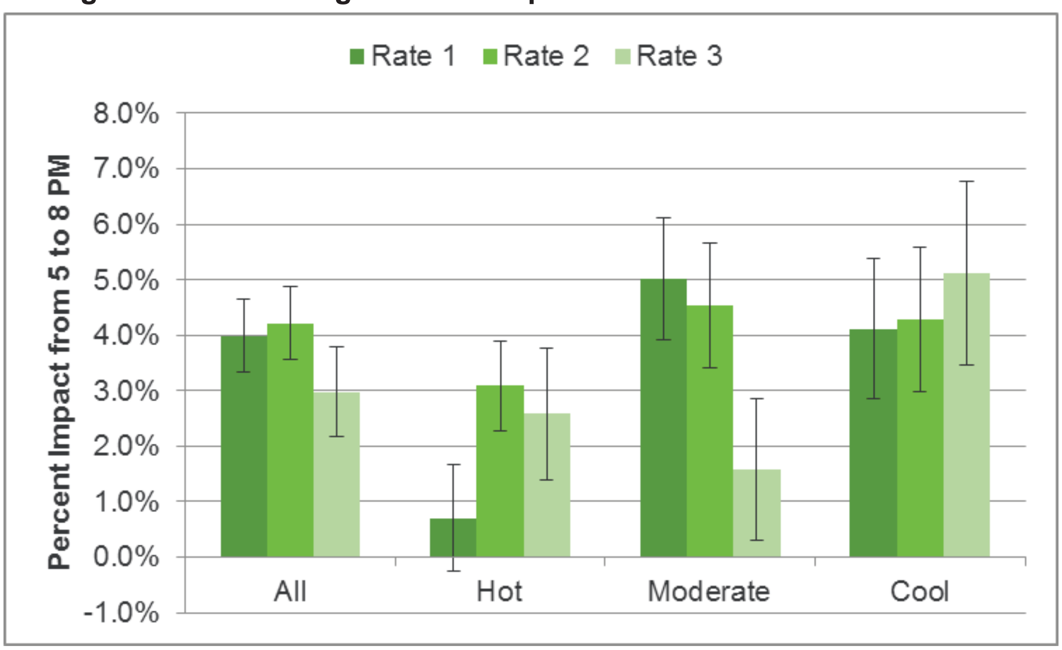
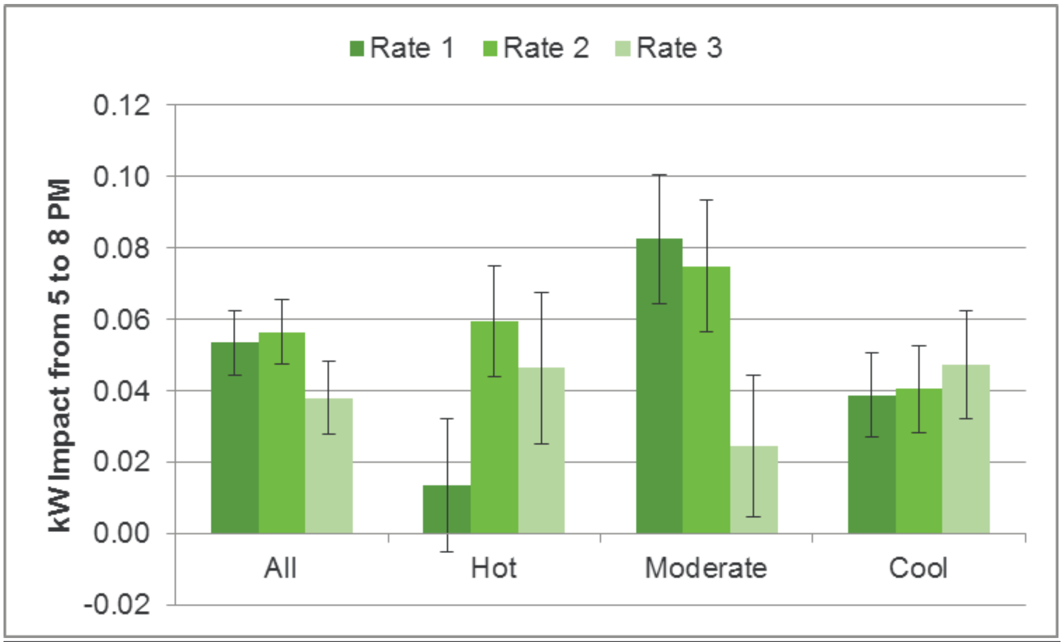


Figure 5.3-17: Average Absolute Impacts from 5 to 8 PM Across Rates



Figures 5.3-18 and 5.3-19 show the reductions in daily electricity use for the three rates for the service territory as a whole and for each climate region. Except for Rate 1 in the hot climate region, all load reductions are statistically significant. The reduction in daily electricity use is greater for Rate 1 than for the other two rates for the service territory as a whole and in the moderate climate region and these differences are statistically significant. However, in the hot region, there is no statistically significant reduction in electricity use for Rate 1, while there is for both Rates 2 and 3. None of the observed differences in daily electricity use between Rates 2 and 3 are statistically significant.

Figure 5.3-18: Average Percent Daily kWh Impacts Across Rates

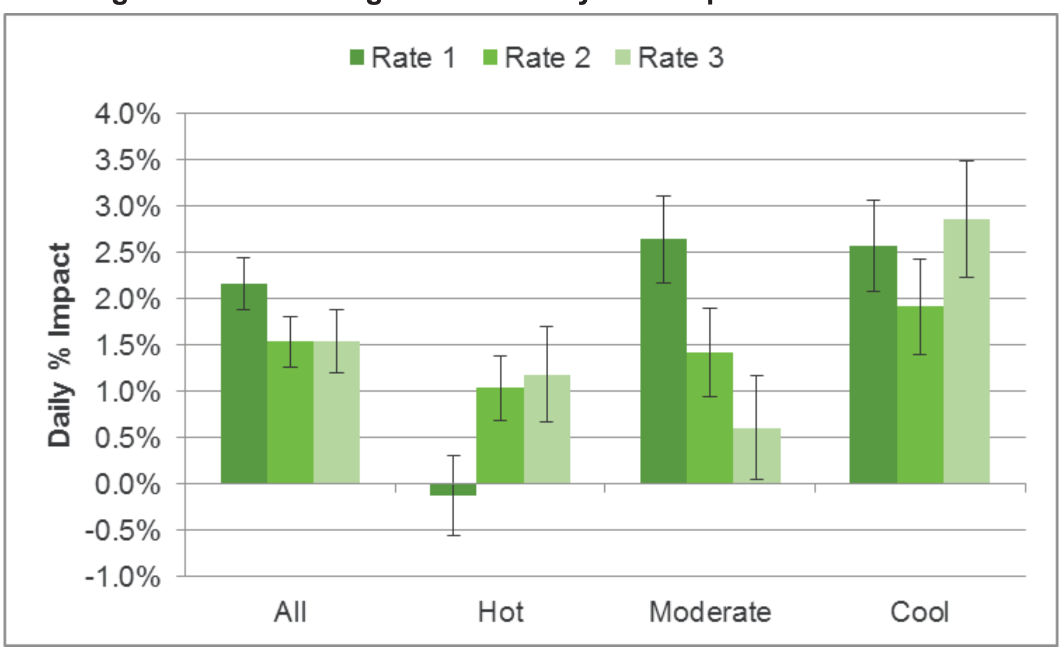
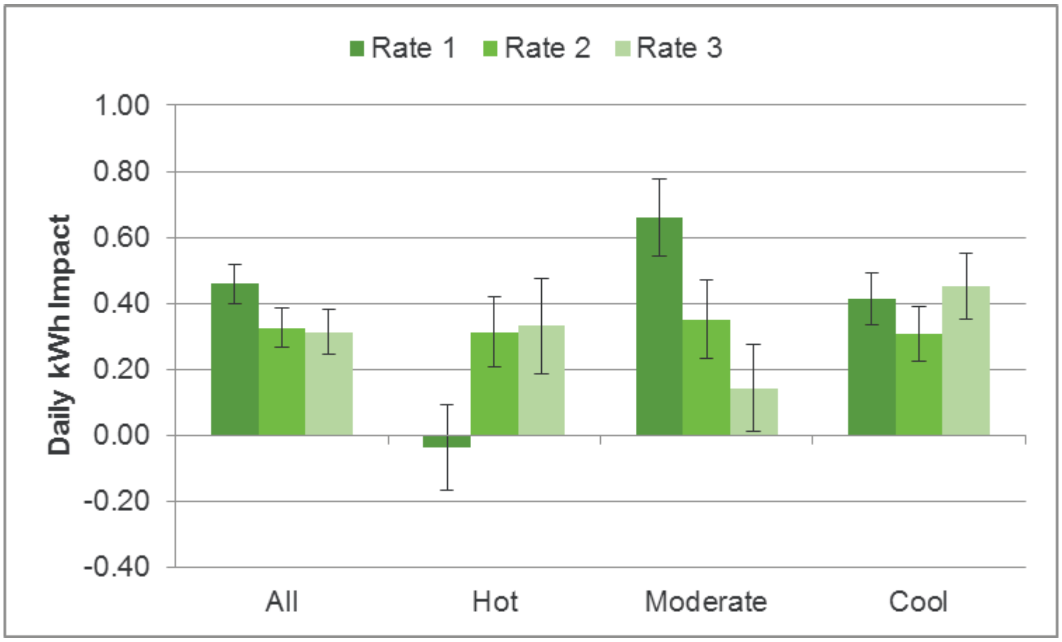


Figure 5.3-19: Average Absolute Daily kWh Impacts Across Rates



5.4 Bill Impacts

This section summarizes the bill impact estimates for the three rate treatments tested by SCE. The CPUC resolution approving SCE's pilot requires that bill impacts be estimated for the following rates, customer segments, and climate regions:

- Seniors, CARE/FERA customers, non-CARE/FERA customers, households with incomes below 100% of FPG, and households with incomes between 100% and 200% of FPG in SCE's hot climate region for Rate 2; and
- For CARE/FERA and non-CARE/FERA customers on each rate across SCE's service territory as a whole and for each climate region.

<u>Summer Bills Increased for Almost all Participants</u>

Annually, the majority of customers on SCE's Rate 1 and 2 would experience modest structural bill impacts for all three rates. However, for Rate 3, the vast majority of customers would see structural bill increases even on an annual basis. For the summer period, nearly all customers experienced structural bill increases and the average customer was only able to mitigate these bill increases by a small amount through changes in usage.

In addition to these required segments, Nexant estimated bill impacts for **seniors, households with incomes below 100% of FPG, and households with incomes between 100% and 200% of FPG in SCE's hot climate region for Rate 1 and Rate 3.** Bill impacts are reported as the average monthly impact for the summer months of July, August, and September[98] for each rate (however, July was not included for Rate 3 due to delayed enrollment), climate zone, and customer segment summarized above. As described in Section 4.8, the following four analyses were conducted:

[98] Estimates were not produced for the month of June because enrollment changed dramatically from the beginning to the end of the month and the estimates would not be comparable to those for other months.

- **Structural benefiter/non-benefiter analysis based on pretreatment usage-** Displaying the proportions of structural benefiters and non-benefiters for each rate and relevant customer segment based on pretreatment data on an annual and summer season basis;
- **Estimation of the average bill impact due to changes in usage-** Displaying the average bill impact resulting from changes in behavior in response to the new price signals for each rate and relevant customer segment (after controlling for exogenous factors);
- **Estimation of the total bill impact due to both the difference in the tariffs (holding usage constant) and behavior change-** Displaying the bill impact for each rate and relevant customer segment due to structural differences in the rate mitigated by changes in behavior; and
- **Change in the distribution of bill impacts due to behavior change-** Displaying the distribution curves of bill impacts (percentage of customers with bill impacts within $10 incremental bins) with and without behavior change in the same graph to illustrate if the distribution for participants shifted to the left or changed shape compared with the distribution for control customers without behavior change.

A more detailed explanation of each type of analysis and how the analysis was conducted is contained in Section 3.7. The remainder of this section is organized according to the four analysis types summarized above—that is, bill impacts are presented for each rate, relevant customer segment, and climate region for each of the four analyses.

5.4.1 Structural Benefiter/Non-Benefiter Analysis Based on Pretreatment Usage

As with PG&E, the structural benefiter analysis was conducted for the summer and annual time periods using pretreatment data from the treatment group for each rate and relevant customer segment. Annual impacts were based on hourly load data from May 2015 through April 2016. Summer impacts were based on June 2015 through September 2015. Monthly bills were estimated for each treatment group customer on the OAT and TOU rate using the hourly load data. The difference in bills based on the TOU rate and the OAT determines if a customer is a structural benefiter, a structural non-benefiter, or falls in a neutral range defined as having a structural bill impact between ±$3.[99]

Final results from the structural benefiter / non-benefiter analysis are presented in column graphs and shown as percentages for the summer season and on an annual basis. For each rate and relevant segment, the percentage of customers who are non-benefiter, neutral (+/- $3), or benefiters based on their average monthly bills for the time period of interest are shown as individual columns. The three columns within each rate and segment combination total to 100%, thus showing the distribution of structural benefiters and non-benefiters for each rate and segment of interest.

Figure 5.4-1 presents the outcome of the structural benefiter analysis for Rate 1 at the aggregate level across climate regions for all customers as well as for CARE/FERA and non-CARE/FERA. The graph on the left presents the analysis on an annual basis, and the graph on the right presents the findings for the summer period. Nearly all customers are structural non-benefiters in the summer season, which was expected. A higher proportion of CARE/FERA customers are structural non-benefiters than non-CARE/FERA customers.

[99] See section 3.2.1 for additional details on the methodology.

Figure 5.4-1: Rate 1 Structural Benefiter / Non-Benefiter Analysis
All | CARE/FERA | Non-CARE/FERA

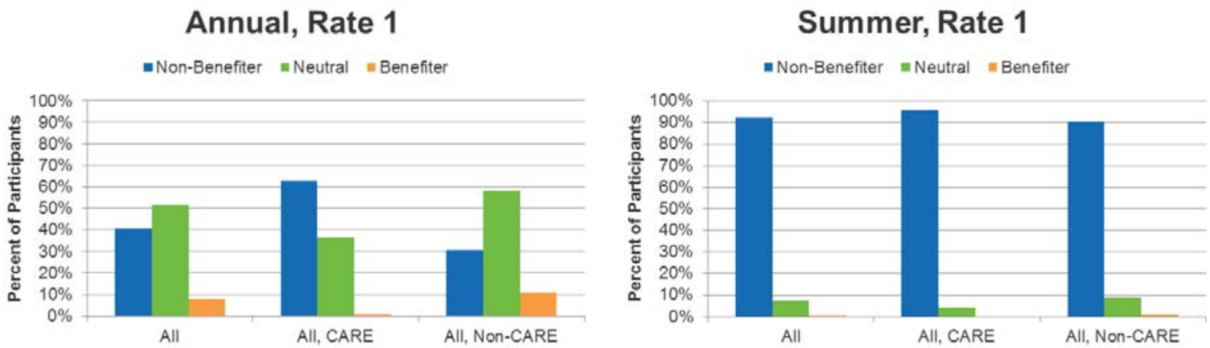


Figure 5.4-2 presents the outcome of the structural benefiter analysis for Rate 1 at the detailed segment level by climate region. The findings at the aggregate level still hold, with nearly all customers as structural non-benefiters in the summer season. The CARE/FERA segments in all three climate regions have a greater proportion of non-benefiters than the non-CARE/FERA segments on an annual basis. A majority of customers in senior households, households with incomes below 100% of FPG, and households with incomes between 100% and 200% of FPG are structural non-benefiters.

Figure 5.4-2: Rate 1 Structural Benefiter / Non-Benefiter Analysis
Detailed Segments by Climate Region

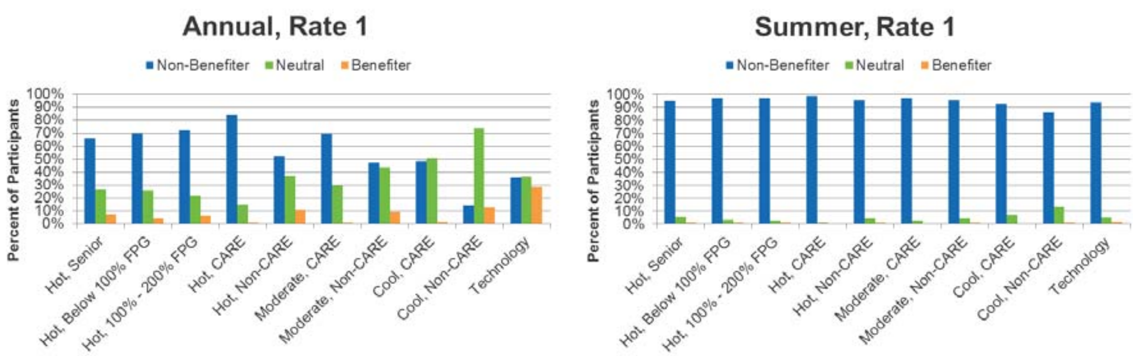


Figure 5.4-3 presents the outcome of the structural benefiter analysis for Rate 2 at the aggregate level across climate regions. SCE's Rate 2 differs from Rate 1 in several important ways. Both rates have three rate periods on summer weekdays; however the Rate 2 peak period is only three hours, from 5 to 8 PM, compared to six hours on Rate 1. Additionally, the peak period price is greater on Rate 2 (53 ¢/kWh versus $35 ¢/kWh). Overall, the general pattern of structural benefiters, non-benefiters, and neutrals is similar between Rate 1 and Rate 2. Nearly all customers are structural non-benefiters in the summer season, and there is a higher proportion of structural non-benefiters among CARE/FERA customers compared to non-CARE/FERA customers.

Figure 5.4-3: Rate 2 Structural Benefiter / Non-Benefiter Analysis All | CARE/FERA | Non-CARE/FERA

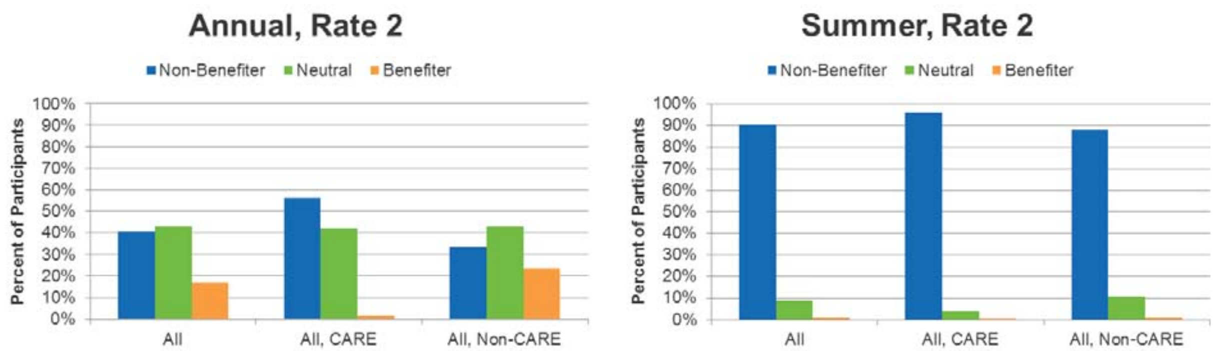


Figure 5.4-4 presents the structural benefiter analysis for Rate 2 at the detailed segment level by climate region. Once again, the findings at the aggregate level still hold, with nearly all customers as structural non-benefiters in the summer season. In the cool climate region, a larger portion of customers fall in the neutral category, while all other segments have a higher proportion of non-benefiters, on an annual basis.

Figure 5.4-4: Rate 2 Structural Benefiter / Non-Benefiter Analysis Detailed Segments by Climate Region

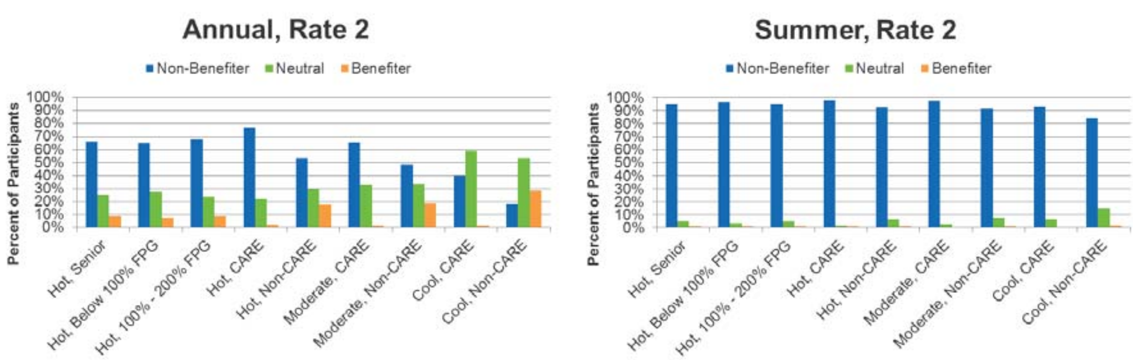
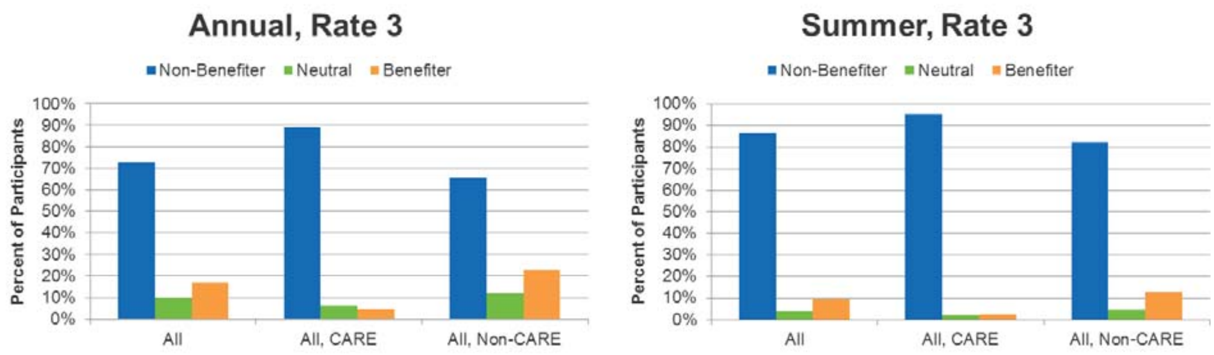


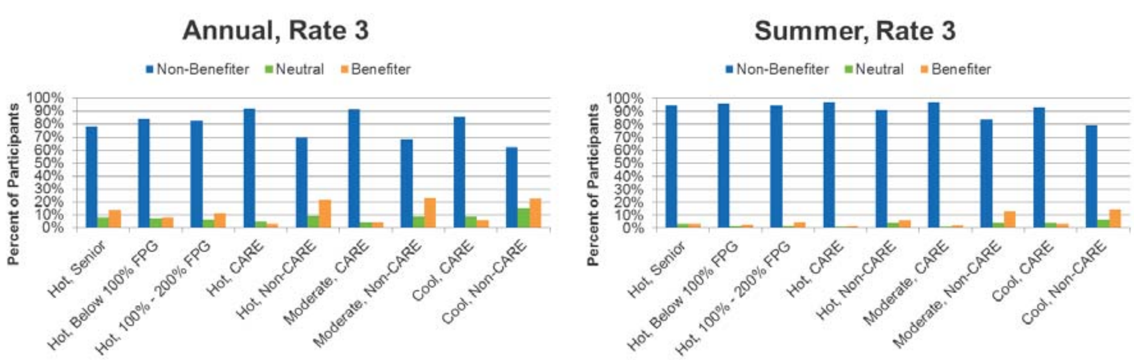
Figure 5.4-5 presents the distribution of structural benefiters, non-benefiters, and neutral customers for Rate 3 at the aggregate level across climate regions. SCE's Rate 3 has a later peak period than Rate 1 and Rate 2, but the peak period price is similar to Rate 1. The biggest difference between Rate 1 and Rate 2, compared to Rate 3 is that Rate 3 does not have a baseline credit. Unlike the previous two rates, a majority of customers are structural non-benefiters on Rate 3 on an annual basis, especially CARE/FERA customers. However, there are more benefiters in the summer season on Rate 3 than on the other two rates.

Figure 5.4-5: Rate 3 Structural Benefiter / Non-Benefiter Analysis
All | CARE/FERA | Non-CARE/FERA



This pattern holds true at the detailed segment level by climate region, as shown in Figure 5.4-6. Non-CARE/FERA customers in the hot and cool climate regions have the highest proportions of structural winners on an annual basis.

Figure 5.4-6: Rate 3 Structural Benefiter / Non-Benefiter Analysis
Detailed Segments by Climate Region



Overall, a general pattern of structural benefiters and non-benefiters emerged that was consistent across Rates 1 and Rate 2, while Rate 3 had a higher proportion of non-benefiters in nearly all customer segments on an annual basis. For all three rates, most customers are structural non-benefiters in the summer season.

The next section presents the analysis showing how much customers were able to reduce their bills as a result of behavior change. Section 5.4.3 combines the findings from the structural benefiter analysis with average bill impact findings to provide the full picture of how much of the structural loss customers were able to offset based on changing their energy usage behavior.

5.4.2 Estimation of the Average Bill Impact Due to Changes in Usage

As described in Section 3.7.2, the average bill impact due to customers changing their energy usage in response to the TOU rate was estimated by calculating the difference in bills calculated using the TOU rate and post-enrollment usage for both the control and treatment group minus the difference in bills on the TOU rate using pretreatment usage for both the control and treatment groups. The control group bill calculated on the TOU rate represents the bill that would be expected if a customer was billed on the TOU rate, but didn't change their energy use behavior. The bill for the treatment group customers on TOU rate reflects any behavioral changes in response to being on the TOU rate. By subtracting the treatment group's average bill from the control group's average bill—and removing any pre-existing differences—we are able estimate the average bill impact attributable to the treatment group's change in behavior resulting from exposure to the pilot rate, after controlling for exogenous factors.[100] A positive impact indicates that customers successfully reduced their bills relative to the control group who did not respond to a TOU rate.

As they were in Section 4.8.2, bill impacts due to behavior change are presented on a column graph and shown as dollar impacts for the average summer monthly bill for July, August, and September 2016 for Rates 1 and Rate 2, and for August and September for Rate 3. The error bars on the graph represent the 90% confidence interval. Therefore, any impacts with error bars that cross below zero are not statistically significant at the 90% confidence level. Impacts are organized by rate, climate region, and segment. The bill impact in percentage terms that corresponds to the dollar amount is also included in the figure to provide context.

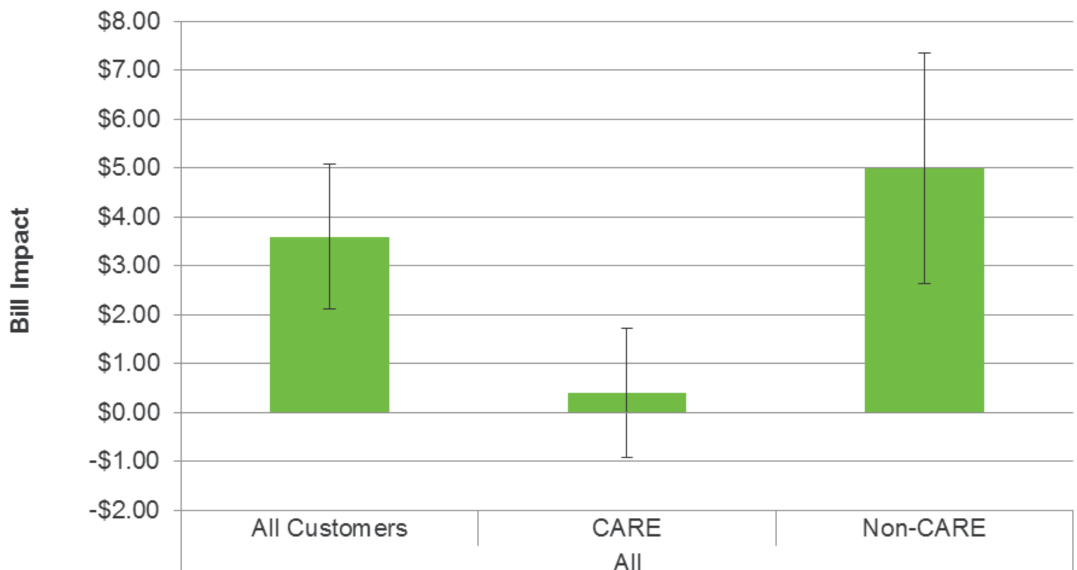
As with PG&E's bill impacts due to behavior change, aggregate level results were weighted following the same approach as used in the load impacts.[101] The weights are representative of the mix of customers eligible to participate in the pilot, not just those who enrolled. Consequently, some of the individual segments shown in the detailed findings section may have more or less weight than other segments when they are combined together to develop the aggregate results. It is important to note that small bill impacts do not necessarily indicate customers did not change their behavior. As seen in the load impact section, load reductions in peak or shoulder periods, which would lead to lower bills all other things equal, are sometimes offset by load increases in the off-peak period. Depending on the relative magnitude of each change, bill impacts could go up, down, or remain largely unchanged even though customers made significant changes in behavior. It is also important to note that the values shown here represent changes in bills due to change in behavior – they do not represent the total change in the bill (nearly all bills increased in the summer). The total changes in the bill will be presented in the next section.

[100] See section 3.2.2 for additional details on the methodology.

[101] See section 3.2.3 for a detailed discussion of the weighting approach.

Figure 5.4-7 provides the overall results for customers on Rate 1. Through changing their energy use the average Rate 1 customer was able to reduce what their average monthly bill would have otherwise been by \$3.59, or 2.7%. Though small, this result is statistically significant at the 90% confidence level. Average hourly peak period load impacts for Rate 1 customers were 4.4% or 0.06 kW. For the six hour peak period, the average daily energy savings is approximately 0.36 kWh (6 hours times 0.06 kWh). If we assume four weeks in a month, and five days a week, the result is twenty days where we would expect to observe the peak period reductions. Multiplying 20 days by the 0.36 kWh we expect to find about 7.2 kWh savings from the peak period per month. When factoring in both the CARE/FERA and non-CARE/FERA rates, the average summer weekday peak period price per kWh on Rate 1 is about \$0.31. An impact of 7.2 kWh per month at \$0.31 per kWh equals a total estimated peak period bill reduction of \$2.22 related to changes in behavior. When factoring in slight decreases in energy use during off-peak hours, the \$3.59 monthly bill impact due to behavior change appears quite reasonable. Bill impacts for CARE/FERA customers much smaller than the territory-wide average customer impact at \$0.40 (0.5%) and were not statistically significant. Non-CARE/FERA customer bill impacts were statistically significant at \$5.00 (3.2%) per month.

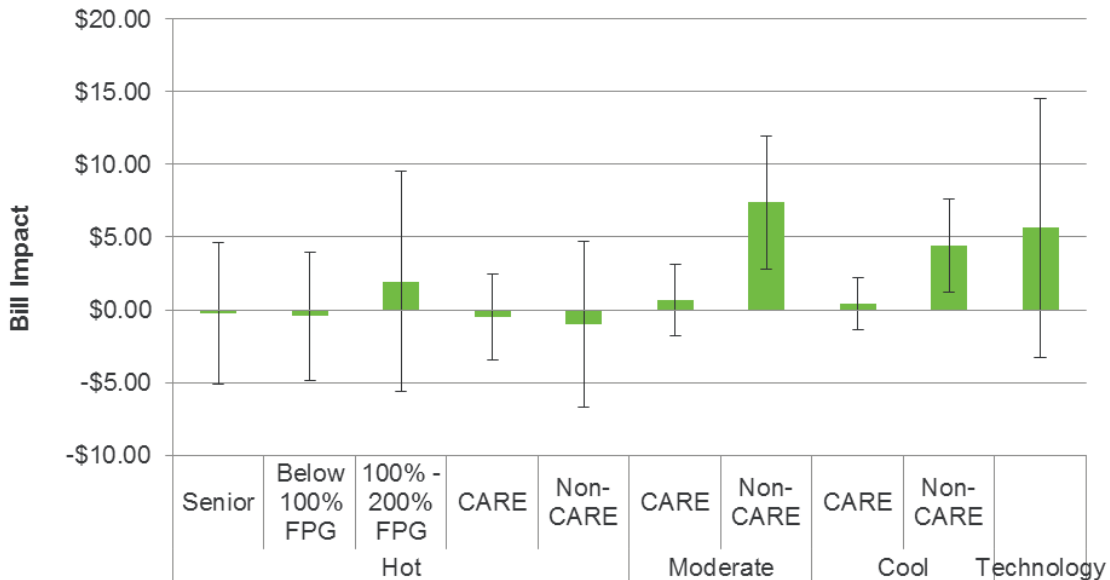
Figure 5.4-7: Rate 1 Average Bill Impacts from Behavior Change
All | CARE/FERA | Non-CARE/FERA
(Positive values represent bill reductions)



	All Customers	CARE	Non-CARE
Bill Impact	\$3.59	\$0.40	\$5.00
Percent Impact	2.7%	0.5%	3.2%

Figure 5.4-8 provides the detailed results by climate region and segment for customers on Rate 1. Non-CARE/FERA customers in the moderate climate region exhibited the largest bill reduction due to changes in behavior at $7.38 per month (3.8%). Non-CARE/FERA customers in the cool climate region were the only other segment to have statistically significant reductions in their bills due to changes in their behavior, at $4.42 per month (3.8%).

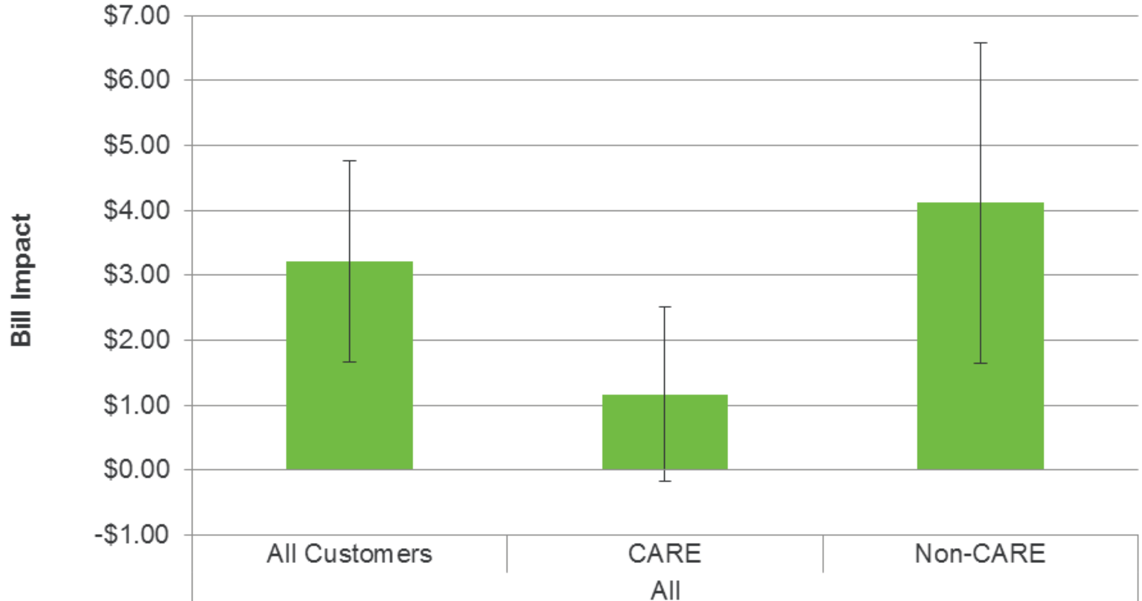
Figure 5.4-8: Rate 1 Average Bill Impacts from Behavior Change Detailed Segments by Climate Region
(Positive values represent bill reductions)



	Hot: Senior	Hot: Below 100% FPG	Hot: 100% - 200% FPG	Hot: CARE	Hot: Non-CARE	Moderate: CARE	Moderate: Non-CARE	Cool: CARE	Cool: Non-CARE	Technology
Bill Impact	-$0.25	-$0.45	$1.93	-$0.49	-$1.02	$0.70	$7.38	$0.40	$4.42	$5.65
Percent Impact	-0.1%	-0.3%	1.1%	-0.4%	-0.5%	0.7%	3.8%	0.7%	3.8%	2.6%

Figure 5.4-9 provides the overall results for customers on Rate 2, which are generally very similar to Rate 1. Through changes in behavior, the average Rate 2 customer was able to reduce what their average monthly bill would have otherwise been by $3.21 or 2.3%. This result is statistically significant at the 90% confidence level. Average hourly peak period load impacts for Rate 2 customers were 4.2% or 0.06 kW. Bill impacts due to behavior change for CARE/FERA customers were not statistically significant.

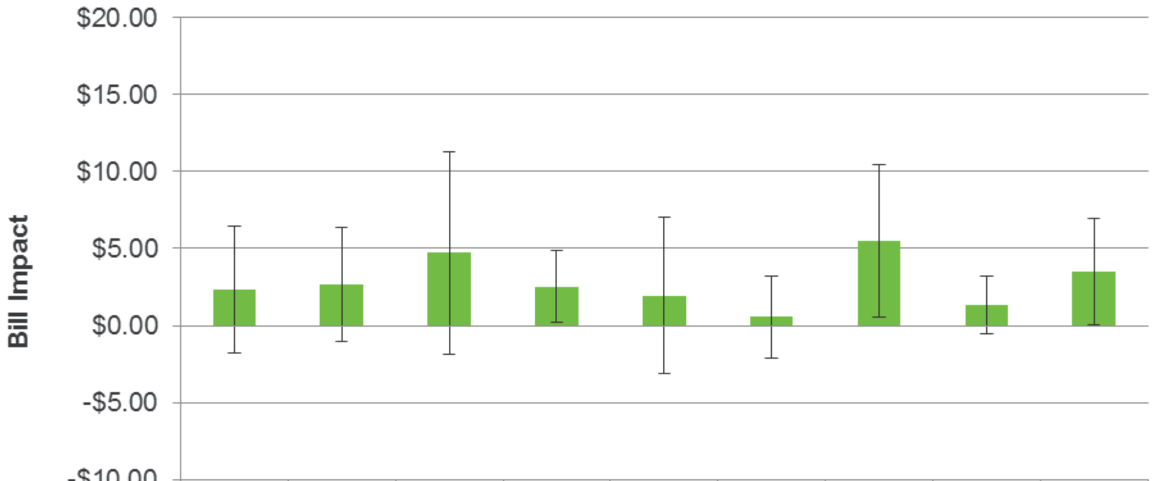
Figure 5.4-9: Rate 2 Average Bill Impacts from Behavior Change All | CARE/FERA | Non-CARE/FERA (Positive values represent bill reductions)



	All Customers	CARE	Non-CARE
Bill Impact	$3.21	$1.16	$4.11
Percent Impact	2.3%	1.3%	2.6%

Figure 5.4-10 presents the detailed results by climate region and segment for customers on Rate 2. Similar to Rate 1, only two segments were able to reduce their bills by a significant amount due to behavior change: non-CARE/FERA customers in the moderate and cool climate regions and CARE/FERA customers in the hot region. Those in the moderate climate regions reduced their bills by $5.52 per month, or 2.9%, due to changes in their energy usage behavior.

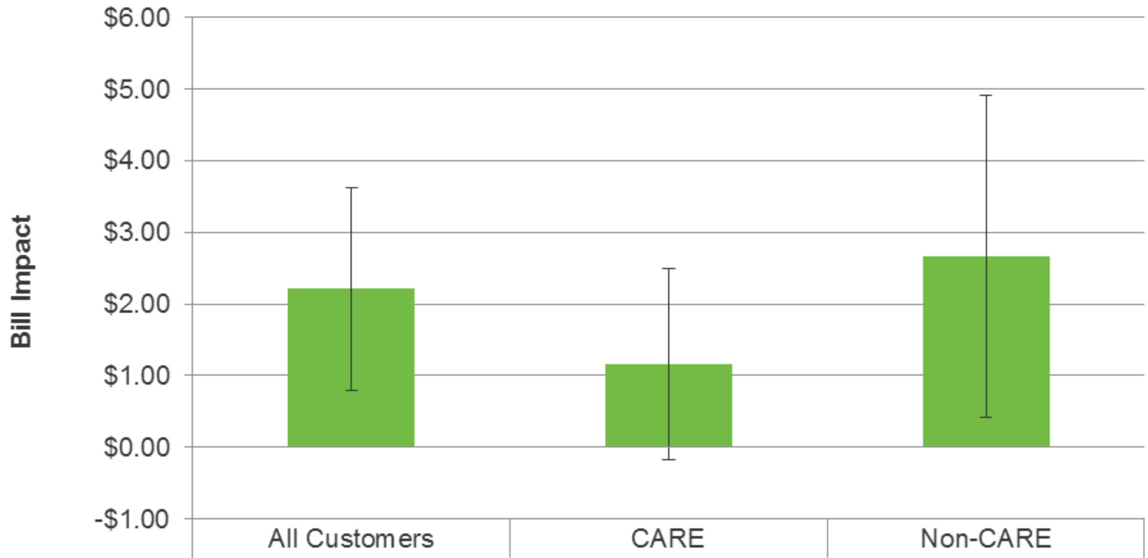
Figure 5.4-10: Rate 2 Average Bill Impacts from Behavior Change Detailed Segments by Climate Region
(Positive values represent bill reductions)



	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Bill Impact	$2.32	$2.67	$4.72	$2.54	$1.94	$0.55	$5.52	$1.32	$3.49
Percent Impact	1.2%	1.8%	2.8%	1.9%	0.9%	0.5%	2.9%	2.1%	2.7%

Figure 5.4-11 provides the overall results for customers on Rate 3. Bill reductions due to behavior change were slightly smaller on this rate compared to Rate 1 and Rate 2, with average reductions of about $2.21 per month, or 1.7%. This could be due to the lack of a baseline credit on Rate 3. Bill reductions by CARE/FERA customers were not statistically significant at the 90% level of confidence. Non-CARE/FERA customers reduced their bills by about $2.67 per month, or 1.7%.

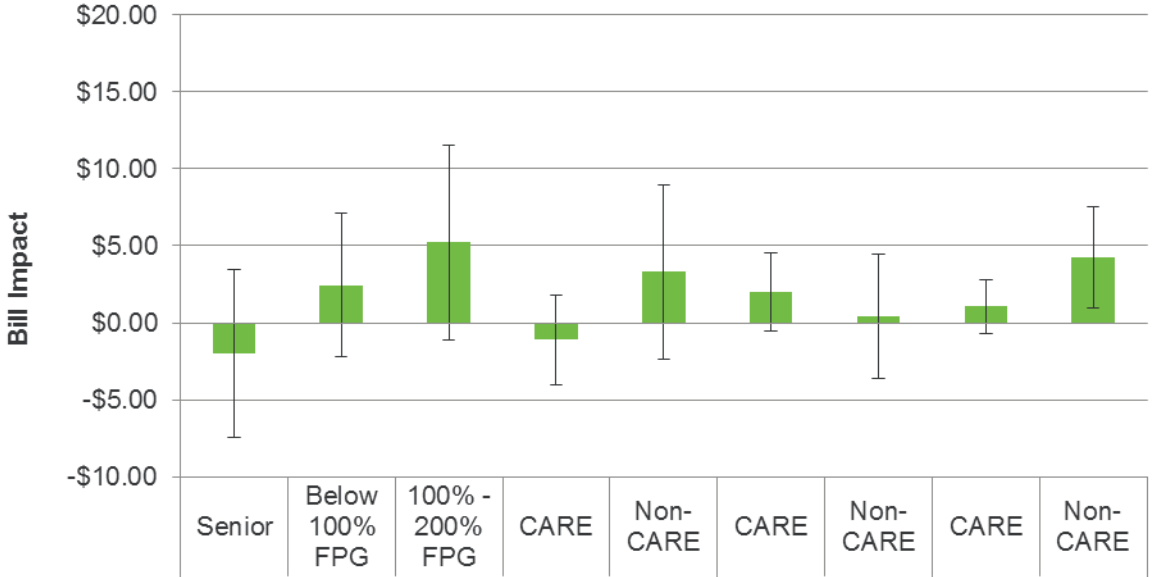
Figure 5.4-11: Rate 3 Average Bill Impacts from Behavior Change
All | CARE/FERA | Non-CARE/FERA
(Positive values represent bill reductions)



	All Customers	CARE	Non-CARE
	All		
Bill Impact	$2.21	$1.17	$2.67
Percent Impact	1.7%	1.4%	1.7%

Figure 5.4-12 presents the detailed level results by climate region and segment for customers on Rate 3. Only non-CARE/FERA customers in the cool climate region were able to reduce their bills with changes in behavior. Their bill reductions were equal to $4.24 or 3.5%. Some segments saw slight bill increases, but these results are not statistically significant.

Figure 5.4-12: Rate 3 Average Bill Impacts from Behavior Change Detailed Segments by Climate Region
(Positive values represent bill reductions)



	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
	Hot					Moderate		Cool	
Bill Impact	-$2.02	$2.43	$5.24	-$1.11	$3.29	$2.01	$0.42	$1.08	$4.24
Percent Impact	-1.2%	1.8%	3.3%	-0.9%	1.6%	2.1%	0.2%	1.7%	3.5%

Overall, bill impacts across all of the rates appear to have been largely driven by the non-CARE/FERA customers in the cool and moderate climate regions, except in Rate 3, which was driven by non-CARE/FERA customers in the cool climate region. Bill impacts due to behavior change for the other segments, rates, and climate regions were very small and not statistically significant.

5.4.3 Estimation of the Total Bill Impact Due to Differences in the Tariffs (Holding Usage Constant) and Behavior Change

Total bill impacts experienced by customers on a TOU rate can be decomposed into two components: the structural impact, and the behavioral impact. The structural impact represents the change in customer bills based solely on the change in the underlying structure of the rate. In this case, it is the change from the OAT to the time-differentiated TOU pilot rates. The behavioral impact represents how the customer changed their energy usage in response to the new pricing structure of the rate—which includes higher prices in the afternoon and evening and lower prices at other times of the day. During the summer period, nearly all customers on the TOU rates experienced a structural increase in their bills. However, customers also had an opportunity to offset that increase by changing their energy use behavior in response to the new price signals. As noted above, it is the combination of structural and behavioral bill impacts that produces the total bill impact experienced by the average study participant on each rate.

The results from this analysis represent the average monthly bill across the summer months of July (for Rate 1 and Rate 2 only), August, and September 2016. Three different bills were calculated for each customer segment:[102]

- **No Change in Behavior or Tariff [1]:** This represents what the treatment group bills would have been in the post-treatment period if they were on the OAT and had not changed their behavior
- **No Change in Behavior, Change in Tariff [2]:** This represents what the treatment group bills would have been in the post-treatment period if they were on the TOU rate and had not changed their behavior
- **Change in Behavior and in Tariff [3]:** This represents what the treatment group bills were in the post-treatment period on the TOU rate with a change in behavior

Based off of components defined above, the following metrics were calculated:

- The difference between **[1]** and **[2]** is the structural bill impact (based on post-treatment usage after adjusting for any pretreatment difference between control and treatment customers);
- The difference between **[1]** and **[3]** is the bill impact due to structural differences in the rates, but mitigated by changes in behavior; and
- The difference between **[2]** and **[3]** is the amount customers were able reduce their bills by changing their behavior.

In the bill impact analysis, a major policy question was to better understand the relationship between the structural bill impacts, and how customers were able to respond. This relationship is represented by the "percentage of structural loss mitigated by change in behavior" shown in the data table at the bottom of the figures below. Put differently, this percentage represents how much of the structural bill increase from the TOU rate the average customer was able to offset. Results are organized by rate, climate region, and segment; similarly to the other bill impact analysis sections.

Figure 5.4-13 presents a set of three average monthly bills as defined above for all customers, CARE/FERA customers, and non-CARE/FERA customers on Rate 1. The blue bar represents a typical summer monthly bill for a customer still on the OAT and not responding to a TOU rate—noted as "No Change in Behavior or Tariff." For the average customer on Rate 1, this dollar amount was $117.87 per month. The green bar represents what a typical summer monthly bill would be for a customer who was billed on a TOU rate, but didn't change their energy use behavior— noted as "No Change in Behavior, Change in Tariff." This dollar amount is $134.79 for the average Rate 1 customer. The difference between the two values, $16.92, is the average increase a customer would see in their bills by changing from the OAT to Rate 1, and not changing their energy use behavior; this is also referred to as the customer's structural loss. The orange bar represents the average Rate 1 customer's bill after factoring in the change in rate from the OAT to the Pilot Rate 1, and then also taking into account any changes in energy use behavior—noted as "With Change in Behavior and Tariff." This bill amount averaged $131.20 for the typical Rate 1 customer. Based off these values, it is possible to estimate the total change in bills including both the change in tariff and in behavior, which was a bill increase of $13.33 per month (11%). The total change in bill is calculated by subtracting the blue ($117.87) from the orange ($131.20).

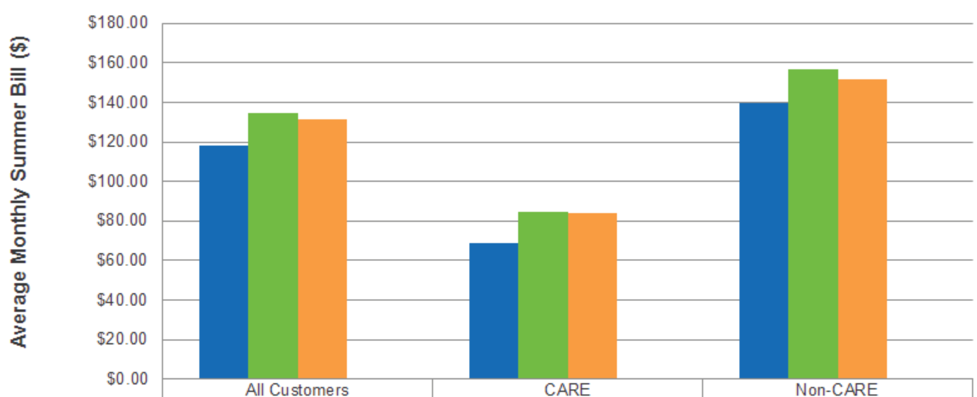
[102] See section 3.2.3 for additional details on the methodology.

An additional important metric is the percent of the structural loss—increase in the bills due strictly to the change in tariff—that can be offset or mitigated by customers changing their energy use behavior. As noted above, the average structural loss for Rate 1 customers was $16.92. The amount customers were able to reduce their bills by changing their behavior—compared to what it would have been without any behavior change—is obtained by subtracting the orange bar (“With Change in Behavior and Tariff”: $131.20) from the green bar (“No Change in Behavior, Change in Tariff”: $134.79), which equals $3.59. Based on these values, customers were able to offset $3.59 out of the $16.92 structural loss, or 21.2%. This value is provided at the bottom of the data table in each figure for convenience.

CARE/FERA customers experienced an average structural loss of $15.69 (23%). Through changes in energy use behavior they were able to offset $0.40 (2.5%), resulting in a total monthly bill increase of $15.29 (22%) after factoring in both changes in the tariff and behavior. It should be noted that the bill impact from behavior change for CARE/FERA customers on Rate 1 was not statistically significant. Given the small dollar amount to begin with, and the lack of statistical significance, the key take away from this analysis is that the average CARE/FERA customer on Rate 1 did not change their energy use behavior sufficiently to mitigate any of the structural loss.

Conversely, non-CARE/FERA customers were able to mitigate some of their structural loss by a larger portion at 28.7% ($5.00). The average structural loss for non-CARE/FERA customers was $17.46 (12.5%), resulting in a total monthly bill increase of $12.46 (8.9%) after factoring in changes in the tariff, and behavior.

Figure 5.4-13: Rate 1 Total Bill Impact Due to Differences in the Tariff and Behavior Change All | CARE/FERA | Non-CARE/FERA

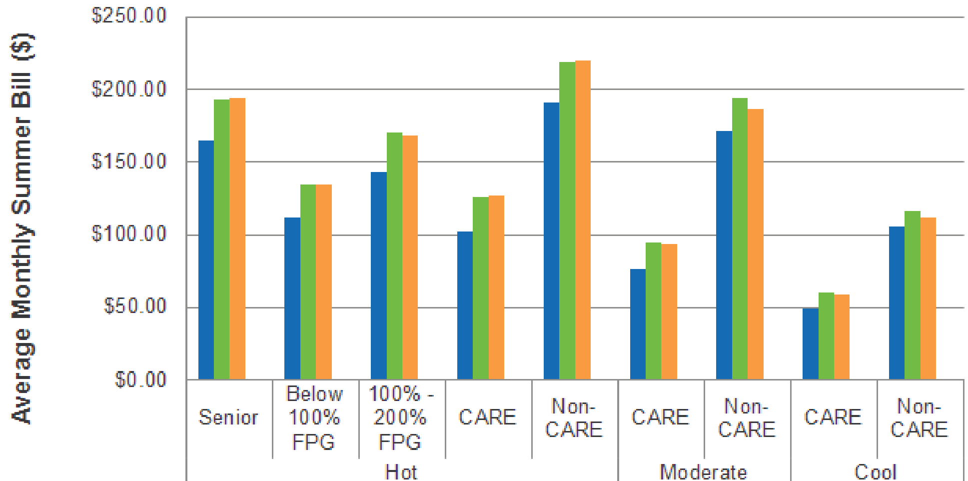


	All Customers	CARE All	Non-CARE
No Change in Behavior or Tariff	$117.87	$68.92	$139.51
No Change in Behavior, Change in Tariff	$134.79	$84.61	$156.97
With Change in Behavior and Tariff	$131.20	$84.21	$151.97
% of structural loss mitigated by change in behavior	21.2% *	2.5%	28.7% *

* Indicates statistically significant result

Figure 5.4-14 presents the three sets of average monthly bills as defined above for the detailed segments by climate region on Rate 1. Non-CARE/FERA customers in the cool and moderate climate regions offset their structural bill increase by more than 30% through behavior change. Behavioral offsets for the other customer segments were less than 5% and not statistically significant. Customers with smart thermostats offset their summer bill increases by about 26.1%, but this reduction was also not statistically significant.

Figure 5.4-14: Rate 1 Total Bill Impact Due to Differences in the Tariff and Behavior Change Detailed Segments by Climate Region

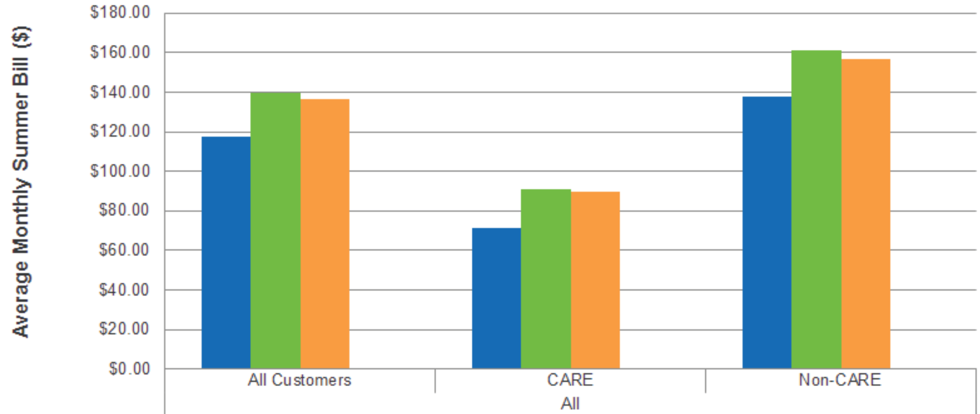


	Hot: Senior	Hot: Below 100% FPG	Hot: 100% - 200% FPG	Hot: CARE	Hot: Non-CARE	Moderate: CARE	Moderate: Non-CARE	Cool: CARE	Cool: Non-CARE
No Change in Behavior or Tariff	$164.43	$112.57	$143.37	$101.89	$190.93	$76.74	$171.28	$49.33	$105.25
No Change in Behavior, Change in Tariff	$193.50	$134.66	$170.42	$126.34	$219.16	$94.55	$193.90	$59.78	$116.66
With Change in Behavior and Tariff	$193.75	$135.11	$168.49	$126.84	$220.18	$93.85	$186.52	$59.38	$112.25
% of structural loss mitigated by change in behavior	-0.8%	-2.0%	7.1%	-2.0%	-3.6%	3.9%	32.6%*	3.8%	38.7%*

* Indicates statistically significant result

Figure 5.4-15 presents the three sets of average monthly bills for all customers, CARE/FERA customers, and non-CARE/FERA customers on Rate 2, which were similar in nature to Rate 1. The average Rate 2 customer experienced a structural loss of $22.15 (19%). Through changes in energy use behavior, they were able to offset about $3.21 (14.5%), resulting in a total monthly bill increase of $18.94 (16%) after factoring in both changes in the tariff and behavior. CARE/FERA customers experienced an average structural loss of $19.44 (27%). They were able to mitigate this loss by about 6.0%, which is more than those on Rate 1 (however, their structural losses were much larger). Non-CARE/FERA customers were able to reduce their structural loss of $23.36 by 17.6%, resulting in a monthly bill increase of $19.24.

Figure 5.4-15: Rate 2 Total Bill Impact Due to Differences in the Tariff and Behavior Change All | CARE/FERA | Non-CARE/FERA

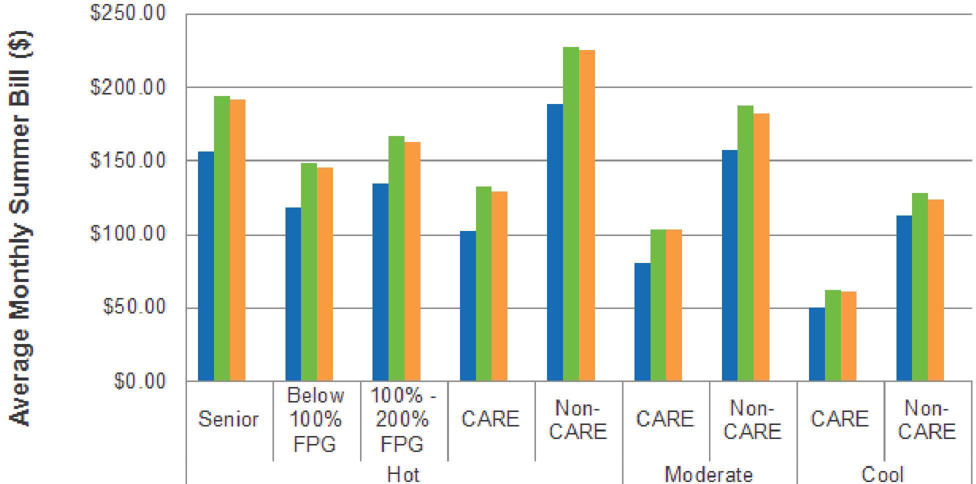


	All Customers	CARE	Non-CARE
No Change in Behavior or Tariff	$117.36	$71.24	$137.74
No Change in Behavior, Change in Tariff	$139.51	$90.68	$161.10
With Change in Behavior and Tariff	$136.30	$89.51	$156.98
% of structural loss mitigated by change in behavior	14.5% *	6.0%	17.6% *

* Indicates statistically significant result

Figure 5.4-16 presents the three sets of average monthly bills for the detailed segments by climate region on Rate 2. Non-CARE/FERA customers in the moderate and cool climate region were able to offset their structural bill increase by 18% and 23.5%, respectively. Customers in households making between 100% and 200% of FPG reduced their structural loss by nearly 15%, however their bill reduction due to behavior change was not statistically significant.

Figure 5.4-16: Rate 2 Total Bill Impact Due to Differences in the Tariff and Behavior Change Detailed Segments by Climate Region

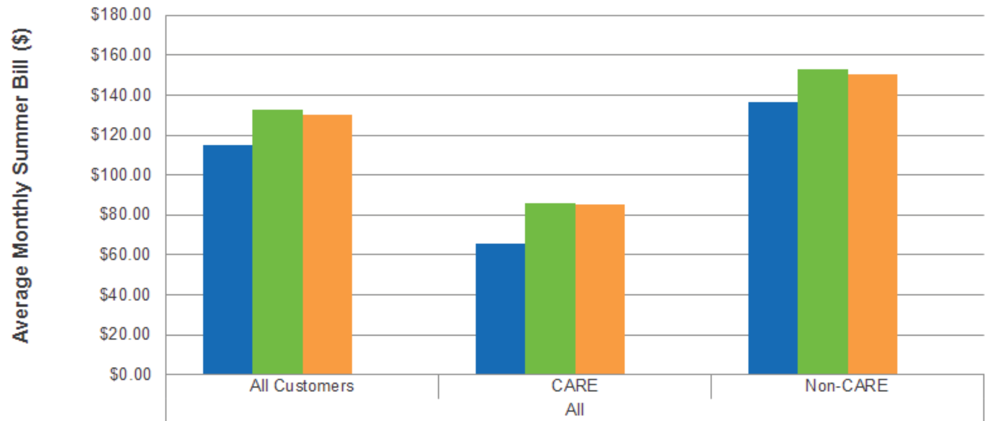


	Hot: Senior	Hot: Below 100% FPG	Hot: 100% - 200% FPG	Hot: CARE	Hot: Non-CARE	Moderate: CARE	Moderate: Non-CARE	Cool: CARE	Cool: Non-CARE
No Change in Behavior or Tariff	$156.49	$118.40	$134.79	$101.84	$189.00	$81.05	$156.90	$50.41	$113.03
No Change in Behavior, Change in Tariff	$194.46	$148.24	$167.19	$132.18	$227.07	$103.85	$187.62	$62.55	$127.88
With Change in Behavior and Tariff	$192.14	$145.57	$162.46	$129.64	$225.13	$103.30	$182.11	$61.23	$124.39
% of structural loss mitigated by change in behavior	6.1%	8.9%	14.6%	8.4%*	5.1%	2.4%	18.0%*	10.9%	23.5%*

* Indicates statistically significant result

Figure 5.4-17 presents the three sets of average monthly bills for all customers, CARE/FERA customers, and non-CARE/FERA customers on Rate 3. For the average Rate 3 customer, the three sets of bills were all slightly lower than their Rate 1 and Rate 2 counterparts, but the percent reduction in structural losses was also a bit smaller. Customers on Rate 3 face an average structural bill increase of $17.53 (15%) but are able to reduce that to $15.33 (13%) through changes in behavior. Non-CARE/FERA customers were the most successful and were able to reduce their structural bill increases by 16.4%.

Figure 5.4-17: Rate 3 Total Bill Impact Due to Differences in the Tariff and Behavior Change All | CARE/FERA | Non-CARE/FERA

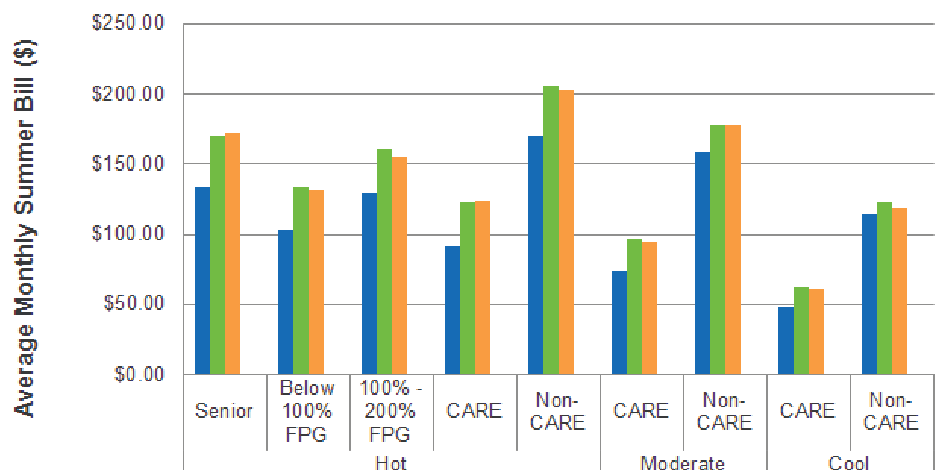


	All Customers	CARE	Non-CARE
		All	
No Change in Behavior or Tariff	$114.88	$65.89	$136.53
No Change in Behavior, Change in Tariff	$132.41	$86.17	$152.85
With Change in Behavior and Tariff	$130.20	$85.00	$150.18
% of structural loss mitigated by change in behavior	12.6% *	5.8%	16.4% *

* Indicates statistically significant result

Figure 5.4-18 presents the three sets of average monthly bills for the detailed segments by climate region on Rate 3. Customers in senior households and CARE/FERA customers in the hot climate zone were not able to reduce their bill increases with changes in behavior, but these results were not statistically significant.

Figure 5.4-18: Rate 3 Total Bill Impact Due to Differences in the Tariff and Behavior Change Detailed Segments by Climate Region



	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
	Hot					Moderate		Cool	
No Change in Behavior or Tariff	$133.47	$103.41	$129.58	$91.75	$170.07	$74.38	$157.94	$48.07	$113.66
No Change in Behavior, Change in Tariff	$170.82	$133.54	$160.83	$123.30	$205.70	$96.77	$178.45	$62.25	$122.95
With Change in Behavior and Tariff	$172.84	$131.11	$155.60	$124.41	$202.40	$94.76	$178.04	$61.17	$118.71
% of structural loss mitigated by change in behavior	-5.4%	8.1%	16.8%	-3.5%	9.2%	9.0%	2.0%	7.6%	45.7%*

* Indicates statistically significant result

Overall, the average customer across each of the rates was able to offset a small portion of the structural bill impact by over 10%. However, the offsets were largely driven by the non-CARE/FERA customers in the moderate and cool climate regions. For the most part, the other segments were not able to offset much of their structural loss and many of the observed behavioral impacts were not statistically significant.

5.4.4 Change in the Distribution of Bill Impacts Due to Behavior Change

The fourth analysis presents the distribution of bill impacts[103] for customers with and without behavioral change, and is designed to show how the distribution shifts when customers respond to the rates by changing behavior. Similar to the other analyses, impact distributions are based on the average summer monthly bills for July (for Rate 1 and Rate 2 only), August, and September. Bill impacts were estimated for two cases—with and without behavior change. Both are based on the structural bill impact calculations; however, impacts with behavior change show how behavioral impacts are able to affect the structural impact distribution. Customers were segmented into ranges of bill impacts. The percentage of customers in each $10 increment from negative $100 to positive $100 per month (with and without behavior change) was determined with and without behavior change. The underlying calculations used to develop the distributions are based off of a difference-in-differences approach that compares the treatment and control customers based on both pre- and post-treatment bill impacts.[104]

The two distributions are presented on a line graph, with the height of the line at any given $10 increment representing the percentage of customers experiencing a bill impact of the corresponding dollar amount. In this case, the bill impact is measured as the difference between the TOU bill and the OAT bill. If the line for the group with changes in behavior is to the left of the line representing the group with no change in behavior, it shows that at least some customers were able to modify their energy usage such that they had lower total bill impacts compared to if they had not changed their behavior.

Figure 5.4-19 presents the distribution of bill impacts with and without energy use behavior change. The blue line represents the structural bill impacts that result when customers are billed on the TOU rate and do not change their energy use behavior. The green line shows the total bill impacts when customers have responded to the TOU rate and, in some cases, changed their energy use behavior. Bill impacts are calculated as the difference between the TOU bill and the OAT bill. Each point along the line graph represents the percentage of customers within a specific bill impacts bin or range. For example, on Rate 1, approximately 18% of the customers have structural bill impact of $21 to $30 per month—the blue line. In other words, approximately 18% of the Rate 1 customers would experience an increase of $21 to $30 per month on Rate 1 compared to the OAT without changing their behavior. The green line represents the bill impacts when customers have had the opportunity to respond to the TOU rate. In this case, the percent of customers experiencing an increase of $21 to $30 per month on Rate 1 compared to the OAT is 16%, showing a slight decrease.

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[103] Bill impacts without behavior change represent the structural bill impact distribution, bill impacts with behavior change show how behavioral impacts affect the structural bill impact distribution.

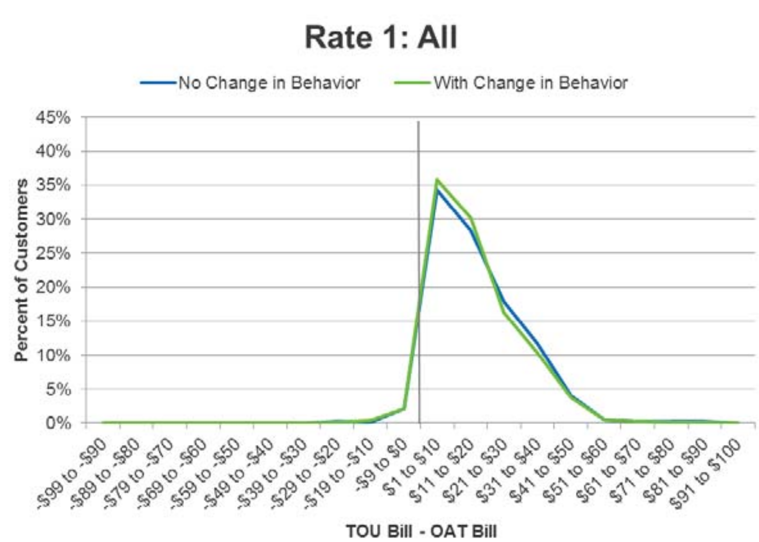
[104] See section 3.2.4 for additional details on the methodology.

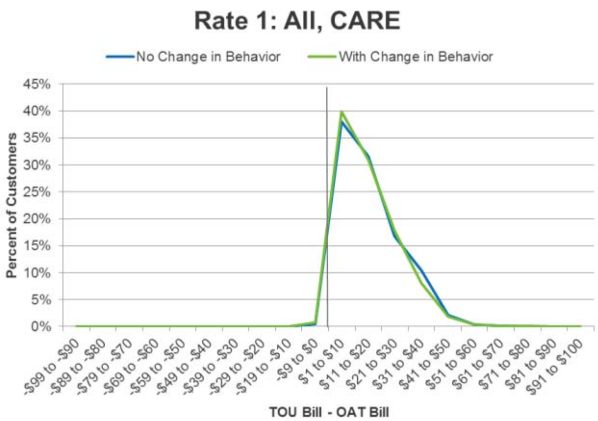
It is important to note that customers could move up or down through the incremental impact bins, and could potentially move more than one bin—meaning that a customer could potentially experience a bill increase due to their behavioral response, or they could jump down several bins and go from a $21 to $30 per month bill impact down to $11 to $20 impact, for example. In the case of the average Rate 1 customers, there is an increase in the percent of customers with a bill impact of between $11 and $20 per month. With no change in behavior, 28% of customers were in this bin and with behavior change 30% of customers are now in this bin. Looking at the shape of the distributions and the table reporting the percentages, it is clear that with behavior change there were fewer customers in the $31 to $40 range, and in the$21 to $30 range. While it isn't clear exactly where those customers moved, it is clear that ultimately some customers were able to make changes in their energy use behavior that resulted in offsetting some of the structural loss, as covered in the previous sections. While the percentage of customers in the $11 to $20 bin increased, it was because they were originally in higher bill impact ranges and have since transitioned down to a lower bin.

As noted in the previous section, CARE/FERA customers on average did not offset any of the structural loss through behavior change. This is also apparent in the graph below, where there is very little separation between the green and blue lines, especially in the lower bill impact bins. On the other hand, the non-CARE/FERA customers were able to slightly offset the structural bill impacts, and this can be observed in the graph where sections of the green line are to the left of or below the blue line. It's also important to note that instances where the green line is to the right of or above the blue line in the lower bill impact ranges indicate more customers have moved into that bin, likely from higher impact bins. This is the case where there is a higher percentage of non-CARE/FERA customers in the $11 to $20 range after behavior change compared to before behavior change.

Figure 5.4-19: Rate 1 Change in the Distribution of Bill Impacts Due to Behavior Change All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0%	0%
-$89 to -$80	0%	0%
-$79 to -$70	0%	0%
-$69 to -$60	0%	0%
-$59 to -$50	0%	0%
-$49 to -$40	0%	0%
-$39 to -$30	0%	0%
-$29 to -$20	0%	0%
-$19 to -$10	0%	0%
-$9 to $0	2%	2%
$1 to $10	34%	36%
$11 to $20	28%	30%
$21 to $30	18%	16%
$31 to $40	12%	10%
$41 to $50	4%	4%
$51 to $60	1%	0%
$61 to $70	0%	0%
$71 to $80	0%	0%
$81 to $90	0%	0%
$91 to $100	0%	0%





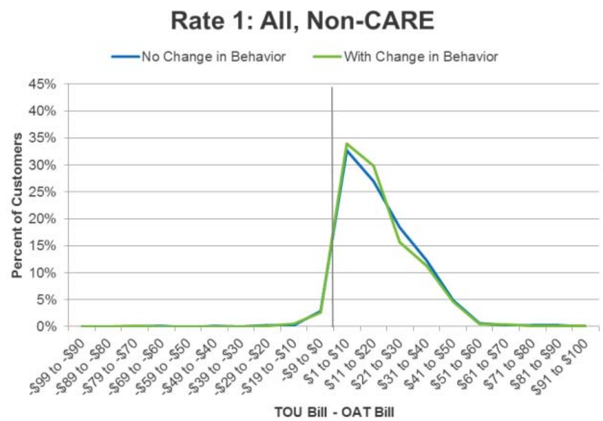
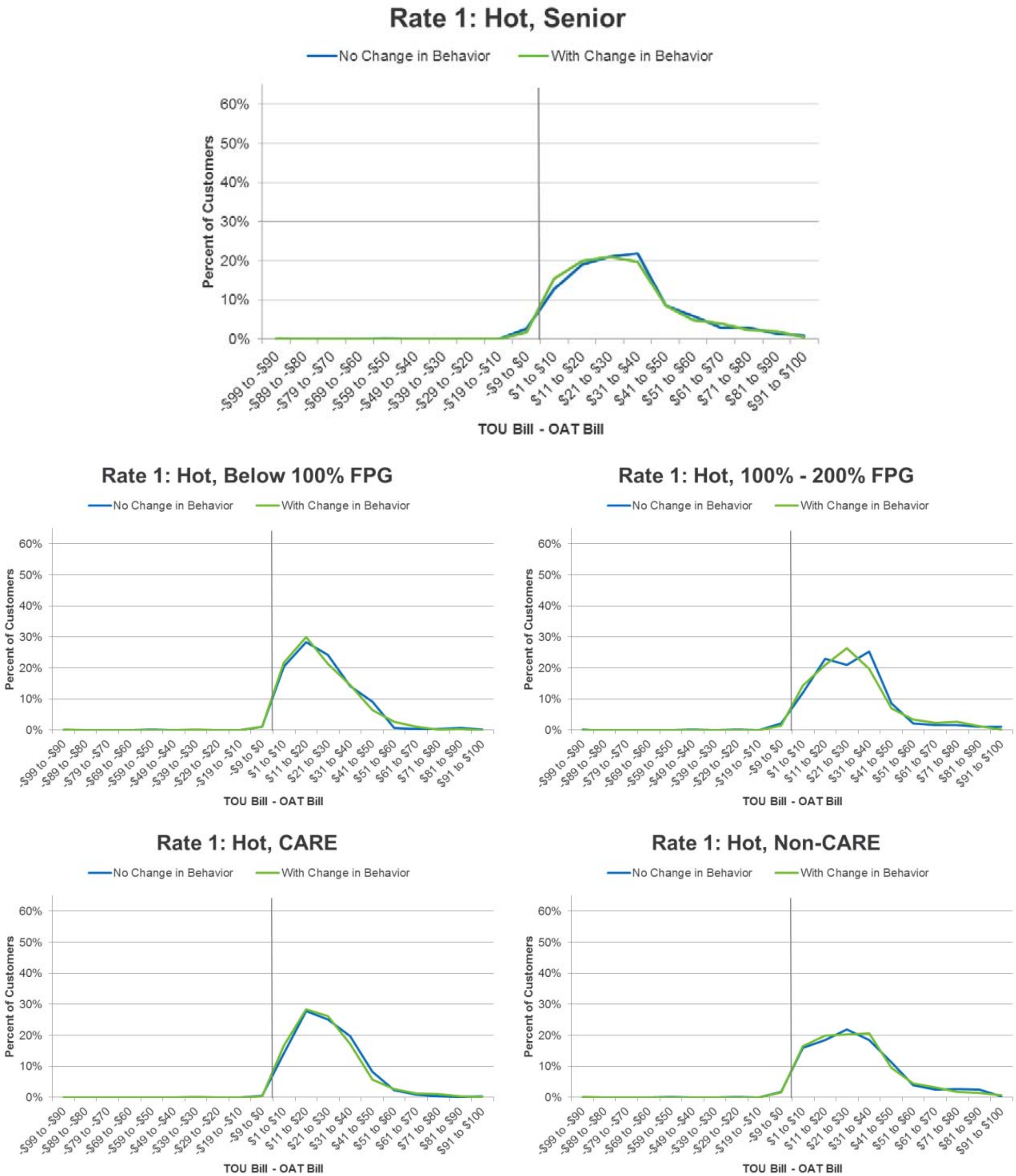


Figure 5.4-20 provides the distribution of bill impacts for the detailed segments by climate zone. As noted above in section 5.4.2, the only Rate 1 segments with statistically significant bill impacts due to behavior change were non-CARE/FERA customers in the moderate and cool climate regions. In each of those segments, it is possible to see how the distribution has shifted slightly. It's also worth noting that there are instances where there weren't statistically significant bill impacts. However, it's clear some shifting took place. Nevertheless, based on the outcomes it is apparent that not all of the shifting was into lower bill impact ranges given that the overall outcome for that segment was near zero and not statistically significant.

Figure 5.4-20: Rate 1 Change in the Distribution of Bill Impacts Due to Behavior Change Detailed Segments by Climate Region



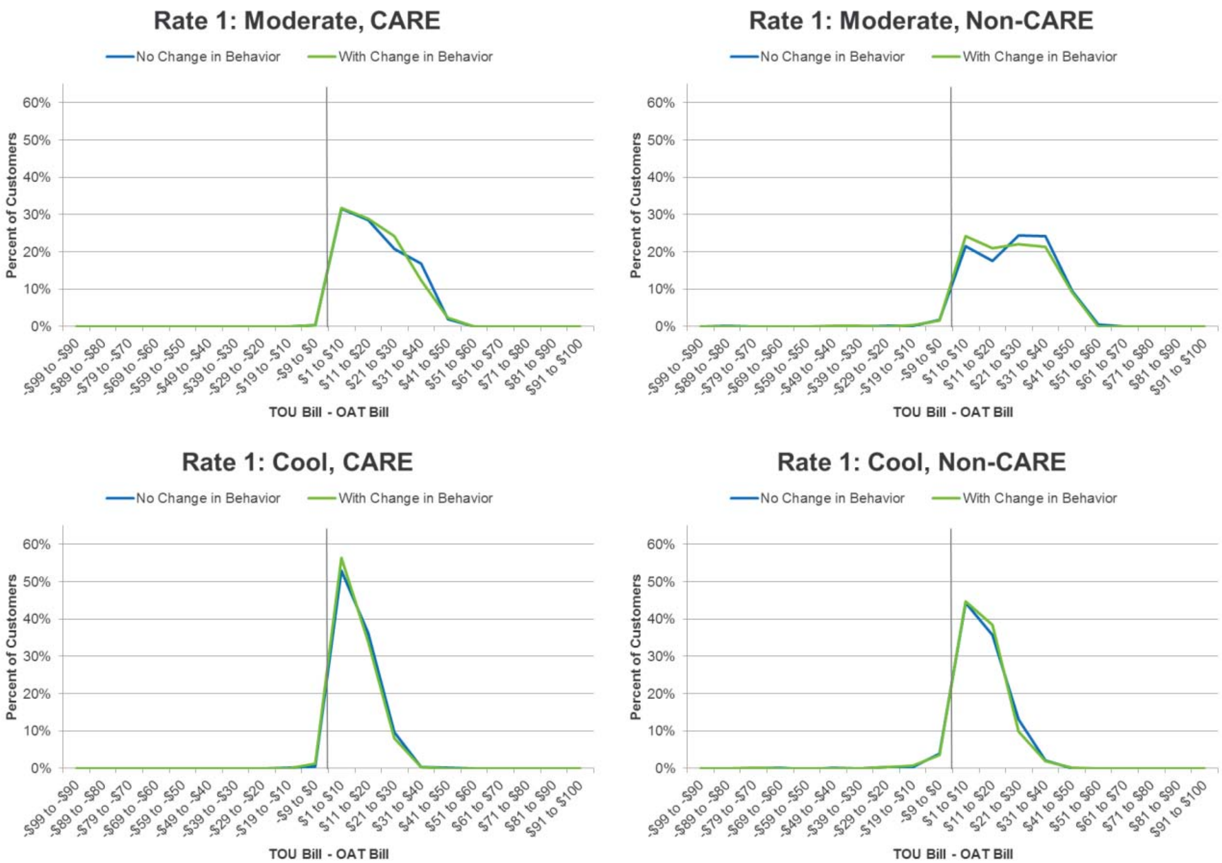
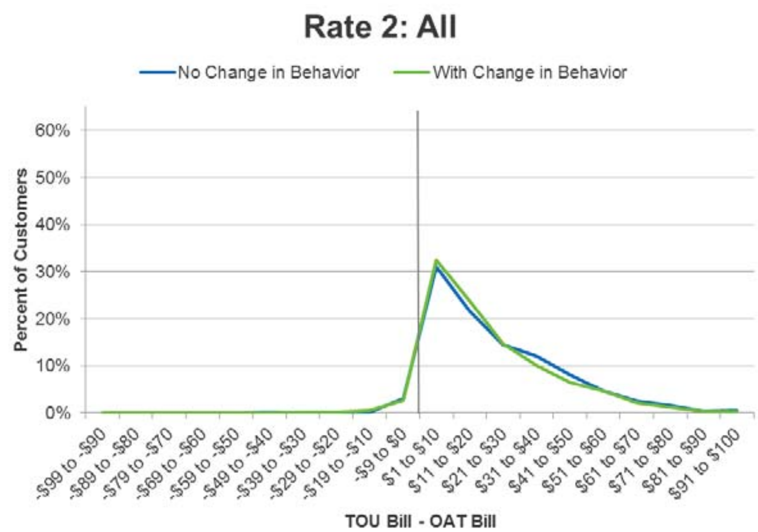
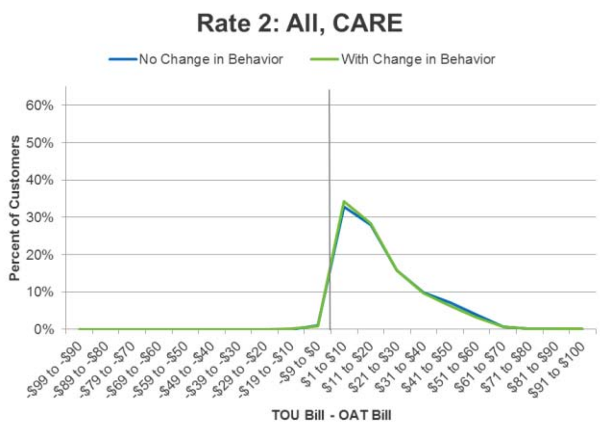


Figure 5.4-21 provides the distributions of bill impacts for all customers and CARE/FERA and non-CARE/FERA customers on Rate 2. The average Rate 2 customer was able to offset approximately $3.21 of the structural loss through behavior change. Based on the graph, some customers with larger impacts in the $41 to $50 range were able to transition down to lower bins. On average, Rate 2 CARE/FERA customers were not able to offset any of the structural loss. This is further illustrated with the very small shifts in the distributions of bill impacts with and without change in behavior. As with Rate 1, non-CARE/FERA customers show the largest behavioral bill impacts. This is shown where there is a notable reduction in the $31 to $40 per month bill impact range, and growth in the lower impact ranges.

Figure 5.4-21: Rate 2 Change in the Distribution of Bill Impacts Due to Behavior Change All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0%	0%
-$89 to -$80	0%	0%
-$79 to -$70	0%	0%
-$69 to -$60	0%	0%
-$59 to -$50	0%	0%
-$49 to -$40	0%	0%
-$39 to -$30	0%	0%
-$29 to -$20	0%	0%
-$19 to -$10	0%	1%
-$9 to $0	4%	4%
$1 to $10	30%	32%
$11 to $20	19%	22%
$21 to $30	14%	14%
$31 to $40	13%	10%
$41 to $50	8%	7%
$51 to $60	5%	5%
$61 to $70	3%	3%
$71 to $80	2%	2%
$81 to $90	0%	1%
$91 to $100	1%	1%





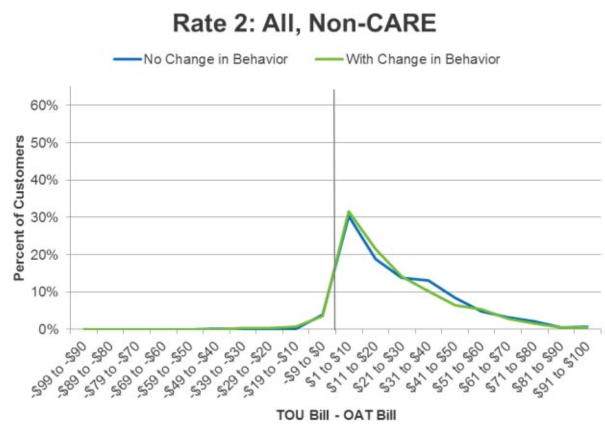
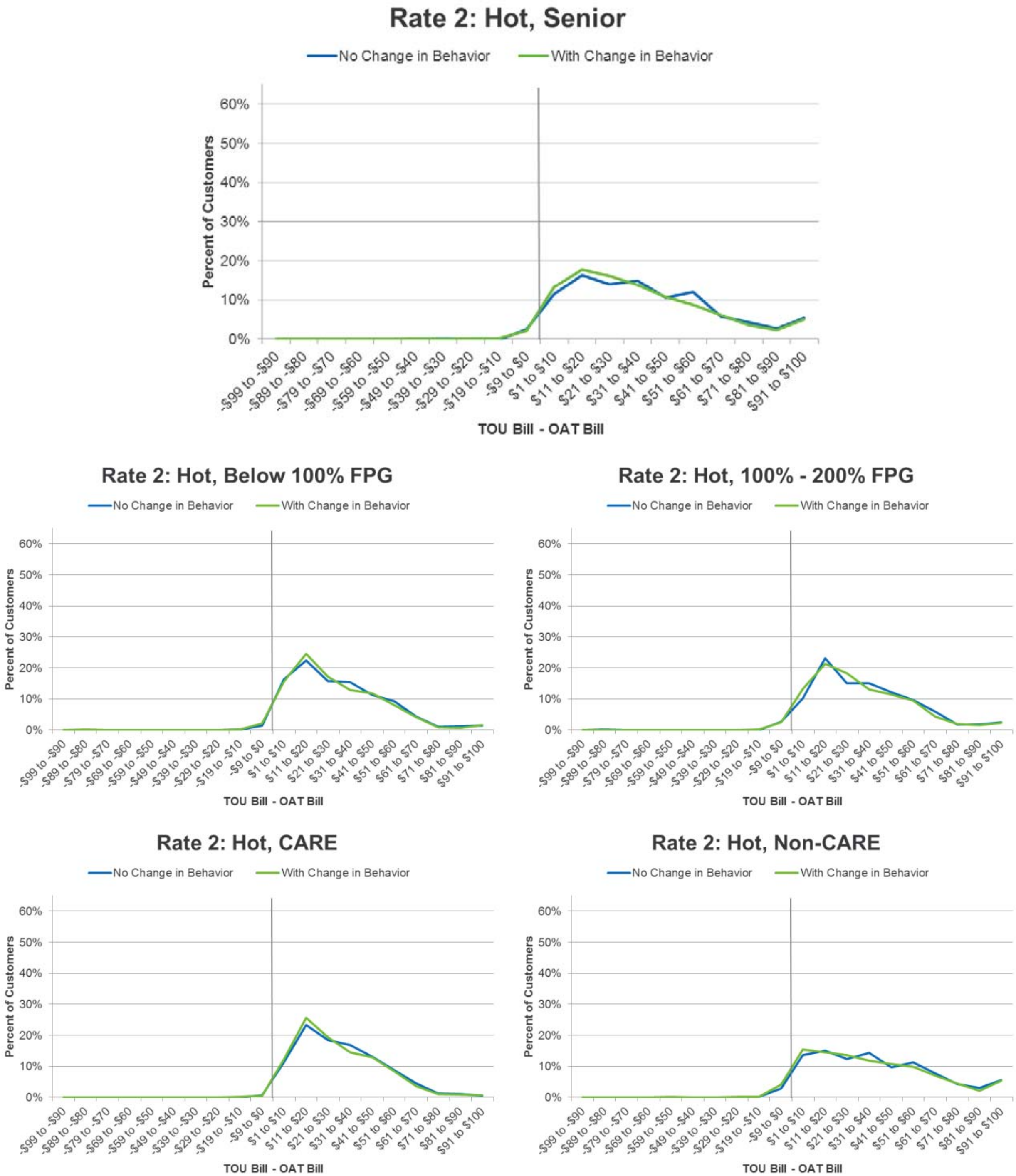
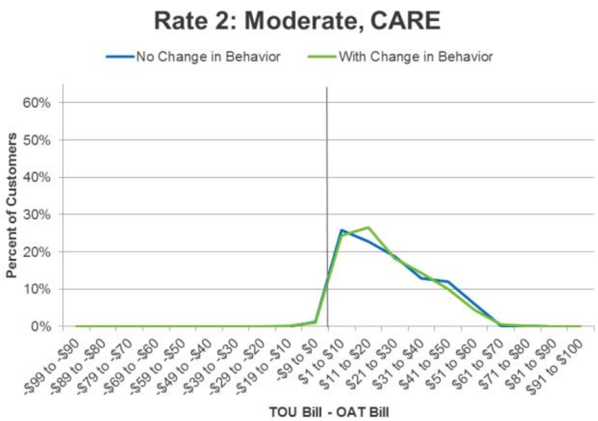
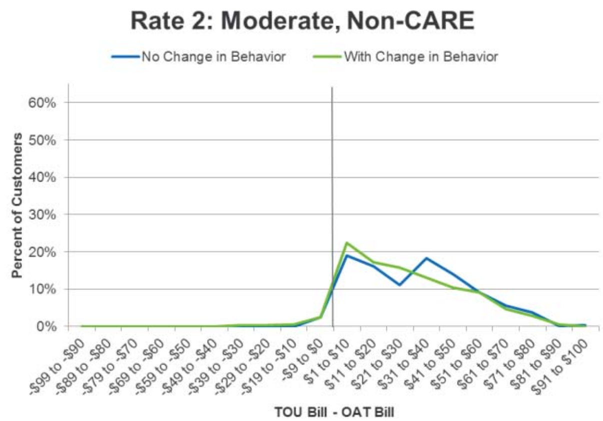


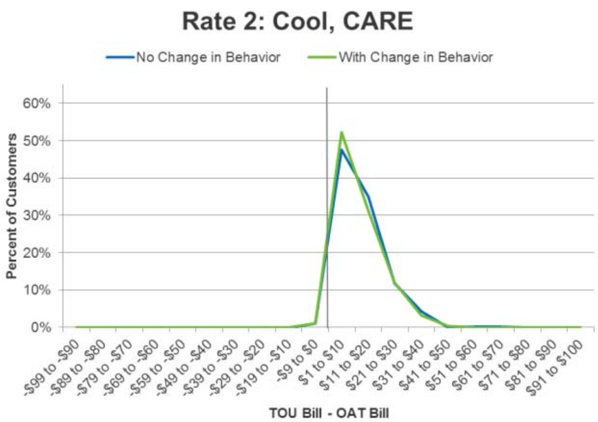
Figure 5.4-22 shows the distribution of bill impacts for the detailed segments by climate zone for Rate 2. As noted above, the only Rate 2 segments with statistically significant bill impacts from behavior change were non-CARE/FERA customers in the cool and moderate climate regions. The non-CARE/FERA customers in the moderate climate region show a dramatic shift in the distribution of bill impacts with and without behavior change. Some of the other segments show changes in the distribution. However, the bill impacts from behavior change for the remaining segments were not statistically significant. This indicates that while on average there were no behavioral bill impacts, there are customers within the segments that produced significant bill impacts due to behavior change.

Figure 5.4-22: Rate 2 Change in the Distribution of Bill Impacts Due to Behavior Change Detailed Segments by Climate Region









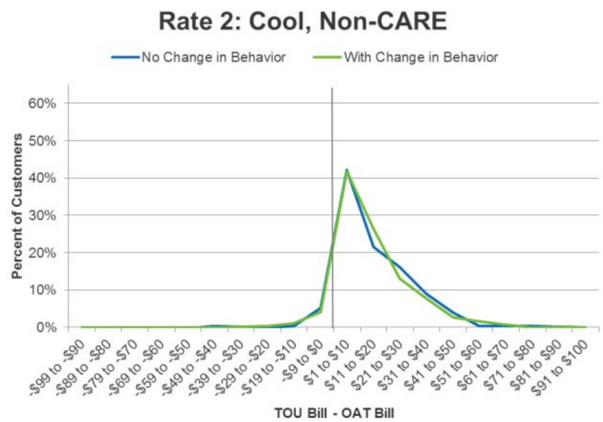


Figure 5.4-23 shows the distribution of bill impacts for all customers and for CARE/FERA and non-CARE/FERA customers on Rate 3. The average Rate 3 customer was able to offset approximately $2.21 (12.6%) of the structural loss. Based on the graph, it appears that some customers who were very close to being structural benefiters were able to shift into that category with changes in behavior. As with Rates 1 and 2, CARE/FERA customers were not able to offset any of their structural loss. Non-CARE/FERA customers were the segment with the largest behavioral bill impacts – the shift from the $11 to $20 to the $1 to $10 range is quite clear.

Figure 5.4-23: Rate 3 Change in the Distribution of Bill Impacts Due to Behavior Change All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0%	0%
-$89 to -$80	0%	0%
-$79 to -$70	0%	0%
-$69 to -$60	1%	0%
-$59 to -$50	1%	0%
-$49 to -$40	0%	1%
-$39 to -$30	2%	1%
-$29 to -$20	2%	1%
-$19 to -$10	3%	3%
-$9 to $0	3%	4%
$1 to $10	11%	13%
$11 to $20	35%	34%
$21 to $30	20%	22%
$31 to $40	13%	12%
$41 to $50	6%	5%
$51 to $60	1%	1%
$61 to $70	1%	0%
$71 to $80	1%	0%
$81 to $90	0%	0%
$91 to $100	0%	0%

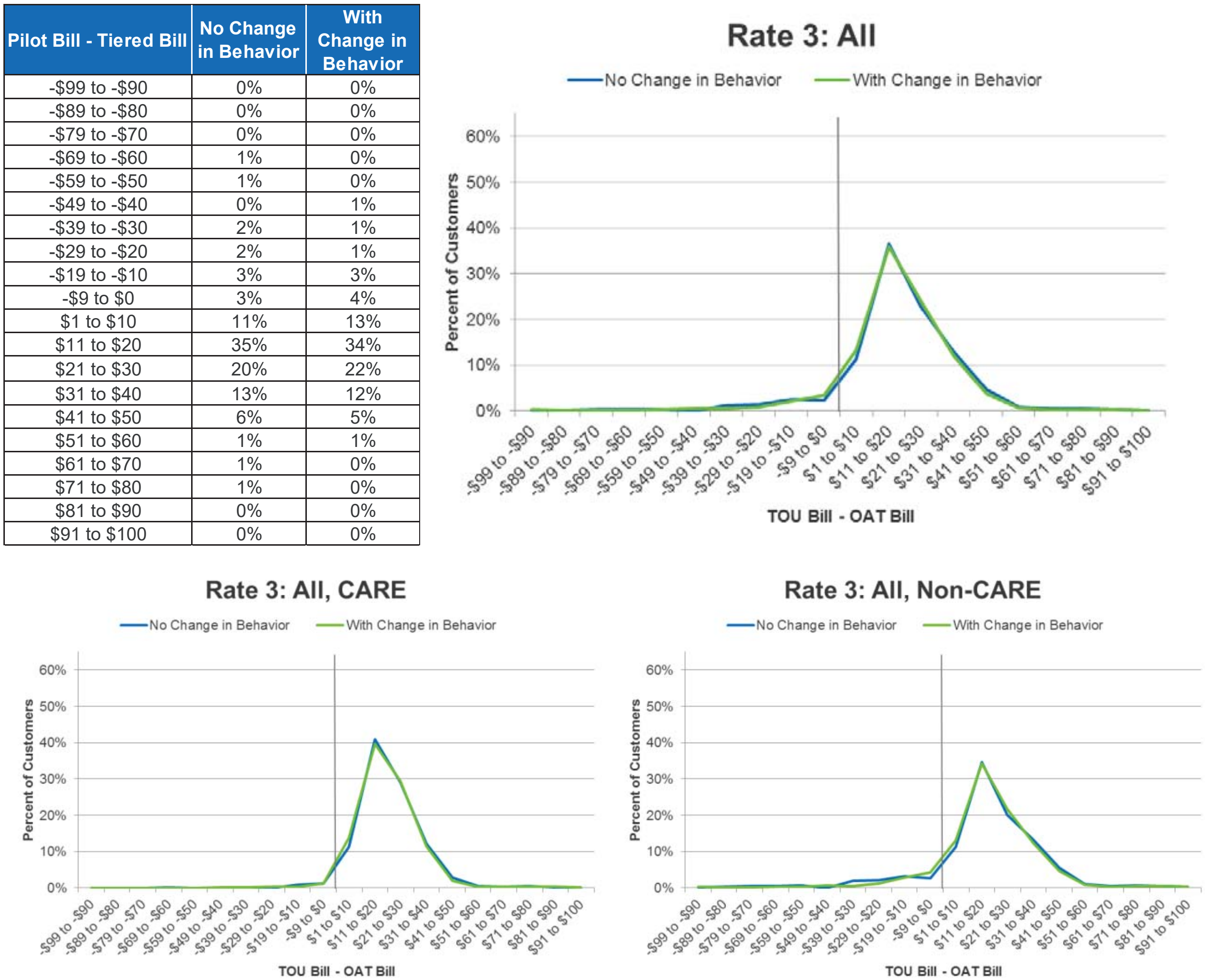
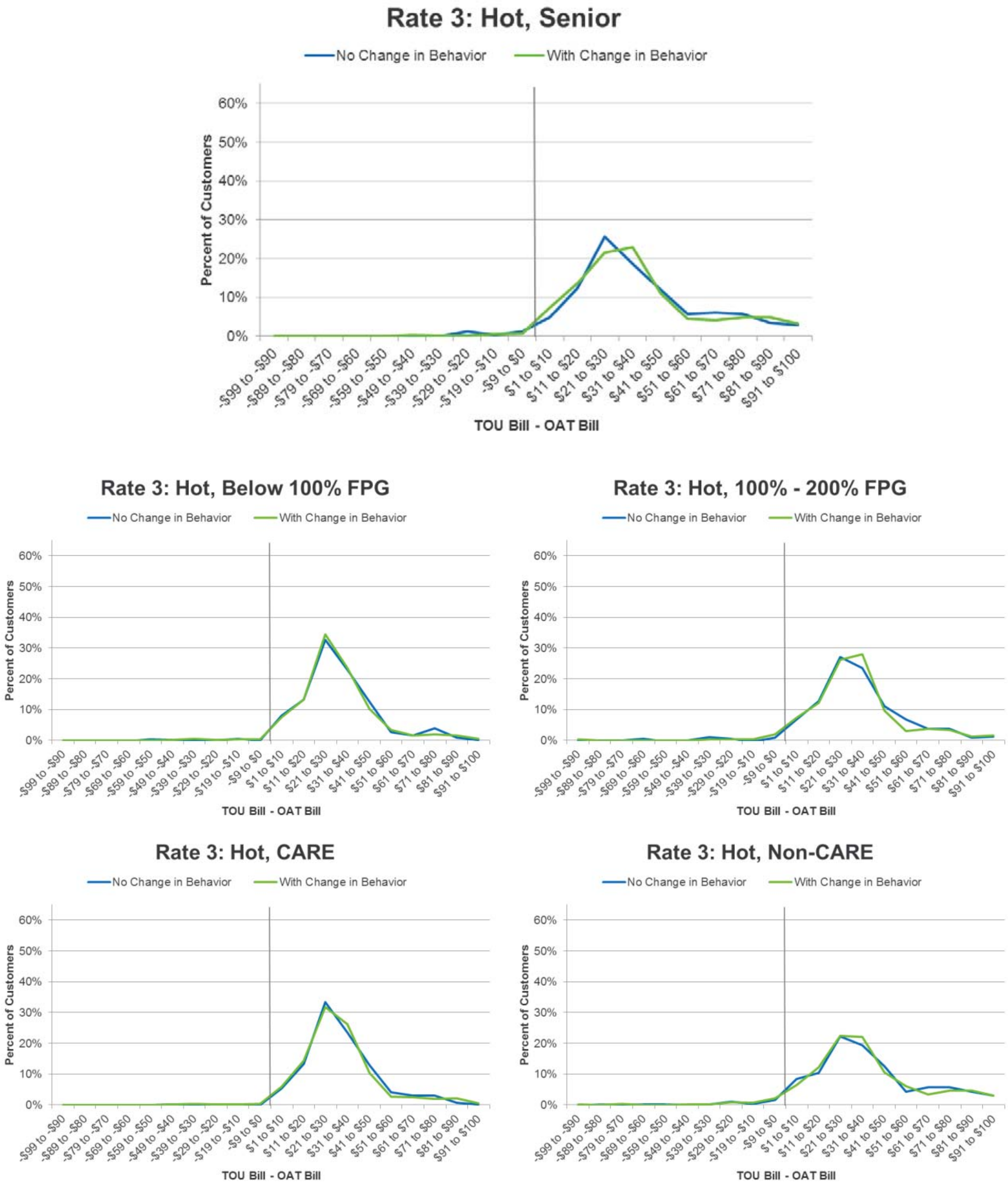
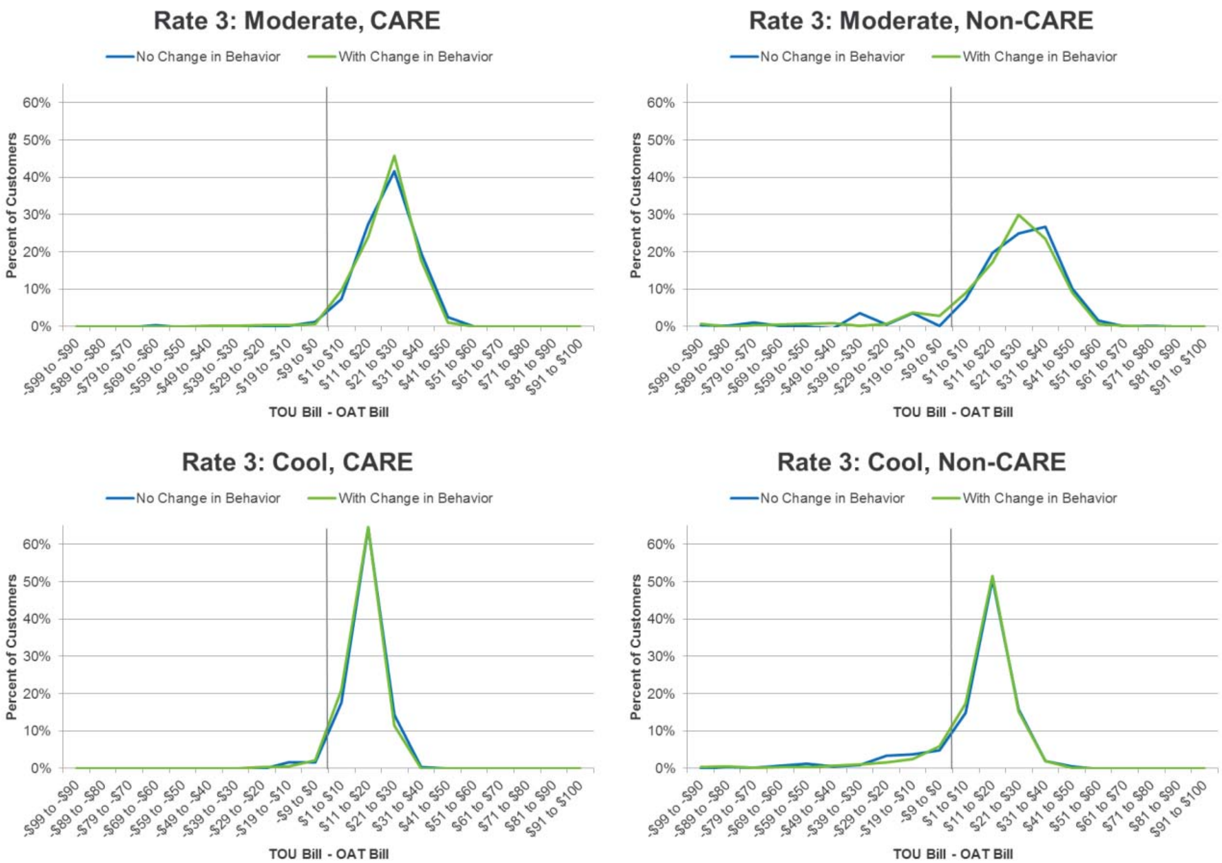


Figure 5.4-24 shows the distribution of bill impacts for the detailed segments by climate zone for Rate 3. As noted above in Section 5.4.2, the only Rate 3 segment with statistically significant bill impacts due to behavior change was non-CARE/FERA customers in the cool climate region. This segment shows a shift in the smaller bill impact bins, but the shift is not immediately obvious in the higher impact bins.

Figure 5.4-24: Rate 3 Change in the Distribution of Bill Impacts Due to Behavior Change Detailed Segments by Climate Region





5.5 Survey Findings

This section summarizes the survey findings for the three rate treatments tested by SCE. The CPUC resolution approving SCE's pilot requires that survey findings be reported for the following rates, customer segments, and climate regions:

- Seniors, CARE/FERA customers, non-CARE/FERA customers and households with incomes below 100% of FPG, and households with incomes between 100% and 200% of FPG in SCE's hot climate region for Rate 2, and
- CARE/FERA and non-CARE/FERA customers for each rate for each climate region.

Sub-Appendix B in Appendix Volume 1 describes the reporting requirements for SCE's opt-in pilot.

5.5.1 Findings Relevant to 745c Decision

Descriptive Statistics of Economic/Health Scores

To assess whether any of the TOU pilot rates caused economic difficulty, difference in average economic index scores were compared between the rate treatment and control groups for the segments shown in Table 5.5-1.

Table 5.5-1: Segments Tested by Rate

Climate	Segment	Control vs. Rate 1	Control vs. Rate 2	Control vs. Rate 3
Hot	Non-CARE/FERA	X	X	X
	CARE/FERA	X	X	X
	CARE/FERA – on or eligible	X	X	X
	Below 100% FPG		X	
	100 to 200% FPG		X	
	Seniors		X	
Moderate	Non-CARE/FERA	X	X	X
	CARE/FERA	X	X	X
	CARE/FERA – on or eligible	X	X	X
Cool	Non-CARE/FERA	X	X	X
	CARE/FERA	X	X	X
	CARE/FERA – on or eligible	X	X	X

Values for descriptive statistics provided in Table 5.5-2 and Figure 5.5-1 to Figure 5.5-3 are shown for all respondents combined, including control and treatment customers, with no weighting applied to adjust for oversampling of sub-segments in the hot climate region or oversampling of CARE/FERA customers in all climate regions.

Table 5.5-2 provides the mean, median, and the 25th and 75th percentile scores for all SCE respondents and Figure 5.5-1 shows the histogram of economic index scores. The dotted line on the histogram shows the median, while the orange line shows the mean. Economic index scores can range from a low of 0 to a high of 10. The higher the score, the more economic difficulty a respondent has. SCE pilot participants had a mean economic index score of 3.0 and median score of 2.6. The distribution of economic index scores is positively skewed.

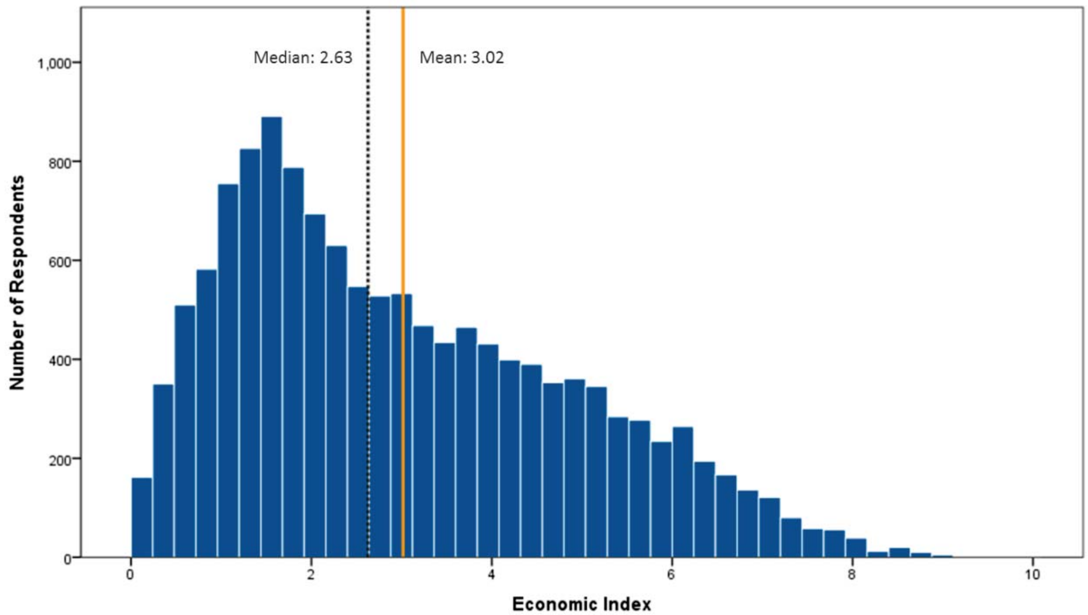
Table 5.5-2: Measures of Central Tendency for Economic Index Scores[1,2]

Statistic	All SCE Sample	Non-CARE/FERA	CARE/FERA	Seniors
Mean	3.02	2.28	4.04	2.74
25th Percentile	1.47	1.14	2.63	1.33
Median	2.63	1.83	3.97	2.33
75th Percentile	4.35	3.08	5.34	3.89

[1] Higher mean index scores = more economic difficulty.

[2] Values are shown for all respondents combined, including control and treatment customers, with no weighting used to adjust for oversampling of sub-segments in the hot climate region or oversampling of CARE/FERA customers in all climate regions.

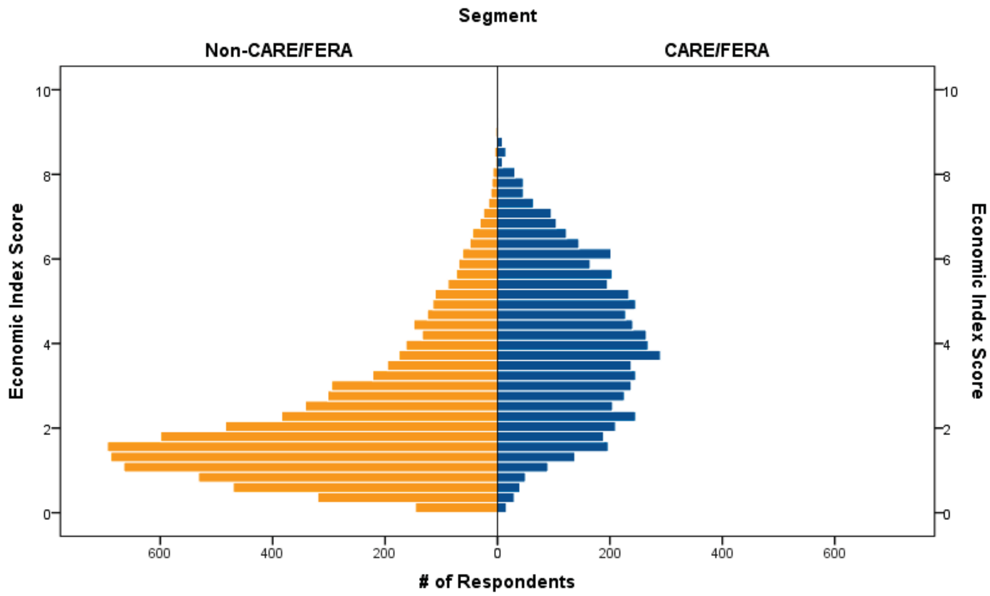
Figure 5.5-1: Histogram of Economic Index Scores[1, 2]



[1] Higher index scores = more economic difficulty.
[2] Values are shown for all respondents combined, including control and treatment customers, with no weighting used to adjust for oversampling of sub-segments in the hot climate region or oversampling of CARE/FERA customers in all climate regions.

As shown in Figure 5.5-2, the distribution of economic index scores is different for CARE/FERA and non-CARE/FERA groups. Both groups show a large spread of economic index scores, but the distribution of CARE/FERA scores is normally distributed, with equal distribution around the average score of 4.04. When comparing the two distributions, the reader is reminded that the CARE/FERA population depicted in the figure includes oversampling for households with incomes below 100% of FPG in the hot climate region and other non-random sampling across climate regions and does not accurately represent the distribution of economic index scores for CARE/FERA customers from the general SCE population.

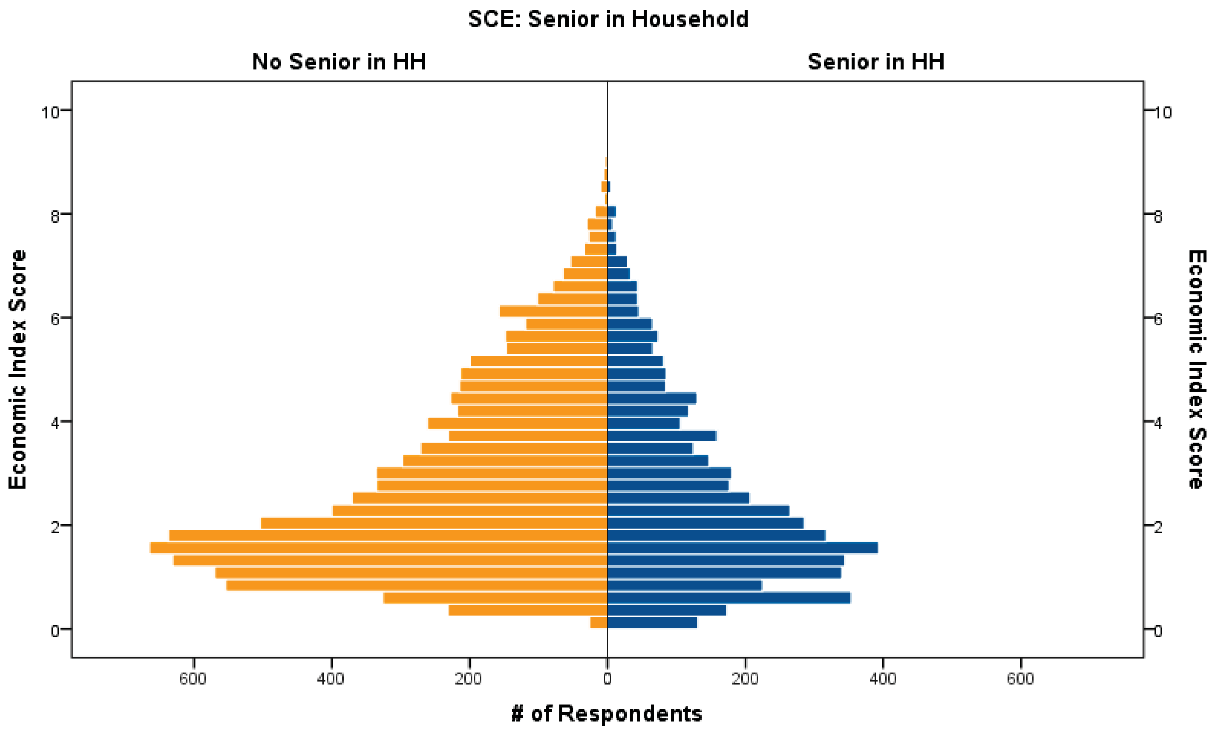
Figure 5.5-2: Histogram of Economic Index Scores for CARE/FERA and non-CARE/FERA Segments[1, 2]



[1] Higher index scores = more economic difficulty.
[2] Values are shown for all respondents combined, including control and treatment customers, with no weighting used to adjust for oversampling of sub-segments in the hot climate region or oversampling of CARE/FERA customers in all climate regions.

As shown in Figure 5.5-3, the distribution of economic index scores very similar between households with a senior as a head of household versus a non-senior as a head of household. Both groups show a large spread of economic index scores and the distributions are both positively skewed. Once again, however, it is important to keep in mind that oversampling of seniors in the hot climate region means that the distributions displayed in the figure do not represent the distribution of scores for senior households from the general SCE population.

Figure 5.5-3: Histogram of Economic Index Scores for Seniors and Non-Seniors[1,2]



[1] Higher index scores = more economic difficulty.

[2] Values are shown for all respondents combined, including control and treatment customers, with no weighting used to adjust for oversampling of sub-segments in the hot climate region or oversampling of CARE/FERA customers in all climate regions.

Health Index: Table 5.5-3 shows the percent of respondents who reported a household member who sought medical attention due to excess heat from among the small minority of respondents who indicated that a household member had a medical condition that required keeping their house cool in the summer. All respondents in each segment also indicated that their home has some form of air conditioning. CARE/FERA customers and those with incomes less than 100% FPG were more likely to report a household member who sought medical attention because of the heat than other segments.

Table 5.5-3: Distribution of Health Index Responses from Customers with AC and a Disability that Requires Cooling by Segment[1]

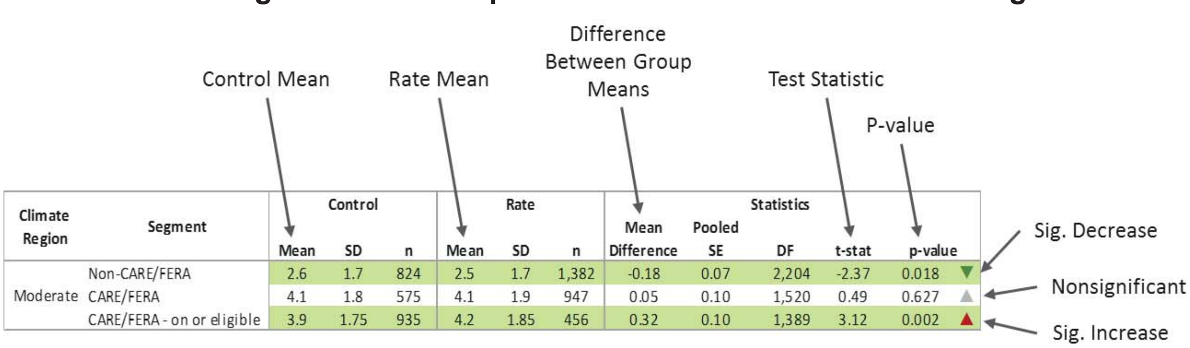
Climate Region	Segment	Total in segment	Total seeking medical attention	% seeking medical attention
Hot	Non-CARE/FERA	472	56	12%
	CARE/FERA	558	141	25%
	CARE/FERA - on or eligible	754	177	23%
	Below 100% FPG	570	142	25%
	100 to 200% FPG	298	53	18%
	Seniors	784	130	17%
Moderate	Non-CARE/FERA	235	35	15%
	CARE/FERA	390	99	25%
	CARE/FERA - on or eligible	497	124	25%
Cool	Non-CARE/FERA	152	30	20%
	CARE/FERA	226	59	26%
	CARE/FERA - on or eligible	284	78	27%

[1] Table includes all respondents who indicated someone in their household had a disability that required they keep their home cool during the summer and had a form of air conditioning in their home. Totals include all control and treatment respondents by segment.

Economic and Health Changes – Control Versus Rate Comparisons

This section compares the average values for the economic and health indices for control and TOU treatment customers for each customer segment, rate and climate region. Given the RCT design, any statistically significant differences between control and treatment customers can be attributed to the TOU rates (or random chance). Statistically significant differences between control and rate groups are highlighted in green. Color-coded triangles are also provided to facilitate interpretation of the results as shown in Figure 5.5-4.

Figure 5.5-4: Example of Results Table with Color Coding



Climate Region	Segment	Control Mean	Control SD	Control n	Rate Mean	Rate SD	Rate n	Mean Difference	Pooled SE	DF	t-stat	p-value
Moderate	Non-CARE/FERA	2.6	1.7	824	2.5	1.7	1,382	-0.18	0.07	2,204	-2.37	0.018 ▼
	CARE/FERA	4.1	1.8	575	4.1	1.9	947	0.05	0.10	1,520	0.49	0.627 ▲
	CARE/FERA - on or eligible	3.9	1.75	935	4.2	1.85	456	0.32	0.10	1,389	3.12	0.002 ▲

Rate 1

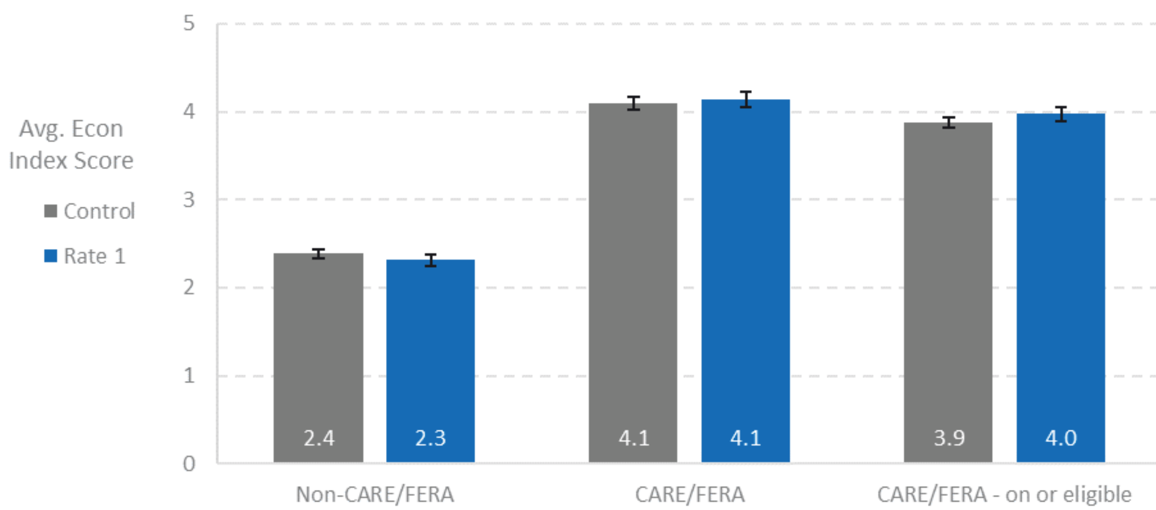
Economic Index: Table 5.5-4 shows the economic index scores for Rate 1 and control group customers by segment and climate region. There was no statistically significant increase in the economic index for customers on Rate 1 in any segment or climate region. However, CARE/FERA customers in both the control and treatment groups had substantially higher economic index scores compared with non-CARE/FERA households in all climate regions.

Table 5.5-4: Comparison of Economic Index Means, Control vs. Rate 1[1]

Climate Region	Segment	Control			Rate 1			Statistics					
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value	
Hot	Non-CARE/FERA	2.4	1.63	1,162	2.3	1.64	740	-0.08	0.08	1,900	-0.99	0.320	▼
	CARE/FERA	4.1	1.7	578	4.1	1.8	417	0.05	0.11	993	0.41	0.683	▲
	CARE/FERA - on or eligible	3.9	1.75	935	4.0	1.83	595	0.09	0.09	1,528	0.99	0.323	▲
Moderate	Non-CARE/FERA	2.3	1.5	521	2.4	1.7	497	0.07	0.10	1,016	0.68	0.499	▲
	CARE/FERA	4.0	1.7	389	3.8	1.9	367	-0.16	0.13	754	-1.22	0.224	▼
	CARE/FERA - on or eligible	3.8	1.7	545	3.7	1.9	516	-0.02	0.11	1,059	-0.17	0.863	▼
Cool	Non-CARE/FERA	2.0	1.43	583	2.1	1.43	575	0.09	0.08	1,156	1.10	0.270	▲
	CARE/FERA	3.9	1.65	375	3.9	1.72	352	-0.01	0.12	725	-0.11	0.916	▼
	CARE/FERA - on or eligible	3.6	1.71	509	3.6	1.77	487	0.01	0.11	994	0.10	0.919	▲

[1] Higher mean index scores = more economic difficulty.

Figure 5.5-5: Mean Economic Index Scores, Control vs. Rate 1 for Key Segments in Hot Region[1]



[1] Higher mean index scores = more economic difficulty.

Health Index: Table 5.5-5 shows the health index proportions for control and treatment customers on Rate 1. The values in the table represent customers in the samples that have air conditioning and who reported a household member who required cooling due to a disability. The proportions shown in the table represent the percent of this population who reported a household member who sought medical attention because of excess heat. A higher proportion of Rate 1 CARE/FERA customers in the hot region reported a household member who sought medical attention due to heat when compared to the control group. Given the small sample sizes in the cool region segments, even relatively large differences between the proportions for those on Rate 1 and those in the control group in the cool region are not statistically significant.

Table 5.5-5: Comparison of Health Index Proportions, Control vs. Rate 1[1, 2]

Climate Region	Segment	Control % with Event	Control Total N	Rate 1 % with Event	Rate 1 Total N	% Difference	SE	Z-stat	p-value	
Hot	Non-CARE/FERA	13%	150	14%	103	0.3%	0.04	0.06	0.95	▲
	CARE/FERA	18%	175	31%	127	12%	0.05	2.51	0.01	▲
	CARE/FERA - on or eligible	19%	245	27%	168	8%	0.04	1.96	0.06	▲
Moderate	Non-CARE/FERA	18%	57	19%	73	2%	0.07	0.24	0.81	▲
	CARE/FERA	22%	107	23%	101	0.3%	0.06	0.06	0.95	▲
	CARE/FERA - on or eligible	24%	135	24%	133	0.4%	0.05	0.07	0.95	▲
Cool	Non-CARE/FERA	16%	45	23%	35	7%	0.09	0.83	0.41	▲
	CARE/FERA	32%	66	18%	60	-13%	0.08	1.74	0.08	▼
	CARE/FERA - on or eligible	31%	84	18%	73	-13%	0.07	1.90	0.06	▼

[1] Table shows health index results for respondents who indicated someone in their household had a disability that required they keep their home cool during the summer and had air conditioning in their home.

[2] The number of total customers that require cooling for a disability and have air conditioning in the moderate and cool climate region are very small. The results are included here for completeness, but the statistical outcomes are not valid due to small sample sizes.

Rate 2

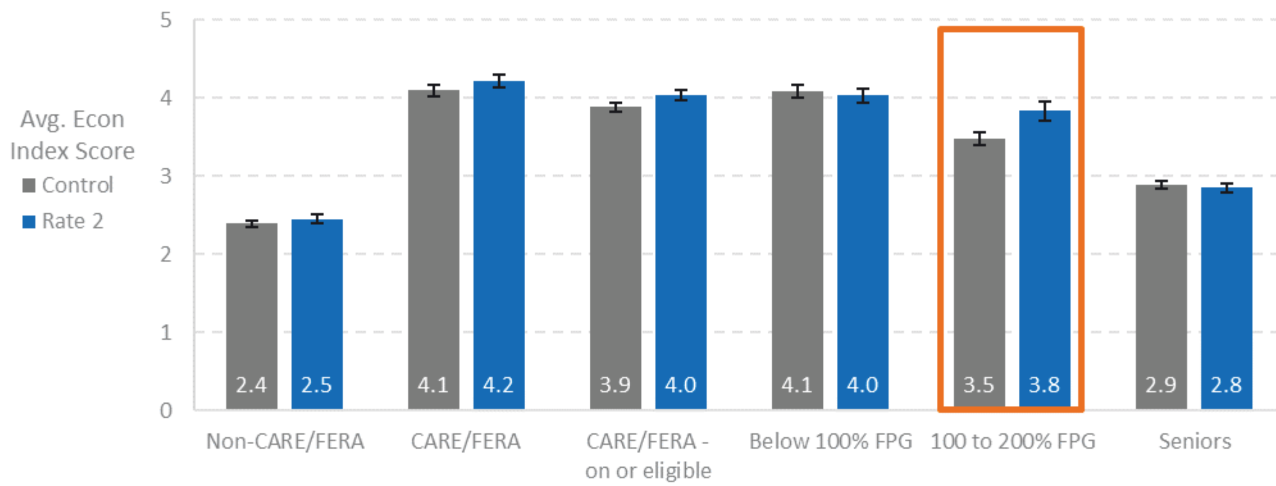
Economic Index: Table 5.5-6 shows the economic index values for control and treatment customers for Rate 2. Rate 2 customers with incomes between 100 and 200% of FPG segment had statistically significantly higher economic index scores when compared the control group. Rate 2 caused a 2-tenth increase in the economic index. This increase is equivalent to a customer noting they had trouble paying one additional bill during the 4-month pilot period. No other segments on Rate 2 had statistically significant higher economic index scores compared with the control group. In addition, as shown in the table and in Figure 5.5-6, the index value is nearly twice as high for CARE/FERA customers and CARE/FERA eligible customers compared with non-CARE/FERA customers.

Table 5.5-6: Comparison of Economic Index Means, Control vs. Rate 2[1]

Climate Region	Segment	Control Mean	Control SD	Control n	Rate 2 Mean	Rate 2 SD	Rate 2 n	Mean Difference	Pooled SE	DF	t-stat	p-value	
Hot	Non-CARE/FERA	2.4	1.6	1,162	2.5	1.8	822	0.06	0.08	1,982	0.84	0.399	▲
	CARE/FERA	4.1	1.7	578	4.2	1.9	514	0.12	0.11	1,090	1.11	0.269	▲
	CARE/FERA - on or eligible	3.9	1.8	935	4.0	1.9	757	0.16	0.09	1,690	1.74	0.083	▲
	Below 100% FPG	4.1	2.0	657	4.0	2.1	577	-0.06	0.11	1,232	-0.50	0.617	▼
	100 to 200% FPG	3.5	1.7	404	3.8	1.9	243	0.36	0.14	645	2.53	0.012	▲
	Seniors	2.9	1.8	1,067	2.8	1.9	960	-0.04	0.08	2,025	-0.46	0.642	▼
Moderate	Non-CARE/FERA	2.3	1.5	521	2.2	1.5	485	-0.07	0.09	1,004	-0.79	0.430	▼
	CARE/FERA	4.0	1.7	389	3.8	1.8	372	-0.18	0.13	759	-1.45	0.147	▼
	CARE/FERA - on or eligible	3.8	1.7	545	3.7	1.8	498	-0.08	0.11	1,041	-0.75	0.451	▼
Cool	Non-CARE/FERA	2.0	1.4	583	2.1	1.5	576	0.05	0.09	1,157	0.59	0.552	▲
	CARE/FERA	3.9	1.7	375	3.9	1.8	378	0.03	0.13	751	0.25	0.799	▲
	CARE/FERA - on or eligible	3.6	1.7	509	3.7	1.8	515	0.09	0.11	1,022	0.81	0.420	▲

[1] Higher mean index scores = more economic difficulty.

Figure 5.5-6: Mean Economic Index Scores, Control vs. Rate 2 for Targeted Segments in Hot Region[1]



[1] Higher mean index scores = more economic difficulty.

Health Index: Table 5.5-7 shows the health index, or the proportion of households reporting at least one medical event due to heat in the summer. The percentage of respondents across all segments in Rate 2 who reported a household member needed to seek medical attention is not statistically different than the percentage of respondents in the corresponding control groups. In addition, the health index is higher for low-income segments and seniors compared to non-CARE/FERA segments.

Table 5.5-7: Comparison of Health Index, Control vs. Rate 2[1, 2]

Climate Region	Segment	Control % with Event	Control Total N	Rate 2 % with Event	Rate 2 Total N	% Difference	SE	Z-stat	p-value	
Hot	Non-CARE/FERA	13%	150	9%	135	-4%	0.04	1.19	0.24	▼
	CARE/FERA	18%	175	26%	159	8%	0.05	1.79	0.07	▲
	CARE/FERA - on or eligible	19%	245	23%	215	4%	0.04	0.95	0.34	▲
	Below 100% FPG	23%	213	23%	210	1%	0.04	0.20	0.85	▲
	100 to 200% FPG	15%	96	17%	90	2%	0.05	0.39	0.70	▲
	Seniors	16%	321	16%	282	-0.3%	0.03	0.10	0.92	▼
Moderate	Non-CARE/FERA	18%	57	9%	53	-8%	0.07	1.24	0.22	▼
	CARE/FERA	22%	107	31%	102	9%	0.06	1.46	0.14	▲
	CARE/FERA - on or eligible	24%	135	28%	123	5%	0.05	0.87	0.38	▲
Cool	Non-CARE/FERA	16%	45	14%	42	-1%	0.08	0.17	0.87	▼
	CARE/FERA	32%	66	26%	53	-5%	0.08	0.64	0.52	▼
	CARE/FERA - on or eligible	31%	84	27%	70	-4%	0.07	0.52	0.60	▼

[1] Table shows health index results for respondents who indicated someone in their household had a disability that required they keep their home cool during the summer and had air conditioning in their home.

[2] The number of total customers that require cooling for a disability and have air conditioning in the moderate and cool climate region are very small. The results are included here for completeness, but the statistical outcomes are not valid due to small sample sizes.

Rate 3

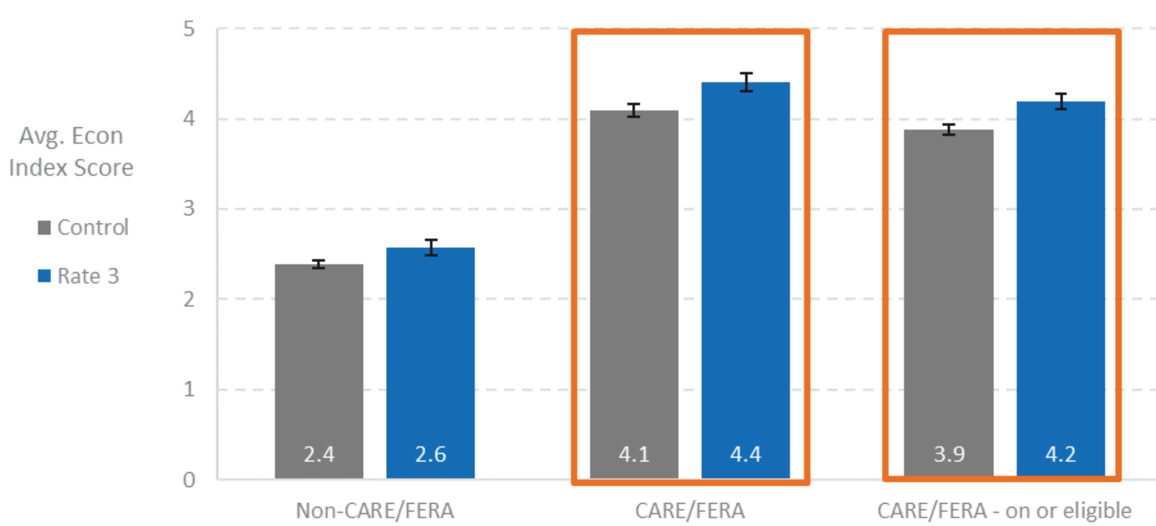
Economic Index: Table 5.5-8 and Figure 5.5 7 show the economic index score for customers on Rate 3 and the corresponding control group. SCE's Rate 3 increased economic index scores for CARE/FERA, and CARE/FERA participating and eligible customers in the hot climate region but not in other climate regions. Rate 3 increased economic index scores by about 3-tenths on average. This increase is equivalent to a customer noting they had trouble paying one additional bill during the 4-month pilot period or taking an additional action to reduce their bills. In addition, the index value is nearly twice as high for CARE/FERA customers and CARE/FERA eligible customers compared with non-CARE/FERA customers.

Table 5.5-8: Comparison of Economic Index Means, Control vs. Rate 3[1]

Climate Region	Segment	Control			Rate 3			Statistics					
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value	
Hot	Non-CARE/FERA	2.4	1.63	1,162	2.6	1.77	424	0.18	0.09	1,584	1.96	0.051	▲
	CARE/FERA	4.1	1.7	578	4.4	1.8	331	0.31	0.12	907	2.58	0.010	▲
	CARE/FERA - on or eligible	3.9	1.75	935	4.2	1.85	456	0.32	0.10	1,389	3.12	0.002	▲
Moderate	Non-CARE/FERA	2.3	1.5	521	2.4	1.6	474	0.12	0.10	993	1.19	0.234	▲
	CARE/FERA	4.0	1.7	389	3.9	1.8	310	-0.10	0.13	697	-0.77	0.442	▼
	CARE/FERA - on or eligible	3.8	1.7	545	3.7	1.8	462	-0.01	0.11	1,005	-0.13	0.898	▼
Cool	Non-CARE/FERA	2.0	1.43	583	2.1	1.56	481	0.08	0.09	1,062	0.90	0.366	▲
	CARE/FERA	3.9	1.65	375	3.9	1.88	310	-0.04	0.13	683	-0.29	0.775	▼
	CARE/FERA - on or eligible	3.6	1.71	509	3.7	1.89	432	0.03	0.12	939	0.27	0.785	▲

[1] Higher mean index scores = more economic difficulty.

Figure 5.5-7: Mean Economic Index Scores, Control vs. Rate 3 for Key Segments in Hot Region[1]



[1] Higher mean index scores = more economic difficulty.

Health Index: As shown in Table 5.5-9 , a statistically significantly higher proportion of Rate 3 CARE/FERA households in the hot region reported a household member who sought medical attention due to heat when compared to their control. There are no other statistically significant differences in the health index between Rate 3 and control customers. In addition, the health index is higher for

CARE/FERA customers compared to non-CARE/FERA segments. However, the sample sizes are too small to provide accurate results for the cool region non-CARE/FERA segment.

Table 5.5-9: Comparison of Health Index Proportions, Control vs. Rate 3[1, 2]

Climate Region	Segment	Control % with Event	Control Total N	Rate 3 % with Event	Rate 3 Total N	Statistics % Difference	SE	Z-stat	p-value	
Hot	Non-CARE/FERA	13%	150	12%	84	-1%	0.05	0.31	0.75	▼
	CARE/FERA	18%	175	29%	97	11%	0.05	2.02	0.04	▲
	CARE/FERA - on or eligible	19%	245	28%	126	9%	0.05	1.89	0.06	▲
Moderate	Non-CARE/FERA	18%	57	12%	52	-6%	0.07	0.88	0.38	▼
	CARE/FERA	22%	107	25%	80	3%	0.06	0.41	0.68	▲
	CARE/FERA - on or eligible	24%	135	24%	106	-0.1%	0.06	0.02	0.98	▼
Cool	Non-CARE/FERA	16%	45	30%	30	14%	0.10	1.50	0.13	▲
	CARE/FERA	32%	66	28%	47	-4%	0.09	0.48	0.63	▼
	CARE/FERA - on or eligible	31%	84	35%	57	4%	0.08	0.51	0.61	▲

[1] Table shows health index results for respondents who indicated someone in their household had a disability that required they keep their home cool during the summer and had air conditioning in their home.

[2] The number of total customers that require cooling for a disability and have air conditioning in the moderate and cool climate region are very small. The results are included here for completeness, but the statistical outcomes are not valid due to small sample sizes.

Cross-Group Analysis

Neither CARE/FERA nor non-CARE/FERA customers on Rate 1 had statistically significantly higher economic index scores than their control group counterparts in any climate region. For customers on Rate 2, only those with incomes between 100 and 200% FPG had statistically significantly higher economic index scores than control customers. For Rate 3, CARE/FERA and CARE/FERA eligible customers had higher economic index scores compared with customers on the OAT. There was no statistically significant difference in the health index score for any customer segments on Rate 2 in the hot climate region. CARE/FERA customers on Rate 1 in the hot climate region had a statistically significantly higher health index score compare with control customers.

<u>Increase in Economic and/or Health Index Scores</u>

For customers on Rate 2, only those with incomes between 100 and 200% FPG had statistically significantly higher economic index scores than control customers. There was no statistically significant difference in the health index score for any customer segments on Rate 2 in the hot climate region.

Further, TOU rates did not increase economic or health index scores for seniors in the hot climate region. Seniors also reported fewer key barriers to shifting use compared to non-seniors in the hot climate region (Table 5.5-10).

Table 5.5-10: Fewer Factors Keep Seniors in Hot Climates from Shifting or Reducing Their Usage[1]

Barriers to reducing or shifting electricity usage in the afternoon and evenings	Seniors	Non-seniors
Nothing keeps me from shifting my usage	21%	16%
I have old appliances that use a lot of energy	10%	13%
Child(ren) in household make it difficult to change our routines	7%	19%
My schedule doesn't allow me to reduce my usage	6%	11%
My home gets uncomfortable if I try to reduce electricity usage	26%	28%

[1] All differences are significant (p<.001).

Question-Level Findings

The following sections compare responses between treatment and control customers for individual questions that underlie the economic and health indices. Results are presented for all three rates to enable cross-rate comparisons and facilitate identification of patterns in the results. Because of the random assignment of customers to treatment and control conditions, statistically significant differences in values between the two groups can be attributed to the TOU rates. Statistically significant differences between the control and rate groups are shaded in grey as shown in the example Table 5.5-11. To facilitate readability, each table provides estimates for the rate with additional targeted segments first, Rate 2, followed by estimates for Rates 1 and 3.

Table 5.5-11: Example of Question-Level Results Table

Rate with targeted segments

Rates without targeted segments

Grey shading = statistical significance

Climate Region	Segment	C	R2		R1		R3	
Hot	Non-CARE/FERA	12%	13%	▲	12%	▲	14%	▲
	CARE/FERA	21%	21%	▲	19%	▼	26%	▲
	Below 100% FPG	22%	22%	▲	-		-	
	100 to 200% FPG	20%	20%	▼	-		-	
	Senior	13%	14%	▲	-		-	
Moderate	Non-CARE/FERA	12%	12%	▼	12%	▲	14%	▲
	CARE/FERA	25%	24%	▼	24%	▼	27%	▲
Cool	Non-CARE/FERA	11%	11%	▲	10%	▼	13%	▲
	CARE/FERA	28%	27%	▼	25%	▼	28%	▼

Customers Worried About Having Enough Money to Pay Electricity Bill

Respondents rated their agreement with six statements designed to measure respondents' attitudes towards adopting energy saving behaviors using an 11-point scale with 0 meaning "do not agree at all" and 10 meaning "completely agree". One of these statements, "I often worry whether there is enough money to pay my electricity bill" is used to create the economic index (Table 5.5-12).

Surveyed customers provided low to moderate ratings, 1.6 to -5.5, to this statement. When comparing responses between Control and Rate treatment groups, Rate 3 customers in the hot region and Rate 2 non-CARE/FERA customers in the hot region reported significantly higher average ratings while Rate 2 customers in the moderate region showed significantly lower ratings. All significant differences were small, with differences between control and rate group ratings being less than 0.5 points on the 11-point rating scale.

Respondents in the CARE/FARE segments reported significantly higher agreement ratings to the statement compared to those in the non-CARE/FERA segments. Additionally, respondents in the hot climate region provided slightly higher ratings to the statement compared to similar segments in the moderate and cool climate regions.

Table 5.5-12: Percentage of Respondents Reporting They Often Worry About Having Enough Money to Pay Their Electricity Bill[1]

Climate Region	Segment	I often worry whether there is enough money to pay my electricity bill			
		C	R2	R1	R3
Hot	Non-CARE/FERA	2.4	2.7	2.2	2.9
	CARE/FERA	5.0	5.2	4.9	5.5
	Below 100% FPG	4.9	5.0	-	-
	100 to 200% FPG	4.1	4.5	-	-
	Senior	3.1	3.2	-	-
Moderate	Non-CARE/FERA	2.3	1.9	2.3	2.5
	CARE/FERA	4.9	4.4	4.4	4.7
Cool	Non-CARE/FERA	1.6	1.6	1.8	1.8
	CARE/FERA	4.7	4.4	4.5	4.4

[1] Used t-test, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Customers Experiencing Issues with Paying Their Bills

Respondents reported the number of times – since participating in the pilot – that their household struggled to pay: a) electricity bills, and b) bills for other basic needs such as food, housing, medicine, and other important bills. Respondents answered on a 4-point scale ranging from “none” to “3 or more times”.

Table 5.5-13 shows the percent of respondents who reported having difficulty paying either their electricity bill or some other bill at least once during the summer. As shown, there is substantial variability across segments (21% to 73% reporting difficulty paying their bills) but there are no statistically significant differences between control and treatment customers for this variable. A much higher percentage of respondents from low income segments reported bill payment difficulty than non-CARE/FERA customers.

Table 5.5-13: Percentage of Respondents Reporting Difficulty Paying Bills Since June 2016[1]

Climate Region	Segment	C	R2	R1	R3
Hot	Non-CARE/FERA	30%	31% ▲	29% ▼	33% ▲
	CARE/FERA	70%	72% ▲	70% ▲	73% ▲
	Below 100% FPG	69%	65% ▼	-	-
	100 to 200% FPG	56%	62% ▲	-	-
	Senior	40%	39% ▼	-	-
Moderate	Non-CARE/FERA	29%	27% ▼	29% ▼	30% ▲
	CARE/FERA	67%	65% ▼	62% ▼	64% ▼
Cool	Non-CARE/FERA	25%	26% ▲	21% ▼	25% ▲
	CARE/FERA	67%	68% ▲	66% ▼	65% ▼

[1] Table shows the percent of respondents who either had difficulty paying their electricity bill or other bills at least one time during the summer.

Financial Well-Being (CFPB)

To gauge respondents' financial health, customers were asked about five items sourced from the Consumer Financial Protection Bureau (CFPB). For the first three items, respondents are asked how each describes their situation using a scale including "not at all," "very little," "somewhat," "very well," and "completely." For the last two items, respondents are asked how often each applies to them using a scale including "never," "rarely," "sometimes," "often," and "always." The CFPB items are:

- Because of my money situation, I feel like I will never get the things I want in life.
- I am just getting by financially.
- I am concerned that the money I have won't last.
- I have money left over at the end of the month.
- My finances control my life.

Using answers to these five items, each respondent's financial well-being score was calculated, with values ranging from 19 (low financial well-being) to 90 (high financial well-being).[105]

As shown in Table 5.5-14, SCE respondents demonstrated a relatively tight range of financial well-being scores, with average scores ranging from 47 to 59, (higher scores indicate higher financial well-being). Rate 2 non-CARE/FERA customers and Rates 1 and 2 CARE/FERA customers in the moderate region had significantly higher financial well-being compared to control group customers, but the difference was less than 2 points out of roughly 49 points. Compared to other segments, low income customers had the lowest financial well-being scores.

[105] The financial well-being score is a methodologically rigorous scale from the Consumer Financial Protection Bureau that measures a customer's financial well-being. The Consumer Financial Protection Bureau's methods for the abbreviated version of their "Financial Well-Being Scale" was followed. See the following documentation for full methodological details: http://files.consumerfinance.gov/f/201512_cfpb_financial-well-being-user-guide-scale.pdf

Table 5.5-14: Average Financial Well-Being Scores[1]

Climate Region	Segment	CFPB						
		C	R2		R1		R3	
Hot	Non-CARE/FERA	57.7	57.9	▲	58.2	▲	57.1	▼
	CARE/FERA	47.3	47.5	▲	47.9	▲	47.7	▲
	Less than 100% FPG	47.8	48.8	▲	-		-	
	100%-200% FPG	50.5	49.6	▼	-		-	
	Senior	54.9	55.2	▲	-		-	
Moderate	Non-CARE/FERA	56.9	58.4	▲	57.7	▲	57.7	▲
	CARE/FERA	46.9	49.3	▲	48.7	▲	48.5	▲
Cool	Non-CARE/FERA	58.5	59.0	▲	57.6	▼	59.3	▲
	CARE/FERA	47.8	48.1	▲	47.9	▲	49.0	▲

[1] Grey shading indicates a significant difference in the responses between control and rate group for that segment (using t-test and an alpha level of .05)

Number of Alternative Methods Used to Pay Bills

Respondents reported how they afforded to pay electricity bills and/or other basic needs over the summer. Respondents could select as many of the following options that applied to their household:

- Use your household's current income
- Use your household's savings or other investments
- Cut back on non-essential spending for things your household wants
- Reduce your household energy usage
- Borrow money from family, friends, or peers
- Borrow money using a short-term loan
- Use a credit card that you can't pay off right away
- Leave rent/mortgage unpaid
- Leave some household bills unpaid past the due date
- Received emergency assistance from [IOU NAME]
- Received emergency assistance from other city or regional programs

Reducing household energy usage[106] and cutting back on non-essential spending are included in the percent of respondents (by rate and segment) that reported using any of the options other than 'current income.' This metric, therefore, measured the maximum number of customers in each rate / segment / region who took some type of action other than using their income to help pay their bills.

As shown in Table 5.5-15, about two-fifths or more of each segment on each rate plan reported using non-income strategies to afford bill payments. Non-CARE/FERA customers in cool climates on Rate 1 were the only respondents that reported using significantly more non-income options than control

[106] The percentages in Table 5.5-15 are significantly lower if "reduce your household energy use" is excluded from the tabulations. For non-CARE/FERA households in the hot climate region, for example, dropping this option from the tabulation reduces the percentages by 16 percentage points (from 53% to 37%). The main conclusion, that there are few statistically significant differences between treatment and control customers, does not change. Indeed, if this response option is dropped, there are no statistically significant differences for any customer segment.

group members. Low income and senior customers were the most likely to report non-income strategies to afford bill payments.

Table 5.5-15: Percentage of Respondents Reporting Affording Summer Bill Payments Using Sources Other than Current Income[1]

Climate Region	Segment	C	R2	R1	R3
Hot	Non-CARE/FERA	53%	56% ▲	52% ▼	58% ▲
	CARE/FERA	81%	79% ▼	80% ▼	78% ▼
	Below 100% FPG	75%	75% ▼	-	-
	100 to 200% FPG	74%	76% ▲	-	-
	Senior	67%	65% ▼	-	-
Moderate	Non-CARE/FERA	50%	50% ▼	53% ▲	53% ▲
	CARE/FERA	74%	72% ▼	72% ▼	74% ▲
Cool	Non-CARE/FERA	42%	45% ▲	47% ▲	44% ▲
	CARE/FERA	73%	73% ▲	73% ▼	74% ▲

[1] Grey shading indicates a significant difference in the responses between control and rate group for that segment (using z-test for proportions and an alpha level of .05)

5.5.2 Other Research Topics

The remainder of this section summarizes findings from the other research topics that were covered by the survey.

Motivations for Participating in the Study

Participation Recall Rate

Nearly all surveyed SCE respondents (between 92% and 98%) recalled participating in the study (Table 5.5-16). When comparing responses between Control and Rate treatment groups, the non-CARE/FERA and senior segments in the hot climate region showed a significant difference compared to the Control groups, although none of the differences are larger than 4%. In addition, slightly fewer respondents in the CARE/FERA segments recalled participating in the study compared to those in the non-CARE/FERA segments (differences ranging between 5% and 10%).

Table 5.5-16: TOU Study Participation Recall Rates[1]

Climate Region	Segment	Recalls participating in the study C	R2	R1	R3
Hot	Non-CARE/FERA	96%	97%	97%	98%
	CARE/FERA	95%	95%	93%	93%
	Below 100% FPG	95%	95%	-	-
	100 to 200% FPG	95%	96%	-	-
	Senior	94%	96%	-	-
Moderate	Non-CARE/FERA	98%	97%	98%	98%
	CARE/FERA	92%	94%	94%	93%
Cool	Non-CARE/FERA	96%	97%	97%	97%
	CARE/FERA	92%	93%	94%	92%

[1] Chi-square used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

Motivations to Participate

Approximately two-fifths to over one-half (39% to 56%) of SCE respondents across all segments reported their primary motivation for participating in the study was to save money on their electricity bills (Table 5.5-17). More respondents in the CARE/FERA groups reported their primary motivation as saving money compared to non-CARE/FERA respondents. Earning a bill credit was the second most mentioned motivation reported by SCE respondents across all segments (ranging from 21% to 30%), and slightly more non-CARE/FERA customers selected this motivation compared to low-income segments. Since it was not expected that the motivation to participate would be influenced by Rate treatment group assignment, responses across Control and Rate treatment groups are combined for this analysis.

Table 5.5-17: Primary Motivation for TOU Study Participation

Climate Region	Segment	To save money on electricity bill	To earn a bill credit	Environmentally responsible	Other[1]
Hot	Non-CARE/FERA	45%	26%	8%	21%
	CARE/FERA	55%	22%	7%	16%
	Less than 100% FPG	56%	22%	7%	15%
	100%-200% FPG	53%	21%	8%	18%
	Senior	52%	21%	9%	19%
Moderate	Non-CARE/FERA	42%	26%	10%	21%
	CARE/FERA	52%	23%	9%	15%
Cool	Non-CARE/FERA	39%	30%	10%	21%
	CARE/FERA	54%	21%	11%	15%

[1] 'Other' includes: bill protection makes it risk free; to be one of the first to learn about new rates; to give PG&E my feedback on the plan, and other.

Customer Outreach: Welcome Packet

SCE sent Rate group customers a welcome packet that included information about their rate and tips for reducing or shifting their energy usage. Most surveyed customers, between 87% and 97%, reported receiving their TOU welcome packet and, of those, between 86% and 95% reported looking through it (Table 5.5-18). The lowest percentages were reported by customers in the low-income groups.

Table 5.5-18: Percentage Who Received and Looked Through the TOU Welcome Packet

Climate Region	Segment	Received welcome packet[1]			Looked through welcome packet[2]		
		R2	R1	R3	R2	R1	R3
Hot	Non-CARE/FERA	93%	94%	96%	90%	89%	95%
	CARE/FERA	92%	91%	94%	90%	86%	89%
	Below 100% FPG	90%	-	-	88%	-	-
	100 to 200% FPG	92%	-	-	90%	-	-
	Senior	91%	-	-	89%	-	-
Moderate	Non-CARE/FERA	94%	96%	95%	89%	92%	90%
	CARE/FERA	91%	90%	93%	87%	87%	88%
Cool	Non-CARE/FERA	95%	96%	97%	91%	89%	89%
	CARE/FERA	87%	87%	92%	86%	88%	89%

[1] Asked only of Rate groups; Control group did not receive a welcome packet.

[2] Asked only to respondents who reported receiving the welcome packet.

Customers who received and looked through their welcome packet agreed most that the information in the packet clearly explained how the price of electricity varies on their rate plan (Table 5.5-19). Customers gave these items the highest average rating on an 11-point scale where 0 means “do not agree at all” and 10 means “completely agree”. Customers also mostly agreed that the items in the packet were easy to understand, that they understood how their rate worked after looking at the packet, and that they used many of the tips included in the packet. Customers somewhat agreed that the decals and stickers were helpful.

Table 5.5-19: Average Level of Agreement with Aspects of the TOU Welcome Packet[1,2]

Climate Region	Segment	Info explained how price varied by time of day etc.			The items were easy to understand			After packet I understand how rate works			I've used many of the tips in the packet			The decals or stickers were helpful		
		R2	R1	R3	R2	R1	R3	R2	R1	R3	R2	R1	R3	R2	R1	R3
Hot	Non-CARE/FERA	8.0	7.8	7.8	7.7	7.6	7.3	7.3	7.2	6.9	6.6	6.6	6.7	5.1	4.9	4.9
	CARE/FERA	8.0	8.1	7.6	7.8	8.0	7.3	7.0	7.3	6.7	7.3	7.4	6.9	6.2	6.3	5.7
	Below 100% FPG	7.8	-	-	7.5	-	-	6.8	-	-	7.0	-	-	6.0	-	-
	100 to 200% FPG	7.9	-	-	7.7	-	-	6.9	-	-	7.1	-	-	5.8	-	-
	Senior	8.1	-	-	7.6	-	-	7.0	-	-	7.1	-	-	5.3	-	-
Moderate	Non-CARE/FERA	8.2	8.1	7.9	8.1	8.0	7.5	7.5	7.3	7.1	6.9	6.7	6.5	5.6	5.4	5.2
	CARE/FERA	8.1	8.3	8.0	7.9	8.0	7.6	7.4	7.5	7.4	7.5	7.3	7.3	6.6	6.6	6.5
Cool	Non-CARE/FERA	8.1	8.0	8.0	7.9	7.8	7.6	7.4	7.4	7.2	6.5	6.7	6.3	5.0	5.2	4.9
	CARE/FERA	8.1	8.3	8.3	7.9	8.2	7.9	7.3	7.5	7.5	7.4	7.4	7.1	6.7	6.8	6.4

[1] Agreement ratings are based on an 11-point scale where 0 means 'do not agree at all' and 10 means 'completely agree'.

[2] Asked only to Rate groups who reported looking through the packet; Control group did not receive a welcome packet.

Satisfaction

Satisfaction with SCE and Rate Plan

Overall, respondents reported being somewhat to mostly satisfied with SCE and their rate plan. Ratings were based on an 11-point scale, where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'. As shown in Table 5.5-20, customers were slightly more satisfied, on average, with SCE (6.5 to 8.2) than with their rate plan (5.5 to 7.8). Control group customers were slightly more satisfied with SCE and the rate plan compared to Rate group customers across all segments. Many of the Control vs. Rate group comparisons are statistically significant, particularly between the groups in the hot climate region and, regarding satisfaction with rate, between groups in the moderate region. The significant differences are very small (less than one point on an 11-point scale) with regards to satisfaction with SCE but are a bit larger with regards to satisfaction with the rate plan (about one point on an 11-point scale), especially for Control vs. Rate 3 group comparisons. In addition, low income customers were slightly more satisfied with SCE and the rate plan compared to the non-CARE/FERA customers.

Table 5.5-20: Average Level of Satisfaction with SCE and Rate Plan[1,2]

Climate Region	Segment	Satisfaction with SCE				Satisfaction with rate			
		C	R2	R1	R3	C	R2	R1	R3
Hot	Non-CARE/FERA	7.0	6.8 ▼	6.8 ▼	6.5 ▼	6.2	5.9 ▼	6.0 ▼	5.5 ▼
	CARE/FERA	8.0	7.6 ▼	7.5 ▼	7.5 ▼	7.4	6.9 ▼	6.8 ▼	6.4 ▼
	Below 100% FPG	7.9	7.4 ▼	-	-	7.3	6.6 ▼	-	-
	100 to 200% FPG	7.6	7.2 ▼	-	-	6.9	6.4 ▼	-	-
	Senior	7.7	7.3 ▼	-	-	7.1	6.5 ▼	-	-
Moderate	Non-CARE/FERA	7.1	7.1 ▲	7.1 ▲	6.9 ▼	6.5	6.4 ▼	6.2 ▼	6.0 ▼
	CARE/FERA	8.1	8.0 ▼	7.8 ▼	7.7 ▼	7.8	7.2 ▼	7.3 ▼	6.9 ▼
Cool	Non-CARE/FERA	7.3	7.4 ▲	7.1 ▼	7.1 ▼	6.8	6.7 ▼	6.6 ▼	6.3 ▼
	CARE/FERA	8.2	8.1 ▼	8.2 ▲	7.9 ▼	7.8	7.7 ▼	7.8 ▲	7.4 ▼

[1] Satisfaction ratings based on 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Table 5.5-21 to Table 5.5-23 show additional statistics for Control vs. Rate group comparisons of average satisfaction with SCE. Table 5.5-24 to Table 5.5-26 show additional statistics for Control vs. Rate group comparisons of average satisfaction with the rate.

Table 5.5-21: Average Level of Satisfaction with SCE, Control vs. Rate 1[1,2]

Climate Region	Segment	Control			Rate 1			Statistics				
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	Non-CARE/FERA	7.0	2.4	1,222	6.8	2.5	800	-0.25	0.109	2020	-2.25	0.024 ▼
	CARE/FERA	8.0	2.3	645	7.5	2.4	473	-0.44	0.142	1116	-3.08	0.002 ▼
Moderate	Non-CARE/FERA	7.1	2.2	539	7.1	2.3	529	0.01	0.137	1066	0.09	0.930 ▲
	CARE/FERA	8.1	2.3	456	7.8	2.1	412	-0.24	0.150	866	-1.58	0.115 ▼
Cool	Non-CARE/FERA	7.3	2.2	624	7.1	2.2	623	-0.16	0.124	1245	-1.29	0.196 ▼
	CARE/FERA	8.2	2.0	456	8.2	2.1	390	0.08	0.144	844	0.52	0.602 ▲

[1] Satisfaction ratings based on 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Table 5.5-22: Average Level of Satisfaction with SCE, Control vs. Rate 2[1,2]

Climate Region	Segment	Control			Rate 2			Statistics				
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	Non-CARE/FERA	7.0	2.4	1,222	6.8	2.5	885	-0.20	0.11	2,105	-1.87	0.061
	CARE/FERA	8.0	2.3	645	7.6	2.4	590	-0.34	0.13	1,233	-2.50	0.012
	Below 100% FPG	7.9	2.4	719	7.4	2.6	659	-0.47	0.14	1,376	-3.46	0.001
	100 to 200% FPG	7.6	2.4	449	7.2	2.5	406	-0.41	0.17	853	-2.48	0.013
	Senior	7.7	2.3	1,176	7.3	2.5	1,054	-0.45	0.10	2,228	-4.38	0.000
Moderate	Non-CARE/FERA	7.1	2.2	539	7.1	2.3	520	0.03	0.14	1,057	0.22	0.824
	CARE/FERA	8.1	2.3	456	8.0	2.1	418	-0.04	0.15	872	-0.26	0.792
Cool	Non-CARE/FERA	7.3	2.2	624	7.4	2.1	616	0.06	0.12	1,238	0.53	0.596
	CARE/FERA	8.2	2.0	456	8.1	2.1	434	-0.05	0.14	888	-0.37	0.714

[1] Satisfaction ratings based on 11-point scale where 0 means ‘not at all satisfied’ and 10 means ‘extremely satisfied’.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Table 5.5-23: Average Level of Satisfaction with SCE, Control vs. Rate 3[1,2]

Climate Region	Segment	Control			Rate 3			Statistics				
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	Non-CARE/FERA	7.0	2.4	1,222	6.5	2.6	456	-0.60	0.133	1676	-4.47	0.000
	CARE/FERA	8.0	2.3	645	7.5	2.6	373	-0.52	0.156	1016	-3.36	0.001
Moderate	Non-CARE/FERA	7.1	2.2	539	6.9	2.4	516	-0.17	0.140	1053	-1.23	0.220
	CARE/FERA	8.1	2.3	456	7.7	2.2	335	-0.36	0.162	789	-2.20	0.028
Cool	Non-CARE/FERA	7.3	2.2	624	7.1	2.2	495	-0.16	0.132	1117	-1.19	0.236
	CARE/FERA	8.2	2.0	456	7.9	2.2	337	-0.27	0.151	791	-1.79	0.075

[1] Satisfaction ratings based on 11-point scale where 0 means ‘not at all satisfied’ and 10 means ‘extremely satisfied’.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Table 5.5-24: Average Level of Satisfaction with Rate, Control vs. Rate 1[1,2]

Climate Region	Segment	Control			Rate 1			Statistics				
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	Non-CARE/FERA	6.2	2.5	1,276	6.0	2.6	827	-0.26	0.113	2101	-2.28	0.023
	CARE/FERA	7.4	2.6	700	6.8	2.6	508	-0.59	0.150	1206	-3.90	0.000
Moderate	Non-CARE/FERA	6.5	2.4	570	6.2	2.5	554	-0.33	0.147	1122	-2.24	0.025
	CARE/FERA	7.8	2.4	495	7.3	2.5	459	-0.46	0.159	952	-2.86	0.004
Cool	Non-CARE/FERA	6.8	2.3	647	6.6	2.4	634	-0.23	0.130	1279	-1.77	0.077
	CARE/FERA	7.8	2.3	499	7.8	2.4	438	0.00	0.153	935	0.01	0.995

[1] Satisfaction ratings based on 11-point scale where 0 means ‘not at all satisfied’ and 10 means ‘extremely satisfied’.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Table 5.5-25: Average Level of Satisfaction with Rate, Control vs. Rate 2[1,2]

Climate Region	Segment	Control			Rate 2			Statistics				
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	Non-CARE/FERA	6.2	2.5	1,276	5.9	2.7	916	-0.33	0.11	2,190	-2.94	0.003
	CARE/FERA	7.4	2.6	700	6.9	2.8	625	-0.44	0.15	1,323	-3.04	0.002
	Below 100% FPG	7.3	2.7	776	6.6	2.9	713	-0.67	0.14	1,487	-4.64	0.000
	100 to 200% FPG	6.9	2.7	485	6.4	2.9	429	-0.52	0.19	912	-2.80	0.005
	Senior	7.1	2.6	1,261	6.5	2.7	1,123	-0.54	0.11	2,382	-5.03	0.000
Moderate	Non-CARE/FERA	6.5	2.4	570	6.4	2.5	541	-0.12	0.15	1,109	-0.85	0.398
	CARE/FERA	7.8	2.4	495	7.2	2.6	456	-0.53	0.16	949	-3.29	0.001
Cool	Non-CARE/FERA	6.8	2.3	647	6.7	2.3	635	-0.09	0.13	1,280	-0.68	0.497
	CARE/FERA	7.8	2.3	499	7.7	2.4	460	-0.09	0.15	957	-0.60	0.548

[1] Satisfaction ratings based on 11-point scale where 0 means ‘not at all satisfied’ and 10 means ‘extremely satisfied’.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Table 5.5-26: Average Level of Satisfaction with Rate, Control vs. Rate 3[1,2]

Climate Region	Segment	Control			Rate 3			Statistics				
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	Non-CARE/FERA	6.2	2.5	1,276	5.5	2.9	476	-0.76	0.140	1750	-5.43	0.000
	CARE/FERA	7.4	2.6	700	6.4	3.1	393	-1.00	0.175	1091	-5.75	0.000
Moderate	Non-CARE/FERA	6.5	2.4	570	6.0	2.6	533	-0.49	0.152	1101	-3.22	0.001
	CARE/FERA	7.8	2.4	495	6.9	2.8	375	-0.89	0.176	868	-5.05	0.000
Cool	Non-CARE/FERA	6.8	2.3	647	6.3	2.5	515	-0.49	0.140	1160	-3.51	0.000
	CARE/FERA	7.8	2.3	499	7.4	2.7	372	-0.40	0.167	869	-2.37	0.018

[1] Satisfaction ratings based on 11-point scale where 0 means ‘not at all satisfied’ and 10 means ‘extremely satisfied’.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Survey respondents were asked to rate their level of agreement with eleven aspects about their rate plan, using an 11-point scale, where 0 means ‘do not agree at all’ and 10 means ‘completely agree’. Table 5.5-27 to Table 5.5-29 summarize the average scores for each segment, rate and climate region.

Overall, the highest average ratings among all statements concerned: the ease of remembering the timing of the peak and off-peak rate periods (6.3-7.5), the bill helps me understand the time of day when they are spending the most on electricity (6.8-8.0), the rate (5.9-7.4) and bill (6.0-7.5) are easy to understand, recommending rate to friends/family (5.3-7.6), rate gave opportunities to save money (5.8-7.5), and wanting to stay on rate after the study ends (5.1-7.8). Customers gave slightly lower ratings, on average, regarding the rate is fair (5.2-7.2), the new rate is better than the old rate (4.6-6.9), the rate works with household schedule (4.8-7.1), and rate is affordable (4.7-7.0).

Many of the Rate group customers reported significantly lower average agreement ratings compared to the respective Control group customers in regard to several aspects about their rate plan. These include wanting to stay on the rate plan after the study ends (14/21 groups), recommending the rate to friends or family (10/21 groups), the rate working with their household schedule (16/21 groups), and the rate being fair (7/21 groups) and affordable (12/21 groups), particularly Rate 3 customers. Conversely, many of the Rate group customers reported significantly higher agreement compared to Control group customers with respect to the rate being easy to understand (10/21 groups), particularly for the non-CARE/FERA customers.

Significant results were mixed for the two other aspects, in which some rate groups reported higher ratings and others provided lower ratings compared to the control groups. The bill being easy to understand was rated higher, on average, by three rate groups in the moderate and cool regions but was rated lower by three rate groups in the hot region. The rate gave opportunities to save money was rated higher, on average, by seven non-CARE/FERA rate groups in all regions and by two CARE/FERA rate groups in the cool region, but was rated lower by three CARE/FERA rate groups in the hot and moderate regions. The statistically significant differences, however, are substantively small for most comparisons (one point or less on an 11-point scale). In addition, low income customers and seniors reported higher average agreement ratings across most of the aspects of their rate plan compared to non-CARE/FERA customers.

Table 5.5-27: Average Level of Agreement with Aspects of the Rate Plan (Aspects 1-4)[1,2,3]

Climate Region	Segment	The peak and off peak times are easy to remember[3]			Bill helps me understand time of day when spending most[3]			Rate is easy to undertand				Bill is easy to understand			
		R2	R1	R3	R2	R1	R3	C	R2	R1	R3	C	R2	R1	R3
Hot	Non-CARE/FERA	7.0	6.5	6.5	7.1	6.8	7.2	6.2	6.7	6.4	6.5	6.3	6.4	6.2	6.0
	CARE/FERA	7.4	7.2	6.6	7.3	7.5	7.3	6.9	6.8	6.8	6.6	7.1	6.8	6.9	6.5
	Below 100% FPG	7.2	-	-	7.3	-	-	6.7	6.7	-	-	7.0	6.7	-	-
	100 to 200% FPG	7.2	-	-	7.2	-	-	6.6	6.7	-	-	6.7	6.6	-	-
	Senior	7.2	-	-	7.3	-	-	6.5	6.7	-	-	6.8	6.6	-	-
Moderate	Non-CARE/FERA	7.0	6.7	6.6	7.2	7.1	7.3	5.9	7.0	6.8	6.7	6.3	6.6	6.6	6.2
	CARE/FERA	7.5	7.3	7.1	7.6	7.5	7.8	6.9	7.1	7.1	6.8	7.1	7.1	7.1	6.9
Cool	Non-CARE/FERA	6.9	6.9	6.3	7.0	7.1	7.5	6.4	6.8	6.7	6.8	6.6	6.6	6.5	6.4
	CARE/FERA	7.2	7.3	7.3	7.6	7.7	8.0	6.7	7.0	7.4	7.1	7.0	7.2	7.5	7.2

[1] Agreement ratings are based on an 11-point scale where 0 means 'do not agree at all' and 10 means 'completely agree'.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

[3] Asked only to Rate groups.

Table 5.5-28: Average Level of Agreement with Aspects of the Rate Plan (Aspects 5-7)[1,2]

Climate Region	Segment	Recommend rate to friends or family				Rate gave opp. to save money				Want to stay on rate after study ends			
		C	R2	R1	R3	C	R2	R1	R3	C	R2	R1	R3
Hot	Non-CARE/FERA	6.3	6.2	6.0	5.3	5.9	6.3	6.2	5.8	6.4	6.2	6.1	5.1
	CARE/FERA	7.4	6.9	7.2	6.1	7.0	6.8	7.1	6.4	7.4	6.6	6.8	5.8
	Below 100% FPG	7.3	6.8	-	-	6.9	6.7	-	-	7.4	6.5	-	-
	100 to 200% FPG	6.9	6.5	-	-	6.6	6.6	-	-	6.9	6.4	-	-
	Senior	7.0	6.6	-	-	6.6	6.6	-	-	7.2	6.7	-	-
Moderate	Non-CARE/FERA	6.4	6.5	6.4	5.7	5.9	6.9	6.6	6.1	6.4	6.3	6.4	5.5
	CARE/FERA	7.7	7.3	7.0	6.8	7.4	7.2	7.0	6.6	7.8	7.0	6.9	6.5
Cool	Non-CARE/FERA	6.5	6.5	6.8	6.0	6.0	6.8	6.8	6.4	6.5	6.4	6.6	5.6
	CARE/FERA	7.6	7.6	7.6	7.2	6.9	7.4	7.5	7.2	7.6	7.4	7.4	7.0

[1] Agreement ratings are based on an 11-point scale where 0 means 'do not agree at all' and 10 means 'completely agree'.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Table 5.5-29: Average Level of Agreement with Aspects of the Rate Plan (Aspects 8-11)[1,2,3]

		Rate is fair				New rate is better than old rate[3]			Rate works with HH schedule				Rate is affordable			
Climate Region	Segment	C	R2	R1	R3	R2	R1	R3	C	R2	R1	R3	C	R2	R1	R3
Hot	Non-CARE/FERA	5.6	5.6	5.7	5.2	5.3	5.4	4.6	6.0	5.5	5.5	4.8	5.5	5.3	5.4	4.7
	CARE/FERA	6.5	6.2	6.4	5.8	5.9	6.1	5.3	6.8	5.9	6.3	5.6	6.4	5.8	6.2	5.5
	Below 100% FPG	6.3	6.1	-	-	5.9	-	-	6.8	5.8	-	-	6.4	5.8	-	-
	100 to 200% FPG	6.2	5.9	-	-	5.6	-	-	6.5	5.8	-	-	6.0	5.5	-	-
	Senior	6.2	5.9	-	-	5.8	-	-	6.7	5.9	-	-	6.2	5.7	-	-
Moderate	Non-CARE/FERA	5.7	6.2	5.8	5.6	5.7	5.7	4.9	6.1	6.0	5.8	4.8	5.8	5.8	5.7	5.1
	CARE/FERA	6.7	6.7	6.5	6.2	6.3	6.3	5.9	7.1	6.3	6.3	5.9	7.0	6.4	6.4	5.9
Cool	Non-CARE/FERA	6.2	6.2	6.2	5.8	5.8	6.0	5.2	6.3	6.0	6.1	5.0	6.3	6.1	6.1	5.4
	CARE/FERA	6.6	6.8	7.2	6.5	6.9	6.8	6.2	7.0	6.9	6.8	6.1	6.8	6.8	6.9	6.2

[1] Agreement ratings are based on an 11-point scale where 0 means 'do not agree at all' and 10 means 'completely agree'.
[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.
[3] Asked only to Rate groups.

Perception of Bill Amount

Respondents reported how the amount of their electricity bill – since participating in the pilot – compared to their expectations. Respondents chose from the following options: higher than you expected; about the same as you expected; lower than you expected; or did not have any expectation.

Table 5.5-30 shows the percent of respondents reporting that their bill was higher than expected. Between 16% and 27% of control customers in the moderate and cool regions, and 22% to 29% of control customers in the hot region, reported that their bills were higher than expected. A statistically significantly greater percent of TOU rate customers in all rates/segments/regions except one (non-CARE/FERA customers in the cool climate region) reported higher than expected bills. For example, 39% to 49% of CARE/FERA customers in the hot climate region reported higher than expected bills, compared to 28% of control group customers. A greater percent of customers in the hot climate region reported higher than expected bills than in the moderate or cool regions. Within each climate region, non-CARE/FERA customers were the most likely to report higher than expected bills.

Table 5.5-30: Percentage of Respondents Reporting That Their Electricity Bills Since June 2016 Have Been Higher Than They Expected[1]

Climate Region	Segment	C	R2	R1	R3
Hot	Non-CARE/FERA	29%	44% ▲	40% ▲	54% ▲
	CARE/FERA	28%	39% ▲	34% ▲	49% ▲
	Below 100% FPG	29%	40% ▲	-	-
	100 to 200% FPG	26%	43% ▲	-	-
	Senior	22%	36% ▲	-	-
Moderate	Non-CARE/FERA	27%	38% ▲	33% ▲	48% ▲
	CARE/FERA	22%	31% ▲	32% ▲	40% ▲
Cool	Non-CARE/FERA	21%	30% ▲	25% ▲	41% ▲
	CARE/FERA	16%	23% ▲	25% ▲	31% ▲

[1] Z-test for proportions used, grey shading indicates statistically significant difference versus Control group at p≤.05.

Reason for Rate Change

When asked why California utilities are changing rates, respondents overwhelmingly selected “to give customers an incentive to reduce electricity at times when use is high,” and “to improve the reliability of the power grid and avoid power outages” (Table 5.5-31). Respondents chose other reasons less frequently. The least likely choice selected was “to help SCE make more money.” While there are significant differences between Rate and Control groups for other reasons selected, no meaningful trends emerged.

Table 5.5-31: Reasons for Why CA Utilities are Changing to TOU Rates[1]

Climate Region	Segment	Help customers save money on electricity bills				Improve reliability of the electricity power grid and avoid power outages				Better align the price customers pay for electricity to the actual cost to produce and deliver it				Help reduce the need to build new power plants			
		C	R2	R1	R3	C	R2	R1	R3	C	R2	R1	R3	C	R2	R1	R3
Hot	Non-CARE/FERA	57%	56%	52%	53%	82%	87%	87%	81%	53%	63%	59%	58%	51%	52%	52%	44%
	CARE/FERA	70%	69%	75%	68%	80%	85%	84%	81%	57%	62%	67%	62%	44%	44%	45%	48%
	Below 100% FPG	69%	70%	-	-	77%	82%	-	-	58%	58%	-	-	44%	47%	-	-
	100 to 200% FPG	72%	64%	-	-	85%	84%	-	-	54%	65%	-	-	47%	48%	-	-
	Senior	68%	60%	-	-	76%	84%	-	-	56%	61%	-	-	46%	48%	-	-
Moderate	Non-CARE/FERA	62%	57%	55%	54%	85%	88%	88%	85%	58%	64%	62%	62%	42%	52%	51%	46%
	CARE/FERA	78%	74%	74%	70%	76%	88%	88%	86%	60%	69%	65%	66%	49%	47%	48%	46%
Cool	Non-CARE/FERA	52%	54%	54%	54%	87%	90%	92%	87%	52%	67%	68%	65%	48%	56%	56%	51%
	CARE/FERA	68%	73%	79%	76%	81%	87%	88%	87%	57%	72%	69%	69%	47%	54%	52%	50%

Climate Region	Segment	Balance the electric grid due to the growing amount of renewable energy				Give customers an incentive to reduce use at times when electricity use is high				Help utility make more money				Help utility keep energy costs down			
		C	R2	R1	R3	C	R2	R1	R3	C	R2	R1	R3	C	R2	R1	R3
Hot	Non-CARE/FERA	54%	56%	57%	49%	89%	93%	92%	89%	22%	31%	33%	33%	59%	61%	62%	55%
	CARE/FERA	52%	56%	52%	55%	83%	90%	90%	89%	13%	20%	18%	25%	77%	72%	69%	71%
	Below 100% FPG	49%	56%	-	-	86%	88%	-	-	20%	20%	-	-	74%	73%	-	-
	100 to 200% FPG	52%	57%	-	-	87%	92%	-	-	11%	26%	-	-	74%	68%	-	-
	Senior	54%	55%	-	-	80%	89%	-	-	17%	27%	-	-	76%	64%	-	-
Moderate	Non-CARE/FERA	51%	53%	52%	49%	82%	92%	93%	89%	25%	24%	28%	32%	58%	66%	65%	59%
	CARE/FERA	54%	62%	60%	57%	80%	92%	90%	89%	15%	16%	18%	20%	74%	77%	72%	69%
Cool	Non-CARE/FERA	60%	56%	57%	50%	95%	95%	95%	92%	27%	22%	22%	26%	73%	68%	67%	66%
	CARE/FERA	57%	60%	59%	63%	82%	87%	90%	90%	18%	16%	14%	19%	72%	72%	79%	72%

[1] Z-test for proportions used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

Frequency of Being Uncomfortably Hot in Home

Respondents reported how frequently they had been uncomfortably hot in their home this summer due to trying to save money on electricity bills. Respondents chose from the following options: never, rarely, sometimes, most of the time, or always. Table 5.5-32 shows the percent of customers that responded either most of the time or always (summarized as “most to all of the time”).

Less than 30% of each segment on each rate reported being uncomfortably hot most to all of the time. The only segment to report being hot significantly more frequently than the Control Group, was CARE/FERA customers on Rate 3 in the hot climate region. Low-income segments tended to more frequently report being uncomfortably hot. Conversely, non-CARE/FERA customers and seniors were the least likely to report frequent heat-induced discomfort.

Table 5.5-32: Percentage of Respondents Reporting Being Uncomfortably Hot ‘Most to All of the Time’ Since June 2016 Due to Trying to Save on Electricity Bills[1]

Climate Region	Segment	C	R2		R1		R3	
Hot	Non-CARE/FERA	12%	13%	▲	12%	▲	14%	▲
	CARE/FERA	21%	21%	▲	19%	▼	26%	▲
	Below 100% FPG	22%	22%	▲	-		-	
	100 to 200% FPG	20%	20%	▼	-		-	
	Senior	13%	14%	▲	-		-	
Moderate	Non-CARE/FERA	12%	12%	▼	12%	▲	14%	▲
	CARE/FERA	25%	24%	▼	24%	▼	27%	▲
Cool	Non-CARE/FERA	11%	11%	▲	10%	▼	13%	▲
	CARE/FERA	28%	27%	▼	25%	▼	28%	▼

[1] Z-test for proportions used, grey shading indicates statistically significant difference versus Control group at p≤.05.

Understanding How Rates Work

As a test to determine the extent to which respondents understood what influences the price of electricity on their rate, respondents were asked to identify which of five factors influences their electricity price. The correct answers varied among control and rate groups. The list of factors and the groups for whom the factors are correct included:

- Time of day: a correct answer for all Rate groups,
- Day of week (weekends vs. weekdays): a correct answer for all Rate groups,
- Seasons: a correct answer for all Rate groups,
- Weather or temperature: an incorrect answer for all groups, and
- Total amount of electricity used: a correct answer for all groups.

Table 5.5-33 reports the percentage of customers that selected over half of the correct answers for their rate plan. Overall, between 29% and 56% of customers understood over half of the factors that influence their electricity rate (Table 5.5-33). Significantly fewer Rate 1 and 2 customers in the low-income segments in each region selected over half the correct answers compared to their respective Control groups. However, significantly more non-CARE/FERA Rate 3 customers in each region and Rate 1 and 2 customers in the moderate region selected over half the correct answers compared to corresponding Control groups. On average, respondents in the low-income segments were most likely to not select over half the correct answer(s) compared to the corresponding non-CARE/FERA segments. In addition, more Rate 1 and 3 customers selected over half the correct answers compared to Rate 2 customers.

Table 5.5-33: Percentage of Respondents Who Selected Over Half of the Correct Factors that Influence the Price of Electricity on their Rate Plan[1]

Climate Region	Segment	% Selected Over Half the Correct Answers C	R2		R1		R3	
Hot	Non-CARE/FERA	46%	46%	▲	50%	▲	56%	▲
	CARE/FERA	42%	35%	▼	37%	▼	40%	▼
	Below 100% FPG	41%	34%	▼				
	100 to 200% FPG	44%	39%	▼				
	Senior	46%	42%	▼				
Moderate	Non-CARE/FERA	41%	47%	▲	51%	▲	53%	▲
	CARE/FERA	41%	31%	▼	35%	▼	37%	▼
Cool	Non-CARE/FERA	43%	43%	▼	48%	▲	54%	▲
	CARE/FERA	40%	29%	▼	33%	▼	40%	▲

[1] Factors include: Time of day, day of week, season, weather/temperature, total amount of electricity used.

Rate group customers were also asked to select the hours of the day, from 12 am to midnight, when electricity is most expensive on their rate plan (peak hours). For Rate 1, the correct hours are 2 pm to 8 pm; for Rate 2, the correct hours are 5 pm to 8 pm; and, for Rate 3, the correct hours are 4 pm to 9 pm.

Table 5.5-34 shows the percent of customers in each segment who, on average, got none of the hours correct and who got over half of the hours correct. As shown, between 27% and 59% of customers selected over half of the correct hours for their rate plan, which for most customers is slightly worse than their understanding of the general factors that influence the price of their electricity (Table 5.5-33). A much lower percentage of customers, 9% to 38%, did not select any of the correct hours. On average, respondents in the low-income segments were most likely to not select any of the correct hours of the day when electricity is most expensive, compared to the corresponding non-CARE/FERA customers. In addition, more Rate 1 customers selected over half the correct hours compared to Rate 2 and 3 customers.

Table 5.5-34: Percentage of Respondents Who Selected None or Over Half of the Correct Times of the Day When the Price of Electricity is Most Expensive on their Rate Plan[1]

Climate Region	Segment	% Selected No Correct Answers R2	R1	R3	% Selected Over 50% Correct Answers R2	R1	R3
Hot	Non-CARE/FERA	24%	14%	15%	42%	52%	44%
	CARE/FERA	31%	20%	29%	33%	42%	26%
	Below 100% FPG	34%	-	-	31%	-	-
	100 to 200% FPG	27%	-	-	37%	-	-
	Senior	30%	-	-	32%	-	-
Moderate	Non-CARE/FERA	21%	9%	16%	44%	59%	39%
	CARE/FERA	33%	18%	25%	30%	44%	30%
Cool	Non-CARE/FERA	23%	12%	13%	40%	52%	47%
	CARE/FERA	38%	20%	24%	27%	36%	29%

[1] Asked only to Rate groups since Control group customers' rate does not vary by time of day.

Actions Taken

Customers were asked how frequently they took ten different actions in the afternoons and evenings to reduce or shift their electricity usage. Customers could choose always, usually, sometimes, rarely, never, or not applicable. Table 5.5-35 to Table 5.5-37 report the percentage of respondents who reported taking the actions 'often', which is a combination of 'always' and 'usually'. Customers who reported 'not applicable' were excluded.

Overall, surveyed customers reported that turning off lights not in use (84%-91%), avoiding doing laundry (47%-75%), and/or avoiding running the dishwasher (49%-78%) are, on average, the most common actions they took to reduce electricity usage in the afternoons and evenings.

Many customers also reported that they 'often' turned off office equipment (42%-66%), avoided running their pool/spa pump (40%-66%), increased their thermostat temperature (27%-57%), turned off air-conditioning (28%-55%), and turning off entertainment equipment (28%-51%). The least common actions reported by respondents, on average, are pre-cooling their home (18%-44%) and avoiding cooking (16%-40%).

Nearly all Rate group customers in the hot climate region (vs. Control group customers) reported more frequently taking most of the actions. However, trends and significant differences varied between rates/segments/regions and were mostly unique for each action, as follows:

- **Turned off lights not in use:** no significant differences between rate and control groups; more hot and moderate climate region customers reported taking action, on average (vs. cool region customers) (Table 5.5-35).
- **Avoided doing laundry:** significantly more Rate group customers in nearly all groups reported taking action (vs. Control group customers); more hot climate region customers reported taking action, on average (vs. customers in moderate and cool regions) (Table 5.5-35).
- **Avoided running the dishwasher:** significantly more Rate group customers in nearly all groups reported taking action (vs. Control group customers); more hot and moderate climate region customers reported taking action, on average (vs. cool region customers) (Table 5.5-35).

Table 5.5-35: Percentage of Respondents Who Reported Taking Actions ‘Often’ to Reduce or Shift Their Electricity Usage in the Afternoons and Evenings (Actions 1-3)[1,2]

Climate Region	Segment	Turned off lights				Avoided laundry				Avoided dishwasher			
		C	R2	R1	R3	C	R2	R1	R3	C	R2	R1	R3
Hot	Non-CARE/FERA	90%	89% ▼	91% ▲	89% ▼	61%	72% ▲	74% ▲	74% ▲	60%	73% ▲	76% ▲	76% ▲
	CARE/FERA	89%	90% ▲	87% ▼	89% ▼	62%	70% ▲	69% ▲	63% ▲	65%	71% ▲	74% ▲	66% ▲
	Below 100% FPG	87%	89% ▲	-	-	63%	65% ▲	-	-	65%	67% ▲	-	-
	100 to 200% FPG	90%	91% ▲	-	-	65%	73% ▲	-	-	65%	76% ▲	-	-
	Senior	89%	91% ▲	-	-	69%	75% ▲	-	-	66%	76% ▲	-	-
Moderate	Non-CARE/FERA	88%	90% ▲	88% ▼	88% ▼	61%	72% ▲	67% ▲	64% ▲	64%	72% ▲	75% ▲	70% ▲
	CARE/FERA	88%	87% ▼	86% ▼	91% ▲	61%	66% ▲	64% ▲	70% ▲	64%	67% ▲	73% ▲	78% ▲
Cool	Non-CARE/FERA	88%	85% ▼	84% ▼	86% ▼	47%	60% ▲	59% ▲	59% ▲	49%	63% ▲	61% ▲	64% ▲
	CARE/FERA	84%	85% ▲	88% ▲	88% ▲	52%	62% ▲	67% ▲	63% ▲	53%	64% ▲	64% ▲	63% ▲

[1] Z-test for proportions used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

[2] Survey responses ‘usually’ and ‘always’ combined into ‘often’.

- **Turned off office equipment:** no significant differences between rate and control groups except significantly more Rate 2 and 3 CARE/FERA customers in the cool region reported taking action (vs. Control group customers); more low-income customers reported taking action, on average (vs. non-CARE/FERA and senior customers) (Table 5.5-36).
- **Avoided cooking:** significantly more Rate 1 and 2 customers reported taking (vs. Control group customers); more low-income and senior customers reported taking action, on average (vs. non-CARE/FERA customers) (Table 5.5-36).
- **Turned off entertainment equipment:** no significant differences between rate and control groups except significantly more Rate 1 and 3 non-CARE/FERA and CARE/FERA customers in the hot region reported taking action (vs. Control group customers); more low-income customers (vs. non-CARE/FERA and senior customers) and more hot, moderate, and cool region customers, respectively, reported taking action, on average (Table 5.5-36).

Table 5.5-36: Percentage of Respondents Who Reported Taking Actions ‘Often’ to Reduce or Shift Their Electricity Usage in the Afternoons and Evenings (Actions 4-6)[1,2]

Climate Region	Segment	Turned off office equipment				Turned off entertainment equipment				Avoided cooking			
		C	R2	R1	R3	C	R2	R1	R3	C	R2	R1	R3
Hot	Non-CARE/FERA	48%	48% ▼	51% ▲	47% ▼	28%	30% ▲	35% ▲	32% ▲	26%	31% ▲	29% ▲	30% ▲
	CARE/FERA	60%	64% ▲	62% ▲	60% ▼	41%	46% ▲	48% ▲	49% ▲	32%	36% ▲	39% ▲	31% ▼
	Below 100% FPG	61%	62% ▲	-	-	39%	41% ▲	-	-	31%	34% ▲	-	-
	100 to 200% FPG	58%	61% ▲	-	-	37%	42% ▲	-	-	31%	40% ▲	-	-
	Senior	52%	55% ▲	-	-	28%	30% ▲	-	-	31%	36% ▲	-	-
Moderate	Non-CARE/FERA	47%	48% ▲	45% ▼	43% ▼	33%	33% ▲	37% ▲	33% ▲	24%	24% ▼	24% ▼	26% ▲
	CARE/FERA	66%	60% ▼	61% ▼	64% ▼	46%	48% ▲	47% ▲	50% ▲	36%	29% ▼	38% ▲	38% ▲
Cool	Non-CARE/FERA	44%	42% ▼	45% ▲	43% ▼	30%	29% ▼	32% ▲	30% ▲	16%	18% ▲	22% ▲	17% ▲
	CARE/FERA	54%	60% ▲	62% ▲	64% ▲	44%	47% ▲	51% ▲	47% ▲	32%	31% ▼	32% ▲	33% ▲

[1] Z-test for proportions used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

[2] Survey responses ‘usually’ and ‘always’ combined into ‘often’.

- **Increased temperature on the thermostat:** significantly more non-CARE/FERA Rate group customers reported taking action (vs. Control group customers); more non-CARE/FERA customers (vs. low-income and senior customers) and more hot and moderate climate region customers (vs. cool region customers) reported taking action, on average (Table 5.5-37).
- ***Turned off air-conditioning:*** no significant differences between rate and control groups except Rate 2 and 3 non-CARE/FERA customers in the moderate region reported taking action (vs. Control group customers); more CARE/FERA customers (vs. non-CARE/FERA customers) and more moderate and cool region customers (vs. hot region customers) reported taking action, on average (Table 5.5-37).
- **Pre-cooled home earlier in the day:** no significant differences between rate and control groups except significantly more non-CARE/FERA Rate group customers in the hot region reported taking action (vs. Control group customers); more low-income customers (vs. non-CARE/FERA and senior customers) and more hot climate region customers (vs. moderate and cool region customers) reported taking action, on average (Table 5.5-37).
- **Avoided running pool or spa pump:** significantly more Rate group customers in 6 of 21 groups reported taking action (vs. Control group customers); more hot and moderate climate region customers reported taking action, on average (vs. cool region customers) (Table 5.5-37).

Table 5.5-37: Percentage of Respondents Who Reported Taking Actions 'Often' to Reduce or Shift Their Electricity Usage in the Afternoons and Evenings (Actions 7-10)[1,2]

Climate Region	Segment	Increased thermostat temp C	R2	R1	R3	Turned off air-conditioning C	R2	R1	R3	Pre-cooled home C	R2	R1	R3	Avoided pool/spa pump C	R2	R1	R3
Hot	Non-CARE/FERA	46%	52% ▲	52% ▲	49% ▲	28%	32% ▲	33% ▲	31% ▲	30%	36% ▲	35% ▲	39% ▲	54%	61% ▲	57% ▲	66% ▲
	CARE/FERA	40%	42% ▲	47% ▲	40% ▼	36%	40% ▲	38% ▲	37% ▲	39%	44% ▲	40% ▲	44% ▲	51%	56% ▲	59% ▲	51% ▲
	Below 100% FPG	35%	39% ▲	-	-	34%	38% ▲	-	-	40%	42% ▲	-	-	46%	50% ▲	-	-
	100 to 200% FPG	48%	50% ▲	-	-	35%	39% ▲	-	-	36%	38% ▲	-	-	53%	66% ▲	-	-
	Senior	41%	44% ▲	-	-	27%	34% ▲	-	-	33%	36% ▲	-	-	53%	56% ▲	-	-
Moderate	Non-CARE/FERA	48%	57% ▲	55% ▲	54% ▲	38%	45% ▲	38% ▲	46% ▲	25%	27% ▲	27% ▲	30% ▲	57%	63% ▲	72% ▲	61% ▲
	CARE/FERA	39%	42% ▲	42% ▲	41% ▲	48%	47% ▼	48% ▼	49% ▲	32%	37% ▲	34% ▲	38% ▲	47%	55% ▲	60% ▲	70% ▲
Cool	Non-CARE/FERA	35%	42% ▲	37% ▲	42% ▲	44%	47% ▲	43% ▼	44% ▲	18%	22% ▲	19% ▲	24% ▲	40%	46% ▲	47% ▲	48% ▲
	CARE/FERA	27%	34% ▲	30% ▲	30% ▲	47%	51% ▲	55% ▲	50% ▲	30%	32% ▲	32% ▲	33% ▲	38%	48% ▲	55% ▲	45% ▲

1 Z-test for proportions used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

2 Survey responses 'usually' and 'always' combined into 'often'.

Respondents had the option provide a 'Not Applicable' (NA) response to all the actions taken asked in the survey. These NA responses can serve as a rough proxy measure of whether respondents have air conditioning, laundry, or dishwashers in their home. While not a perfect measure of availability in the home, these responses indicate that, when compared to non-CARE/FERA households, more low income households (CARE/FERA and below 100% FPG) indicated NA for avoiding laundry use, avoiding dishwasher use, and turning off office equipment (Table 5.5-38). A similar proportion of CARE/FERA and non-CARE/FERA households indicated NA to their ability to turn off entertainment equipment, air conditioning actions, and avoiding using spa or pool-pump.

Table 5.5-38: Not Applicable Responses for Key Actions Taken by Segment

Climate Region	Segment	Avoided laundry	Avoided dishwasher	Turned off office equipment	Turned off entertainment equipment	Increased thermostat temp	Turned off air-conditioning	Pre-cooled home	Avoided pool/spa pump
Hot	Non-CARE/FERA	4%	18%	10%	7%	9%	8%	12%	66%
	CARE/FERA	8%	34%	18%	6%	11%	8%	12%	72%
	Below 100% FPG	10%	38%	23%	8%	14%	10%	16%	72%
	100 to 200% FPG	6%	28%	16%	7%	10%	9%	12%	74%
	Senior	7%	25%	18%	9%	9%	9%	13%	71%
Moderate	Non-CARE/FERA	4%	21%	7%	5%	9%	5%	8%	71%
	CARE/FERA	11%	40%	19%	6%	15%	8%	13%	72%
Cool	Non-CARE/FERA	10%	24%	7%	5%	32%	36%	39%	76%
	CARE/FERA	21%	47%	20%	8%	34%	35%	43%	77%

Overall, customers reported that taking actions to reduce or shift their electricity usage in the afternoons and evenings were somewhat easy (Table 5.5-39). On a scale of 0 to 10, where 0 means 'not at all easy' and 10 means 'extremely easy', customers reported an average rating between 5.6 and 6.7 across the groups and segments. Across all climate regions, Rate 3 non-CARE/FERA customers reported significantly lower average ratings than the respective Control group customers. These differences, however, are substantively small (less than one point on an 11-point scale), and no other significant differences were found. In addition, CARE/FERA customers typically reported slightly higher ratings than non-CARE/FERA customers across all climate regions.

Table 5.5-39: Respondents' Average Level of Ease of Taking Energy Saving Actions in the Afternoons and Evenings[1,2]

Climate Region	Segment	Ease of taking action C	R2		R1		R3	
Hot	Non-CARE/FERA	6.0	6.0	▲	6.2	▲	5.6	▼
	CARE/FERA	6.2	6.2	▲	6.4	▲	6.2	▼
	Below 100% FPG	6.3	6.0	▼	-		-	
	100 to 200% FPG	6.0	6.2	▲	-		-	
	Senior	6.5	6.3	▼	-		-	
Moderate	Non-CARE/FERA	6.3	6.5	▲	6.2	▼	5.8	▼
	CARE/FERA	6.4	6.6	▲	6.5	▲	6.1	▼
Cool	Non-CARE/FERA	6.4	6.5	▲	6.3	▼	5.9	▼
	CARE/FERA	6.7	6.6	▼	6.7	▼	6.8	▲

[1] Level of ease ratings are based on an 11-point scale where 0 means 'not at all easy' and 10 means 'extremely easy'.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Respondents were also asked which of 10 barriers keep them from reducing or shifting their electricity usage in the afternoons and evenings (Table 5.5-40 to Table 5.5-42). Across the climate regions and segments, the most common barriers to reducing or shifting electricity usage during the afternoons and evenings reported by customers include the respondent being home most of the day (24%-47%), the household already using very little electricity (24%-42%), and the home gets uncomfortable (13%-33%) (Table 5.5-40). The least common barriers reported by customers include working from home (4%-17%), household schedule doesn't allow reduction in usage (4%-17%), and the presence of disabled household member(s) (3%-13%) (Table 5.5-42).

There were few significant differences between rate and control groups for each barrier but there is some variation between rates/segments/regions. Trends were mostly unique for each barrier, as follows:

- **Respondent at home most of the day:** no significant differences between rate and control groups except significantly more Rate 1 and 3 non-CARE/FERA customers in the hot and moderate climate regions reported the barrier (vs. Control group customers); more low-income customers reported the barrier, on average (vs. non-CARE/FERA customers) (Table 5.5-40).
- **Household already uses little electricity:** no significant differences between rate and control groups except significantly fewer non-CARE/FERA customers in the hot and cool regions reported the barrier (vs. Control group customers); more low-income and senior customers reported the barrier, on average (vs. non-CARE/FERA customers) (Table 5.5-40).

- **Home gets uncomfortable:** no significant differences between rate and control groups except more Rate 3 non-CARE/FERA customers in the cool region reported the barrier (vs. Control group customers); more non-CARE/FERA customers reported the barrier, on average (vs. low-income and senior customers) (Table 5.5-40).

Table 5.5-40: Percentage of Respondents Who Reported Barriers to Reducing or Shifting Their Electricity Use During Afternoons and Evenings (Barriers 1-3)[1,2]

Climate Region	Segment	I am at home most of the day				My household already uses very little electricity				My home gets uncomfortable if I try to reduce electricity usage			
		C	R2	R1	R3	C	R2	R1	R3	C	R2	R1	R3
Hot	Non-CARE/FERA	31%	32%	30%	37%	29%	29%	24%	24%	28%	29%	28%	33%
	CARE/FERA	39%	38%	40%	44%	32%	28%	30%	33%	27%	26%	23%	28%
	Below 100% FPG	42%	43%	-	-	35%	30%	-	-	27%	27%	-	-
	100 to 200% FPG	39%	37%	-	-	32%	27%	-	-	28%	28%	-	-
	Senior	47%	47%	-	-	33%	30%	-	-	24%	25%	-	-
Moderate	Non-CARE/FERA	24%	26%	31%	29%	28%	26%	28%	31%	26%	25%	30%	31%
	CARE/FERA	34%	32%	31%	34%	38%	33%	41%	38%	22%	20%	23%	22%
Cool	Non-CARE/FERA	25%	27%	26%	29%	41%	35%	37%	32%	14%	17%	13%	19%
	CARE/FERA	28%	31%	31%	29%	42%	37%	38%	37%	17%	14%	17%	13%

[1] Z-test for proportions used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

[2] Respondents could select more than one item, and respondents who selected all items or items mutually exclusive are excluded from the results.

- **Presence of elderly household member(s):** no significant differences between rate and control groups; more low-income and senior customers reported the barrier, on average (vs. non-CARE/FERA customers) (Table 5.5-41).
- **Can't think of anything else to do** is slightly more frequently reported by: no significant differences between rate and control groups except fewer Rate 1 non-CARE/FERA customers in the hot region and Rate 1 CARE/FERA customers in the cool region reported the barrier (vs. Control group customers) (Table 5.5-41).
- **Children in household** more frequently reported by: no significant differences between rate and control groups; more low-income customers in the hot climate region reported the barrier (vs. seniors and non-CARE/FERA customers) (Table 5.5-41).

Table 5.5-41: Percentage of Respondents Who Reported Barriers to Reducing or Shifting Their Electricity Use During Afternoons and Evenings (Barriers 4-6)[1,2]

Climate Region	Segment	Elderly household member makes it difficult to change our routines				I can't think of anything else to do				Child(ren) in household make it difficult to change our routines			
		C	R2	R1	R3	C	R2	R1	R3	C	R2	R1	R3
Hot	Non-CARE/FERA	9%	11%	9%	12%	14%	12%	10%	13%	12%	10%	14%	9%
	CARE/FERA	13%	15%	12%	15%	14%	13%	15%	13%	18%	19%	17%	19%
	Below 100% FPG	15%	17%	-	-	13%	14%	-	-	15%	16%	-	-
	100 to 200% FPG	17%	17%	-	-	14%	12%	-	-	13%	16%	-	-
	Senior	24%	24%	-	-	12%	12%	-	-	3%	5%	-	-
Moderate	Non-CARE/FERA	8%	8%	9%	9%	13%	11%	11%	15%	15%	16%	16%	16%
	CARE/FERA	12%	11%	14%	13%	12%	15%	10%	13%	15%	17%	15%	19%
Cool	Non-CARE/FERA	6%	6%	6%	7%	13%	12%	10%	12%	15%	15%	16%	18%
	CARE/FERA	10%	13%	10%	12%	14%	13%	9%	10%	15%	19%	16%	14%

[1] Used z-test for proportions, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

[2] Respondents could select more than one item, and respondents who selected all items or items mutually exclusive are excluded from the results.

- **Schedule doesn't allow it:** significantly more non-CARE/FERA and CARE Rate group customers, particularly on Rates 2 and 3, reported the barrier (vs. Control group customers); more non-CARE/FERA customers reported the barrier, on average (vs. lower-income customers and seniors) (Table 5.5-42).
- **Old appliances use lots of energy:** no significant differences between rate and control groups; more low-income customers reported the barrier, on average (vs. non-CARE/FERA customers and seniors) (Table 5.5-42).
- **Working from home:** no significant differences between rate and control groups except more Rate 1 non-CARE/FERA customers in the hot region and Rate 3 customers in the moderate regions reported the barrier; more non-CARE/FERA reported the barrier, on average (vs. low-income groups and seniors) (Table 5.5-42).
- **Presence of disabled household member(s):** no significant differences between rate and control groups; more low-income and senior customers (vs. non-CARE/FERA customers) and hot climate region customers (vs. moderate and cool region customers) reported the barrier, on average (Table 5.5-42).

Table 5.5-42: Percentage of Respondents Who Reported Barriers to Reducing or Shifting Their Electricity Use During Afternoons and Evenings (Barriers 7-10)[1,2]

Climate Region	Segment	My schedule doesn't allow me to reduce my usage				I have old appliances that use a lot of energy				Working from home makes it difficult to use less electricity				Disabled household member makes it difficult to change our routines			
		C	R2	R1	R3	C	R2	R1	R3	C	R2	R1	R3	C	R2	R1	R3
Hot	Non-CARE/FERA	7%	11%	11%	12%	7%	9%	7%	7%	12%	10%	15%	11%	4%	5%	5%	6%
	CARE/FERA	6%	9%	8%	11%	17%	14%	14%	16%	8%	6%	9%	8%	12%	13%	11%	13%
	Below 100% FPG	5%	7%	-	-	15%	16%	-	-	6%	6%	-	-	11%	13%	-	-
	100 to 200% FPG	7%	9%	-	-	16%	14%	-	-	7%	7%	-	-	10%	9%	-	-
	Senior	4%	5%	-	-	12%	10%	-	-	7%	6%	-	-	10%	10%	-	-
Moderate	Non-CARE/FERA	7%	13%	11%	15%	5%	7%	7%	7%	13%	11%	13%	17%	4%	3%	5%	2%
	CARE/FERA	6%	7%	7%	8%	11%	10%	12%	13%	5%	7%	8%	9%	9%	9%	7%	11%
Cool	Non-CARE/FERA	10%	14%	11%	17%	7%	6%	7%	9%	15%	16%	15%	17%	3%	3%	4%	4%
	CARE/FERA	5%	9%	6%	10%	15%	14%	12%	14%	4%	7%	6%	7%	8%	8%	10%	8%

[1] Used z-test for proportions, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

[2] Respondents could select more than one item, and respondents who selected all items or items mutually exclusive are excluded from the results.

General Attitudes and Awareness Towards EE and DR

Respondents rated their agreement with six statements designed to measure respondents' attitudes towards adopting energy saving behaviors using an 11-point scale with 0 meaning "do not agree at all" and 10 meaning "completely agree" (Table 5.5-43 & Table 5.5-44).[107] The statements were designed to capture respondents' intention to conserve, responsibility to conserve, concern about environment, and concern about their electricity bill. All significant differences were small, with differences between Control and treatment group ratings less than a point on the 11-point rating scale.

SCE respondents provided moderate ratings, 5.5 to 6.8, to the statement "I am very concerned about how my energy use affects the environment" (Table 5.5-43). When comparing responses between Control and Rate treatment groups, Rate 1 customers in two of the five segments in the hot climate region, and the non-CARE/FERA segment in the moderate and cool climate regions, reported lower average ratings when compared to their Control groups. Overall, responses were consistent across segments.

SCE respondents provided low to moderate ratings, 1.6 to 5.5, to the statement "it is my responsibility to use as little energy as possible to help the environment" (Table 5.5-43). When comparing responses between Control and Rate treatment groups, Rate 3 customers in hot climate region and Rate 2 customers in the moderate climate region showed significant differences. Respondents in the CARE/FERA segments provided higher agreement ratings to the statement compared to those in the non-CARE/FERA segments. Additionally, respondents in the hot and moderate climate regions provided slightly higher ratings to the statement compared to similar segments in the cool climate regions.

Table 5.5-43: Average Level of Agreement with Attitudinal Statements Related to Adopting Energy Saving Behaviors (Statements 1-2)[1]

		I am very concerned about how my energy use affects the environment				It is my responsibility to use as little energy as possible to help the environment			
Climate Region	**Segment**	**C**	**R2**	**R1**	**R3**	**C**	**R2**	**R1**	**R3**
Hot	Non-CARE/FERA	5.8	5.5	5.8	5.7	2.4	2.7	2.2	2.9
	CARE/FERA	6.3	6.0	6.2	6.2	5.0	5.2	4.9	5.5
	Below 100% FPG	6.3	5.8	-	-	4.9	5.0	-	-
	100 to 200% FPG	6.1	6.0	-	-	4.1	4.5	-	-
	Senior	5.9	5.7	-	-	3.1	3.2	-	-
Moderate	Non-CARE/FERA	6.1	5.9	5.6	5.9	2.3	1.9	2.3	2.5
	CARE/FERA	6.5	6.3	6.6	6.5	4.9	4.4	4.4	4.7
Cool	Non-CARE/FERA	6.4	6.0	6.2	5.8	1.6	1.6	1.8	1.8
	CARE/FERA	6.7	6.3	6.6	6.8	4.7	4.4	4.5	4.4

[1] Used t-test, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

[107] The first statement, "I often worry whether there is enough money to pay my electricity bill," was used in the economic index and is reported in section 5.5.1.

SCE respondents provided moderate ratings, 5.0 to 6.7, to the statement "I feel guilty if I use too much energy" (Table 5.5-44). When comparing responses between Control and Rate treatment groups, four of the five Rate 1 segments in the hot climate region, and the non-CARE/FERA segment in the moderate and cool climate regions, had lower ratings on average than their corresponding Control groups. Respondents in the CARE/FARE segments provided slightly higher agreement ratings to the statement compared to those in the non-CARE/FERA segments.

SCE respondents provided moderate to high ratings, 7.2 to 7.7, to the statement "I conserved electricity in my home this summer" (Table 5.5-44). Overall, responses were consistent across segments, with two significant differences between Rate 2 and Control groups.

SCE respondents provided moderate to high ratings, 7.5 to 8.5, to the statement "if my electricity bill goes up, I feel l must do something to reduce it" (Table 5.5-44). When comparing responses between Control and Rate treatment groups, the Rate 2 below 100% FPG segment and the Rate 3 non-CARE/FERA segment in the moderate climate region reported significantly lower agreement with this statement than their Control groups. Respondents in the CARE/FARE segments provided slightly higher agreement ratings to the statement compared to those in the non-CARE/FERA segments.

Table 5.5-44: Average Level of Agreement with Attitudinal Statements Related to Adopting Energy Saving Behaviors (Statements 3-5)[1]

		I feel guilty if I use too much energy				I conserved electricity in my home this summer				If my electricity bill goes up, I feel I must do something to reduce it			
Climate Region	**Segment**	**C**	**R2**	**R1**	**R3**	**C**	**R2**	**R1**	**R3**	**C**	**R2**	**R1**	**R3**
Hot	Non-CARE/FERA	5.3	5.0	5.1	5.0	7.3	7.6	7.3	7.5	7.5	7.5	7.4	7.6
	CARE/FERA	5.9	5.6	5.7	5.9	7.5	7.7	7.7	7.7	8.5	8.4	8.3	8.2
	Below 100% FPG	5.9	5.2	-	-	7.5	7.4	-	-	8.3	7.9	-	-
	100 to 200% FPG	5.8	5.6	-	-	7.6	7.9	-	-	8.2	8.1	-	-
	Senior	5.5	5.1	-	-	7.7	7.8	-	-	7.6	7.7	-	-
Moderate	Non-CARE/FERA	5.9	5.5	5.3	5.5	7.4	7.4	7.5	7.3	7.7	7.5	7.4	7.4
	CARE/FERA	6.7	6.5	6.5	6.5	7.6	7.8	7.6	7.7	8.5	8.4	8.3	8.4
Cool	Non-CARE/FERA	5.9	5.5	5.7	5.5	7.2	7.3	7.3	7.2	7.3	8.2	8.3	8.1
	CARE/FERA	6.5	6.4	6.3	6.3	7.7	7.3	7.7	7.7	8.2	8.2	8.3	8.1

[1] Used t-test, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Demographic Characteristics

This section summarizes the responses to demographic characteristics questions contained in the survey and trends in differences between segments.[108]

Respondent Age (Table 5.5-45)

- Segments with the lowest mean age were: CARE/FERA in the hot region, groups in the moderate and cool regions.
- On average, cool and moderate climate segments tended to be slightly younger than the hot climate segments across all Rate groups.
- Although the average age is high across groups in the hot climate region, the senior segment was much older.

Table 5.5-45: Respondents' Average Age[1]

Climate Region	Segment	Mean	Inter Quartile Range		
			Percentile 25	Median	Percentile 75
Hot	Non-CARE/FERA	60	51	61	70
	CARE/FERA	55	42	55	67
	Below 100% FPG	57	44	59	71
	100 to 200% FPG	59	47	60	71
	Senior	72	67	72	78
Moderate	Non-CARE/FERA	55	44	55	65
	CARE/FERA	56	45	56	68
Cool	Non-CARE/FERA	55	44	55	67
	CARE/FERA	55	43	55	67

[1] Results are based on weighted averages across all four RCT groups (Control, Rate 1, Rate 2, and Rate 3)

Respondent Educational Attainment (Table 5.5-46)

- Some college or less was the most commonly reported levels of education for low income segments and some college or more was most common among non-CARE/FERA and senior segments. Non-CARE/FERA customers in the moderate and cool climate regions were the most highly educated group, with around three-fifths reporting that they had a four-year or graduate/professional degree (59% and 68%, respectively).
- CARE/FERA customers were slightly over-representative of California households with a high school diploma or less (38%) while non-CARE/FERA customers were over-representative of Californians with a graduate degree (11%) (2015 ACS 5-year estimates).

Table 5.5-46: Respondents' Educational Attainment

Climate Region	Segment	Some HS	HS Diploma	Some College	Tech. College	Two-year Degree	Four-year Degree	Grad Degree
Hot	Non-CARE/FERA	2%	10%	24%	7%	10%	23%	24%
	CARE/FERA	14%	25%	24%	9%	10%	11%	7%
	Below 100% FPG	17%	25%	24%	8%	9%	9%	8%
	100 to 200% FPG	9%	21%	26%	9%	11%	14%	10%
	Senior	8%	16%	24%	6%	10%	18%	18%
Moderate	Non-CARE/FERA	2%	7%	19%	6%	9%	28%	31%
	CARE/FERA	13%	22%	24%	9%	9%	15%	9%
Cool	Non-CARE/FERA	2%	5%	14%	4%	7%	33%	35%
	CARE/FERA	17%	20%	23%	6%	9%	16%	10%

[108] Trend analyses did not include tests for statistical significance and are based on observation of the differences in values.

Annual Household Income (Table 5.5-47)

- CARE/FERA and low-income surveyed customers had lower annual household incomes compared to non-CARE/FERA and other customer segments.
- More than three-fifths of respondents in the below 100% FPG segment in the hot climate region had an annual household income of less than $21,000 per year across all Rate groups.
- On average, most non-CARE/FERA customers made more than $50,000/year across all Rate groups. Conversely, nearly all CARE/FERA customers made less than $50,000/year across all Rate groups.

Table 5.5-47: Annual Household Income

Climate Region	Segment	Less than $12k	$12k to < $17k	$17k to < $21k	$21k to < $25k	$25k to < $29k	$29k to < $33k	$33k to < $37k	$37k to < $41k	$41k to < $50k	$50k to < $100k	$100k or more
Hot	Non-CARE/FERA	2%	2%	2%	3%	2%	5%	4%	5%	11%	35%	28%
	CARE/FERA	18%	17%	13%	14%	9%	8%	5%	4%	6%	5%	1%
	Below 100% FPG	31%	21%	11%	8%	5%	4%	3%	2%	4%	8%	2%
	100 to 200% FPG	3%	11%	11%	15%	10%	11%	7%	7%	10%	13%	2%
	Senior	10%	11%	9%	9%	6%	7%	4%	4%	9%	18%	13%
Moderate	Non-CARE/FERA	1%	1%	1%	2%	2%	3%	4%	4%	8%	36%	37%
	CARE/FERA	16%	18%	11%	12%	10%	9%	5%	5%	7%	6%	1%
Cool	Non-CARE/FERA	1%	1%	1%	2%	2%	3%	3%	4%	9%	33%	42%
	CARE/FERA	20%	15%	13%	12%	10%	7%	6%	5%	5%	6%	1%

Respondent Employment Status (Table 5.5-48)

- Most surveyed customers were either employed full or part time, or were retired.
- Non-CARE/FERA customers in the cool and moderate regions were most likely to be employed full-time.
- Low-income customers were more likely be unemployed or unable to work due to a disability compared to all other customer segments.

Table 5.5-48: Respondents' Employment Status[1]

Climate Region	Segment	Employed full-time	Employed part-time	Homemaker	Retired	Can't work (disability)	Other[2]
Hot	Non-CARE/FERA	50%	8%	5%	37%	3%	7%
	CARE/FERA	28%	14%	11%	31%	19%	18%
	Below 100% FPG	22%	13%	11%	38%	21%	20%
	100 to 200% FPG	33%	12%	7%	41%	12%	11%
	Senior	13%	8%	5%	75%	10%	7%
Moderate	Non-CARE/FERA	59%	9%	5%	26%	3%	7%
	CARE/FERA	35%	14%	10%	31%	16%	15%
Cool	Non-CARE/FERA	59%	10%	5%	27%	3%	7%
	CARE/FERA	34%	16%	10%	26%	15%	17%

[1] Allows for multiple responses, rows may not add to 100%.

[2] Includes respondents who reported being seasonally employed, unemployed but looking for work, unemployed but not looking for work, and students.

Major Life Changes during the Past Summer (Table 5.5-49)

- A majority of surveyed customers across all Rate groups and segments reported not experiencing any of the eight "life changes" items on the survey.
- However, CARE/FERA and low-income customers were more likely to report having experienced one of the eight "life changes" items on the survey when compared to the corresponding non-CARE/FERA segments.
- On average, the most commonly reported "life change" was having work hours or pay reduced.
- Low-income customers the hot climate region were more likely to report having lost a job or became unemployed, had work hours or pay reduced, or became disabled or seriously ill compared to all other segments.
- Very few respondents reported having received a foreclosure or eviction notice, got divorced, had a baby, or had a death of a household member compared to other "life changes" items.

Table 5.5-49: Life Changes During the Past Summer

Climate Region	Segment	Became unemployed	Hours or pay reduced	Became disabled or seriously ill	Cared for elderly or disabled	Had a death in household	Divorced or separated	Had a baby	Got foreclosure or eviction	None of the above
Hot	Non-CARE/FERA	6%	9%	5%	7%	2%	2%	3%	1%	73%
	CARE/FERA	14%	16%	12%	10%	4%	4%	3%	2%	53%
	Below 100% FPG	14%	15%	13%	11%	5%	4%	4%	2%	53%
	100 to 200% FPG	10%	13%	10%	11%	3%	4%	2%	1%	60%
	Senior	5%	6%	10%	13%	4%	3%	1%	1%	68%
Moderate	Non-CARE/FERA	8%	10%	4%	7%	2%	2%	2%	0%	72%
	CARE/FERA	14%	15%	11%	11%	3%	4%	2%	1%	54%
Cool	Non-CARE/FERA	8%	9%	4%	6%	2%	2%	3%	0%	74%
	CARE/FERA	14%	18%	12%	10%	4%	4%	3%	1%	52%

Households with Members Who are Disabled (Table 5.5-50)

- Few surveyed customers reported a household member who receives disability payments or has a serious disability.
- A higher proportion of respondents reported a household member having a serious disability than reported a household member receiving disability payments.
- CARE/FERA and low-income customers were most likely to report a household member having a serious disability or who received disability payments across all three climate regions.
- Below 100% FPG customers in the hot region were both most likely to report a household member having a serious disability and who received disability payments.

Table 5.5-50: Household Member(s) with Serious Medical Condition and/or Disability Payments

Climate Region	Segment	Has serious medical condition	Receives disability payments
Hot	Non-CARE/FERA	19%	8%
	CARE/FERA	31%	21%
	Below 100% FPG	33%	21%
	100 to 200% FPG	27%	15%
	Senior	30%	12%
Moderate	Non-CARE/FERA	12%	5%
	CARE/FERA	26%	18%
Cool	Non-CARE/FERA	13%	5%
	CARE/FERA	23%	19%

Household Disability Requirements (Table 5.5-51)

- The most commonly reported disability requirement was the need for someone in the household to stay home for most the day, followed by the need to cool the home in the summer; very few (3%-7%) of respondents reported that they needed to use more energy for medical equipment.
- Seniors, CARE/FERA and low-income customers were most likely to report having disability requirements across all three climate regions.
- Below 100% FPG customers in the hot region were most likely to state they need their home to be cooled in the summer, but also reported they use electricity for medical equipment and have a member of the household who needs to stay home for most the day.

Table 5.5-51: Requirements for Households with Disabled Residents

Climate Region	Segment	Need home cooled in the summer	Need more energy for medical equip	Need to be home most of the day
Hot	Non-CARE/FERA	16%	4%	22%
	CARE/FERA	29%	6%	37%
	Below 100% FPG	33%	7%	39%
	100 to 200% FPG	24%	5%	33%
	Senior	28%	6%	35%
Moderate	Non-CARE/FERA	11%	3%	19%
	CARE/FERA	26%	6%	36%
Cool	Non-CARE/FERA	8%	3%	15%
	CARE/FERA	20%	6%	31%

Household Size (Table 5.5-52)

- On average, most surveyed customers reported a household size of about three people across all segments and climate regions.
- CARE/FERA customers in the moderate region reported the largest household size of 3.6 and an inter-quartile range from 2 to 5.
- Seniors reported having the fewest number of people (2.5) living in their home, on average.

Table 5.5-52: Household Size[1]

Climate Region	Segment	Mean	Inter Quartile Range Percentile 25	Median	Percentile 75
Hot	Non-CARE/FERA	2.9	2	3	3
	CARE/FERA	3.5	2	3	5
	Below 100% FPG	3.5	2	3	5
	100 to 200% FPG	3.2	2	3	4
	Senior	2.5	2	2	3
Moderate	Non-CARE/FERA	3.3	2	3	4
	CARE/FERA	3.6	2	3	5
Cool	Non-CARE/FERA	3.1	2	3	4
	CARE/FERA	3.5	2	3	5

[1] Results are based on weighted averages across all four RCT groups (Control, Rate 1, Rate 2, and Rate 3); includes all ages and respondent

Respondent Race & Ethnicity (Table 5.5-53)

- Surveyed customers were most to least likely to report being White, Hispanic, Other, Asian, and African American.
- CARE/FERA and low-income customers were more likely to report being non-white.
- There were fewer Asian respondents in the hot climate region when compared to moderate and cool climate regions.

Table 5.5-53: Respondents' Race and Ethnicity[1]

Climate Region	Segment	Asian	African American	Hispanic	White	Other[2]
Hot	Non-CARE/FERA	7%	4%	13%	78%	8%
	CARE/FERA	5%	8%	37%	49%	9%
	Below 100% FPG	4%	9%	36%	53%	11%
	100 to 200% FPG	4%	5%	28%	63%	8%
	Senior	4%	5%	13%	77%	8%
Moderate	Non-CARE/FERA	23%	5%	17%	58%	8%
	CARE/FERA	23%	9%	38%	31%	8%
Cool	Non-CARE/FERA	20%	5%	12%	66%	8%
	CARE/FERA	17%	15%	36%	30%	9%

[1] Allows for multiple responses, rows may not add to 100%.

[2] Includes American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, Middle Eastern or North African, and Other.

Household Characteristics

This section summarizes the responses to household characteristics questions contained in the survey and trends in differences between segments.[109]

Times Home is Occupied on Weekends & Weekdays (Table 5.5-54)

- Nearly all surveyed customers reported that there was someone home during the evenings and nights throughout the week.
- Fewer customers reported their home being occupied in the mornings and afternoons on both the weekends and weekdays compared to evening and nights.
- Morning and afternoon occupancy is higher on weekends than on weekdays.
- Customers in the cool climate region reported the lowest level of occupancy throughout the morning and afternoons compared to hot and moderate region customers.

Table 5.5-54: Times of the Day When Home is Occupied on Weekdays and Weekends During the Summer Months

Climate Region	Segment	Weekday Morning	Weekday Afternoon	Weekday Evening	Weekday Night	Weekend Morning	Weekend Afternoon	Weekend Evening	Weekend Night
Hot	Non-CARE/FERA	81%	78%	92%	94%	93%	91%	93%	95%
	CARE/FERA	90%	89%	98%	99%	96%	93%	96%	98%
	Below 100% FPG	90%	90%	96%	97%	94%	92%	95%	97%
	100 to 200% FPG	90%	88%	97%	98%	96%	93%	96%	98%
	Senior	90%	89%	94%	95%	92%	91%	93%	95%
Moderate	Non-CARE/FERA	86%	80%	97%	99%	96%	93%	96%	99%
	CARE/FERA	89%	87%	96%	99%	95%	92%	95%	98%
Cool	Non-CARE/FERA	82%	76%	96%	99%	97%	91%	95%	99%
	CARE/FERA	86%	83%	96%	98%	94%	88%	94%	97%

Own or Rent Home (Table 5.5-55)

- A slight majority of surveyed customers reported owning their home, with exception to CARE/FERA customers in the cool region.
- CARE/FERA and low-income customers were more likely to report renting their home and receiving subsidized housing assistance, such as Section 8, compared to non-CARE/FERA and senior customers.
- On average, hot climate region customers were more likely to report owning their home compared to customers in moderate or cool climate regions.

Table 5.5-55: Home Ownership Status

Climate Region	Segment	Own	Rent without subsidies	Rent with subsidies
Hot	Non-CARE/FERA	86%	13%	0%
	CARE/FERA	59%	34%	7%
	Below 100% FPG	56%	36%	8%
	100 to 200% FPG	74%	23%	3%
	Senior	83%	14%	3%
Moderate	Non-CARE/FERA	83%	16%	1%
	CARE/FERA	54%	37%	9%
Cool	Non-CARE/FERA	76%	23%	1%
	CARE/FERA	40%	45%	15%

[109] Trend analyses did not include tests for statistical significance and are based on observation of the differences in values.

Type of Housing (Table 5.5-56)

- Most surveyed customers reported living in a single-family detached home, followed by apartments or condos.
- CARE/FERA customers in the moderate and cool regions were most likely to report living in an apartment or condo.
- Hot climate region customers were more likely to report living in a manufactured or mobile home compared to the corresponding customers in the moderate or cool climate regions.

Table 5.5-56: Housing Type

Climate Region	Segment	Single-Family Detached	2 to 4 plex	Apt or condo	Townhome	Man. or mobile home, or mobile unit
Hot	Non-CARE/FERA	76%	3%	11%	3%	7%
	CARE/FERA	65%	5%	17%	3%	10%
	Below 100% FPG	62%	6%	18%	2%	12%
	100 to 200% FPG	71%	4%	12%	3%	10%
	Senior	67%	4%	15%	2%	12%
Moderate	Non-CARE/FERA	77%	2%	13%	5%	2%
	CARE/FERA	52%	5%	32%	5%	6%
Cool	Non-CARE/FERA	59%	5%	26%	9%	1%
	CARE/FERA	34%	10%	48%	6%	2%

Number of Bedrooms in Home (Table 5.5-57)

- On average, most surveyed customers across all segments reported having two to three bedrooms in their home.
- Very few respondents reported having five or more bedrooms or living in a studio.
- CARE/FERA and low-income customers were more likely to report having fewer bedrooms in their home compared to non-CARE/FERA customers.

Table 5.5-57: Number of Bedrooms in Home

Climate Region	Segment	Studio	One	Two	Three	Four	Five +
Hot	Non-CARE/FERA	0.5%	4.2%	25.6%	45.9%	20.1%	3.7%
	CARE/FERA	0.9%	9.4%	27.8%	44.1%	15.1%	2.6%
	Below 100% FPG	1.2%	11.3%	33.2%	40.3%	11.9%	2.2%
	100 to 200% FPG	0.9%	7.9%	26.5%	44.5%	17.4%	2.8%
	Senior	0.6%	8.8%	32.1%	43.9%	12.4%	2.2%
Moderate	Non-CARE/FERA	0.5%	5.5%	18.6%	37.0%	29.8%	8.6%
	CARE/FERA	1.0%	16.9%	32.4%	31.3%	14.9%	3.6%
Cool	Non-CARE/FERA	1.4%	9.9%	26.0%	37.2%	21.0%	4.5%
	CARE/FERA	2.5%	23.2%	39.1%	26.7%	7.2%	1.3%

Cooling Equipment in Home (Table 5.5-58)

- A large majority of surveyed customers reported having and using ceiling or portable fans in their home.
- Hot climate region customers were more likely to report having central air-conditioning or a room air-conditioning unit in their home and report using it more frequently, compared to customers in moderate or cool climate regions.
- More CARE/FERA customers reported having a room air conditioning unit or evaporative/swamp cooler and fewer reported central air conditioning, heat pumps, or fans compared to non-CARE/FERA customers.
- Very few respondents reported having a heat pump in their home, and of those who did, around three-quarters reported never using it.

Table 5.5-58: Cooling Equipment in Home and Frequency of Use[1]

Item	Install & Use	Hot					Moderate		Cool	
		Non-CARE/FERA	CARE/FERA	Below 100% FPG	100 to 200% FPG	Senior	Non-CARE/FERA	CARE/FERA	Non-CARE/FERA	CARE/FERA
Central air-conditioning	Have in home	84%	74%	65%	79%	79%	87%	66%	47%	31%
	Daily	57%	46%	43%	48%	55%	38%	27%	23%	12%
	Several days a week	17%	21%	19%	21%	18%	31%	29%	23%	21%
	Several days a month	15%	19%	18%	17%	16%	24%	25%	33%	25%
	Never	11%	15%	19%	14%	11%	7%	19%	20%	41%
Room air conditioning unit	Have in home	15%	23%	27%	19%	17%	20%	38%	21%	33%
	Daily	23%	27%	30%	25%	23%	19%	25%	14%	17%
	Several days a week	14%	16%	21%	12%	15%	23%	29%	21%	28%
	Several days a month	14%	13%	13%	15%	14%	18%	20%	32%	25%
	Never	49%	45%	36%	48%	47%	40%	26%	33%	30%
Evaporative or swamp cooler	Have in home	33%	43%	47%	42%	39%	4%	15%	3%	5%
	Daily	48%	46%	49%	47%	47%	9%	21%	11%	10%
	Several days a week	15%	18%	19%	19%	19%	10%	15%	7%	10%
	Several days a month	9%	11%	9%	11%	10%	5%	9%	11%	8%
	Never	28%	25%	22%	23%	25%	76%	54%	71%	72%
Heat pump	Have in home	8%	5%	5%	6%	7%	4%	4%	5%	6%
	Daily	12%	7%	8%	8%	11%	6%	6%	6%	5%
	Several days a week	4%	4%	5%	5%	4%	4%	4%	6%	6%
	Several days a month	7%	4%	5%	4%	6%	5%	6%	12%	10%
	Never	76%	84%	81%	82%	79%	85%	83%	76%	79%
Ceiling or portable fans	Have in home	91%	82%	80%	87%	89%	86%	79%	82%	75%
	Daily	72%	68%	66%	72%	68%	66%	58%	52%	49%
	Several days a week	16%	17%	19%	15%	18%	22%	25%	25%	25%
	Several days a month	8%	8%	9%	7%	10%	9%	11%	17%	17%
	Never	4%	6%	6%	5%	5%	4%	7%	5%	8%

[1] Allows for multiple responses, columns may not add to 100%.

Thermostat for Heating and/or Cooling (Table 5.5-59)

- Hot and moderate climate region customers were more likely to report having a thermostat for both heating and cooling compared to cool climate region customers.
- Low-income and senior customers were more likely to report having a thermostat for heating only or not having a thermostat in their home.
- Very few respondents reported having a thermostat for cooling only.

Table 5.5-59: Thermostat in Home for Heating and/or Cooling

Climate Region	Segment	Thermostat for heating only	Thermostat for cooling only	Thermostat for both heating & cooling	No thermostat
Hot	Non-CARE/FERA	7%	2%	85%	6%
	CARE/FERA	15%	3%	69%	13%
	Below 100% FPG	18%	3%	60%	19%
	100 to 200% FPG	11%	3%	77%	10%
	Senior	12%	3%	77%	8%
Moderate	Non-CARE/FERA	9%	2%	84%	6%
	CARE/FERA	15%	4%	57%	24%
Cool	Non-CARE/FERA	38%	1%	47%	15%
	CARE/FERA	35%	3%	26%	36%

Thermostat Type (Table 5.5-60)

- Hot climate non-CARE/FERA customers were much more likely to report having a programmable or smart thermostat in their home compared to all other segments.
- CARE/FERA customers were most likely to have a standard thermostat.

Table 5.5-60: Thermostat Type in Home

Climate Region	Segment	A standard thermostat	A programmable thermostat	A smart thermostat
Hot	Non-CARE/FERA[1]	35%	43%	21%
	CARE/FERA	57%	39%	4%
	Below 100% FPG	62%	36%	2%
	100 to 200% FPG	54%	43%	3%
	Senior	55%	41%	3%
Moderate	Non-CARE/FERA	44%	49%	6%
	CARE/FERA	66%	32%	2%
Cool	Non-CARE/FERA	51%	43%	6%
	CARE/FERA	72%	26%	2%

[1] Control and Rate 1 groups were targeted with a smart thermostat rebate.

Thermostat Temperature Settings (Table 5.5-61)

- Surveyed customers in the cool climate region were more likely to report turning their thermostat to a low setting or completely off in the late afternoon and evenings during the summer.
- Low-income customers were more likely to report setting their thermostat to "off" or setting it to a lower temperature compared to non-CARE/FERA customers.
- There was very little variation between customers' reported thermostat settings on weekdays versus weekends.

Table 5.5-61: Thermostat Settings in Late Afternoons and Evenings on Weekdays and Weekends During Summer Months

		Hot					Moderate		Cool	
Weekday / Weekend	Temperature	Non-CARE/FERA	CARE/FERA	Below 100% FPG	100 to 200% FPG	Senior	Non-CARE/FERA	CARE/FERA	Non-CARE/FERA	CARE/FERA
Weekday	Off	6%	8%	10%	8%	6%	7%	12%	19%	28%
	Below 68 F	1%	3%	4%	2%	2%	1%	3%	2%	4%
	69 F to 71 F	4%	7%	8%	6%	6%	5%	6%	5%	9%
	72 F to 74 F	12%	12%	13%	11%	11%	11%	14%	15%	15%
	75 F to 77 F	19%	20%	20%	19%	18%	25%	24%	26%	20%
	78 F to 80 F	41%	39%	33%	42%	41%	43%	34%	29%	20%
	81 F or higher	17%	11%	11%	12%	16%	8%	6%	5%	4%
Weekend	Off	6%	8%	10%	8%	6%	7%	11%	17%	27%
	Below 68 F	1%	3%	4%	2%	2%	1%	3%	2%	5%
	69 F to 71 F	5%	7%	8%	6%	6%	4%	7%	6%	9%
	72 F to 74 F	12%	12%	14%	12%	11%	13%	14%	16%	15%
	75 F to 77 F	22%	21%	21%	21%	19%	26%	27%	28%	21%
	78 F to 80 F	41%	38%	32%	40%	41%	42%	32%	26%	18%
	81 F or higher	14%	10%	11%	12%	16%	6%	7%	5%	4%

Smart Thermostats

In the web version of the survey, customers who reported having a smart thermostat installed in their home were asked about their overall satisfaction and their level of agreement with four statements regarding their smart thermostat. Due to small sample sizes, in this section only findings for non-CARE/FERA SCE customers in the hot climate region for the Control and Rate 1 treatment group are presented.[110]

Twenty-one percent of SCE non-CARE/FERA customers reported having a smart thermostat installed in their home (see Table 5.5-59 above). Significantly more Rate 1 treatment group customers reported having a smart thermostat installed compared to Control group customers (37% compared to 27%, respectively; not shown in table). Customers in the Control and Rate 1 treatment group who reported having a smart thermostat provided high satisfaction ratings with their smart thermostat (both groups providing an average rating of 9.0 on an 11-point scale, with 0 meaning “not satisfied at all” and 10 meaning “extremely satisfied”). Customers rated their level of agreement with four statements regarding aspects of their smart thermostat using an 11-point scale, with 0 meaning “do not agree at all” and 10 meaning “completely agree.” On average, SCE customers provided the highest agreement ratings to the statement “[my thermoset] is easy to use” and the lowest agreement ratings to the statement “[my thermostat] helps me lower my electricity bill” (Table 5.5-62). Agreement ratings did not differ significantly between the Control and Rate 1 treatment group.

Table 5.5-62: Respondents’ Average Level of Agreement with Aspects of Their Smart Thermostat [1,2]

Statement	Control (n=200)	Rate 1 (n=173)
Easy to use	8.7	8.6
Helps keep home at a comfortable temperature	8.1	8.3
Helps lower electricity bill	7.1	6.9
Helped manage electricity use during study	6.7	6.8

[1] Agreement ratings are based on an 11-point scale where 0 means ‘do not agree at all’ and 10 means ‘completely agree’.

[2] Asked to web survey respondents in the Control and Rate 1 groups who reported having a smart thermostat; Rate 2 and 3 groups not asked.

[110] For this analysis, any segments or rate treatment groups where sample sizes were too small to draw inferences (50 or fewer respondents) were excluded.

Newsletters and Websites

Nearly all web survey respondents (between 90% and 98%) reported receiving the TOU study welcome packet (Table 5.5-63). Slightly fewer respondents reported receiving the summer newsletter (between 70% and 84%) and between one-third and one-half (33% to 47%) reported receiving the fall newsletter.

Table 5.5-63: Percentage of Respondents Who Received TOU Study Information[1]

Climate Region	Segment	Welcome packet R1	Welcome packet R2	Welcome packet R3	Summer newsletter R1	Summer newsletter R2	Summer newsletter R3	Fall newsletter R1	Fall newsletter R2	Fall newsletter R3
Hot	Non-CARE/FERA	93%	93%	97%	72%	72%	81%	33%	34%	35%
	CARE/FERA	93%	94%	96%	81%	78%	81%	42%	37%	41%
	Below 100% FPG	93%	93%	94%	82%	74%	77%	45%	36%	42%
	100% to 200% FPG	94%	94%	98%	82%	77%	84%	46%	36%	41%
	Senior	93%	92%	96%	79%	75%	84%	42%	37%	40%
Moderate	Non-CARE/FERA	96%	94%	97%	74%	72%	78%	35%	33%	38%
	CARE/FERA	90%	91%	92%	78%	75%	83%	42%	39%	46%
Cool	Non-CARE/FERA	95%	95%	96%	74%	70%	81%	34%	35%	43%
	CARE/FERA	90%	91%	95%	74%	75%	84%	44%	43%	47%

[1] Asked to web survey respondents in the Rate groups; Control group not asked.

Respondents who reported receiving the TOU study welcome packet or the summer/fall newsletters found the informational materials to be moderately useful (using a 11-point scale with 0 meaning "not useful at all" and 10 meaning "extremely useful";" Table 5.5-64). Respondents in the non-CARE/FARE segments found informational materials slightly less useful compared to those in the CARE/FERA segments. Usefulness ratings did not vary substantially between informational material type or Rate treatment group.

Table 5.5-64: Average Usefulness Rating for TOU Study Information[1,2]

Climate Region	Segment	Welcome packet R1	Welcome packet R2	Welcome packet R3	Summer newsletter R1	Summer newsletter R2	Summer newsletter R3	Fall newsletter R1	Fall newsletter R2	Fall newsletter R3
Hot	Non-CARE/FERA	6.7	6.8	6.9	6.3	6.5	6.4	6.2	6.4	6.1
	CARE/FERA	7.6	7.4	7.0	7.3	7.3	6.9	7.4	7.4	7.0
	Below 100% FPG	7.8	7.2	7.2	7.6	7.1	7.5	7.7	7.3	7.5
	100% to 200% FPG	7.4	7.2	6.9	6.9	7.0	6.7	7.1	7.1	6.8
	Senior	7.0	7.0	7.0	6.8	6.8	6.5	6.7	6.8	6.3
Moderate	Non-CARE/FERA	7.0	7.0	7.1	6.4	6.6	6.4	6.6	6.3	6.3
	CARE/FERA	7.6	7.7	7.4	7.3	7.6	7.4	7.0	8.1	7.4
Cool	Non-CARE/FERA	6.8	7.0	6.8	6.2	6.5	6.3	6.3	8.0	6.2
	CARE/FERA	7.8	7.8	7.6	7.7	7.5	7.6	7.7	7.6	8.0

[1] Usefulness ratings are based on an 11-point scale where 0 means 'not at all useful' and 10 means 'extremely useful'.

[2] Asked to web survey respondents in the Rate groups who reported receiving each item; Control group not asked.

Between two-fifths and one-half of SCE respondents (between 38% and 53%) reported visiting the SCE My Account website since summer of 2016 (Table 5.5-65). Fewer SCE respondents reported visiting the rate plan study website since summer 2016 (between 11% and 32%). Overall, responses did not differ substantially between respondent segment or Rate treatment group.

Table 5.5-65: Percentage of Respondents Who Visited IOU and TOU Study Websites[1]

Climate Region	Segment	SCE My Account website			Rate plan study website		
		R1	R2	R3	R1	R2	R3
Hot	Non-CARE/FERA	58%	44%	48%	16%	11%	20%
	CARE/FERA	51%	51%	51%	22%	16%	27%
	Below 100% FPG	47%	47%	46%	28%	15%	32%
	100% to 200% FPG	49%	51%	46%	18%	14%	21%
	Senior	42%	38%	39%	15%	11%	20%
Moderate	Non-CARE/FERA	51%	50%	45%	13%	12%	17%
	CARE/FERA	53%	50%	45%	20%	19%	20%
Cool	Non-CARE/FERA	44%	46%	44%	14%	14%	18%
	CARE/FERA	51%	50%	40%	18%	20%	22%

[1] Asked to web survey respondents in the Rate groups; Control group not asked.

Respondents who reported visiting the SCE My Account website or the TOU rate plan study website found the websites to be moderately useful (using a 11-point scale with 0 meaning “not useful at all” and 10 meaning “extremely useful”;” Table 5.5-66). Respondents in the non-CARE/FARE segments found the websites slightly less useful compared to those in the CARE/FERA segments. Usefulness ratings did not vary substantially between website type or Rate treatment group.

Table 5.5-66: Average Usefulness Rating for IOU and TOU Study Websites[1,2]

Climate Region	Segment	SCE My Account website			Rate plan study website		
		R1	R2	R3	R1	R2	R3
Hot	Non-CARE/FERA	6.9	7.2	5.7	6.7	6.9	6.5
	CARE/FERA	7.6	7.6	6.7	7.4	7.6	6.7
	Below 100% FPG	7.7	7.4	6.5	7.5	7.1	7.3
	100% to 200% FPG	7.5	7.4	6.2	7.0	7.3	6.8
	Senior	7.1	7.0	6.1	7.2	7.2	6.4
Moderate	Non-CARE/FERA	7.1	6.9	6.5	7.3	6.9	6.7
	CARE/FERA	7.7	7.9	7.2	6.7	7.8	7.7
Cool	Non-CARE/FERA	6.6	7.2	6.1	6.5	6.6	6.4
	CARE/FERA	7.8	8.0	7.3	7.3	7.9	7.4

[1] Usefulness ratings are based on an 11-point scale where 0 means ‘not at all useful and 10 means ‘extremely useful’.

[2] Asked to web survey respondents in the Rate groups who reported visiting each website; Control group not asked.

Respondents who received TOU study information in both English and in their native language were asked about the importance of receiving information in both languages (using a 11-point scale with 0 meaning “not important at all” and 10 meaning “extremely important”). On average, SCE respondents found having materials available in their native language to be of high importance (Table 5.5-67). Responses were consistent across segments and Rate treatment groups, except for the lower ratings in moderate and cool climate region non-CARE/FERA segments compared to the hot region segments. Due to small sample sizes, however, results should be interpreted carefully.

Table 5.5-67: Average Importance Rating for Receiving Information in Respondents Native Language[1,2,3]

Climate Region	Segment	Rate 1 n	Rate 1 Average	Rate 2 n	Rate 2 Average	Rate 3 n	Rate 3 Average
Hot	Non-CARE/FERA	--	--	6	9.7	9	8.1
	CARE/FERA	40	8.7	91	9.5	26	9.3
	Below 100% FPG	26	8.8	57	9.6	22	9.0
	100% to 200% FPG	16	8.4	30	9.4	12	9.0
	Senior	10	9.7	24	9.6	11	8.3
Moderate	Non-CARE/FERA	14	9.3	13	7.4	17	7.8
	CARE/FERA	74	9.2	81	9.3	67	9.1
Cool	Non-CARE/FERA	13	7.5	10	7.4	8	5.1
	CARE/FERA	86	9.2	83	9.2	57	8.7

[1] Importance ratings are based on an 11-point scale where 0 means ‘not at all important and 10 means ‘extremely important’.

[2] Blank cells in figure indicate sample size for that segment/Rate treatment group was fewer than five.

[3] Asked only to web survey respondents who are non-English speakers in the Rate groups and who reported receiving information from SCE.

Overall, SCE web survey respondents provided moderate to high satisfaction ratings with TOU study outreach (using a 11-point scale with 0 meaning “not satisfied at all” and 10 meaning “extremely satisfied;” Table 5.5-68). Respondents in the non-CARE/FARE segments reported being slightly less satisfied with TOU study outreach compared to those in the CARE/FERA segments.

Table 5.5-68: Average Satisfaction Rating for All TOU Study Outreach[1,2]

Climate Region	Segment	Rate 1	Rate 2	Rate 3
Hot	Non-CARE/FERA	7.5	7.7	7.3
	CARE/FERA	8.2	8.1	7.6
	Below 100% FPG	8.3	8.0	7.5
	100% to 200% FPG	8.1	7.9	7.5
	Senior	7.9	7.8	7.7
Moderate	Non-CARE/FERA	7.8	7.8	7.6
	CARE/FERA	8.3	8.4	8.1
Cool	Non-CARE/FERA	7.7	7.8	7.7
	CARE/FERA	8.5	5.4	8.3

[1] Satisfaction ratings are based on an 11-point scale where 0 means ‘not at all satisfied’ and 10 means ‘extremely satisfied’.

[2] Asked to web survey respondents in the Rate groups who reported receiving any outreach item; Control group not asked.

5.6 Synthesis for SCE Pilot

This section compares input from the load impact analysis, the bill impact analysis, and the survey analysis. The objective of these comparisons, at least in part, is to determine if the information and conclusions observed for individual metrics are supported by findings from other metrics or, alternatively, findings for one metric contradict those for another metric. We also look for clues from the survey findings that might help explain why load or bill impacts for one rate differ from those for other rates.

Readers are referred to the beginning of Section 4.6 for two important cautions when interpreting these results—namely that the timing of this analysis means that the negative bill impacts (and perceptions related to that) are probably as bad as they will be throughout the entire pilot period (except for the enrollment credits that were provided during the summer) and that, given the large samples underlying the survey analysis, statistically significant differences may not reflect meaningful differences from a policy perspective.

5.6.1 Synthesis

Tables 5.6-1 through 5.6-3 summarize some of the relevant findings from the load impact, bill impact and survey analysis. Readers are directed to Section 4.6.1 for an explanation of the variables and symbols contained in the tables. As a reminder, unlike with PG&E where two pilot rates had two pricing periods and one had three, all three of SCE's pilot rates had three pricing periods on weekdays and two on weekends. The shoulder periods for all three rates were long, beginning at 8 AM for two of the rates and at 11 AM for the third. Also, Rate 3 has no baseline credit whereas Rates 1 and 2 do.

Non-CARE/FERA Customers

As was seen in Sections 5.3.1 through 5.3.3, for the service territory as a whole, non-CARE/FERA customers had larger peak period load reductions than CARE/FERA customers in both absolute and percentage terms on Rates 1 and 2 and larger impacts in absolute terms on all three rates. For Rate 3, the absolute load impact between non-CARE/FERA and CARE/FERA customers was not statistically significant. However, these differences were not observed for all rates and all climate regions. As seen in Tables 5.6-1 through 5.6-3, n the hot climate region, there was no statistically significant difference between non-CARE/FERA and CARE/FERA customers for any of the rates in percentage terms and for Rates 1 and 2 in absolute terms. In the moderate and cool climate regions, the difference was statistically significant for some rates and not others. These findings contrast with those in PG&E's service territory, where the difference in impacts between the two segments were statistically significant in the nearly all rates and climate regions.

Peak period load reductions for non-CARE/FERA customers were all statistically significant but also quite modest in the hot climate regions for all three rates, ranging from 1.1% for Rate 1 to roughly 3.0% for Rates 2 and 3. The percentage change in daily electricity use in the hot region was not statistically significant for Rate 1 and equaled only 0.6% for Rate 2 and 1.8% for Rate 3. In the moderate and cool regions, percentage reductions in peak period electricity use were typically between 4% and 6% except for participants on Rate 3 in the moderate region where peak period reductions were only 1.4%.

Table 5.6-1: Load Impacts, Bill Impacts, and Selected Survey Findings for SCE Rate 1

Climate	Segment	Load Impacts: Peak Period Load Reduction	Load Impacts: Net Decrease in Daily Usage	Bill Impacts: Summer Monthly Average Structural Bill Impact	Bill Impacts: Average Behavioral Bill Impact	Bill Impacts: Total Bill Impact	Survey: Respondents Reporting Being Uncomfortably Hot	Survey: Health Index	Survey: Bill Higher than Expected	Survey: Difficulty Paying Bills	Survey: Economic Index (Range 0-10)	Survey: Understanding TOU Pricing (None-Correct)	Survey: Satisfaction w/ Rate (11 pt. Scale)	Survey: Satisfaction w/ Utility (11 pt. Scale)
Hot	Non-CARE/FERA	1.1% ▼	-0.3% -	$28.23	$1.02 -	$29.25 ▲	12% -	14% -	40% ▲	29% -	2.3 -	14%	6.0 ▼	6.8 ▼
	CARE/FERA	1.8% ▼	0.2% -	$24.46	$0.49 -	$24.95 ▲	19% -	31% ▲	34% ▲	70% -	4.1 -	20%	6.8 ▼	7.5 ▼
Moderate	Non-CARE/FERA	5.5% ▼	3.5% ▼	$22.62	-$7.38 ▼	$15.24 ▲	12% -	19% -	33% ▲	29% -	2.4 -	9%	6.2 ▼	7.1 -
	CARE/FERA	3.3% ▼	0.5%	$17.81	-$0.70 -	$17.11 ▲	24% -	23% -	32% ▲	62% -	3.8 -	18%	7.3 ▼	7.8 -
Cool	Non-CARE/FERA	5.8% ▼	3.0% ▼	$11.42	-$4.42 -	$7.00 ▲	10% -	I/S	25% -	21% -	2.1 -	12%	6.6 -	7.1 -
	CARE/FERA	2.4% ▼	1.1% ▼	$10.45	-$0.40 -	$10.05 ▲	25% -	18% -	25% ▲	66% -	3.9 -	20%	7.8 -	8.2 -

Table 5.6-2: Load Impacts, Bill Impacts, and Selected Survey Findings for SCE Rate 2

Climate	Segment	Load Impacts: Peak Period Load Reduction	Load Impacts: Net Decrease in Daily Usage	Bill Impacts: Summer Monthly Average Structural Bill Impact	Bill Impacts: Average Behavioral Bill Impact	Bill Impacts: Total Bill Impact	Survey: Respondents Reporting Being Uncomfortably Hot	Survey: Health Index	Survey: Bill Higher than Expected	Survey: Difficulty Paying Bills	Survey: Economic Index (Range 0-10)	Survey: Understanding TOU Pricing (None-Correct)	Survey: Satisfaction w/ Rate (11 pt. Scale)	Survey: Satisfaction w/ Utility (11 pt. Scale)
Hot	Non-CARE/FERA	2.9% ▼	0.6% ▼	$38.08	-$1.94 -	$36.13 ▲	13% -	9% -	44% ▲	31% -	2.5 -	24%	5.9 ▼	6.8 -
	CARE/FERA	3.5% ▼	1.9% ▼	$30.34	-$2.54 -	$27.80 ▲	21% -	26% -	39% ▲	72% -	4.2 -	31%	6.9 ▼	7.6 ▼
	Senior	4.1% ▼	1.4% ▼	$37.97	-$2.32 -	$35.65 ▲	14% -	16% -	36% ▲	39% -	2.8 -	30%	6.5 ▼	7.3 ▼
	HH < 100% FPG	3.1% ▼	1.3% ▼	$29.84	-$2.67 -	$27.17 ▲	22% -	23% -	40% ▲	65% -	4.0 -	34%	6.6 ▼	7.4 ▼
	100% FPG < HH < 200% FPG	N/A	N/A	$32.40	-$4.72 -	$27.67 ▲	20% -	17% -	43% ▲	62% -	3.8 ▲	27%	6.4 ▼	7.2 ▼
Moderate	Non-CARE/FERA	5.6% ▼	1.8% ▼	$30.72	-$5.52 ▼	$25.20 ▲	12% -	9% -	38% ▲	27% -	2.2 -	21%	6.4 -	7.1 -
	CARE/FERA	1.7% ▼	0.4% -	$22.81	-$0.55 -	$22.25 ▲	24% -	31% -	31% ▲	65% -	3.8 -	33%	7.2 ▼	8.0 -
Cool	Non-CARE/FERA	4.2% ▼	2.0% ▼	$14.85	-$3.49 -	$11.36 ▲	11% -	14% -	30% ▲	26% -	2.1 -	23%	6.7 -	7.4 -
	CARE/FERA	4.6% ▼	1.7% ▼	$12.14	-$1.32 -	$10.82 ▲	27% -	26% -	23% ▲	68% -	3.9 -	38%	7.7 -	8.1 -

Table 5.6-3: Load Impacts, Bill Impacts, and Selected Survey Findings for SCE Rate 3

Climate	Segment	Load Impacts: Peak Period Load Reduction	Load Impacts: Net Decrease in Daily Usage	Bill Impacts: Summer Monthly Average Structural Bill Impact	Bill Impacts: Average Behavioral Bill Impact	Bill Impacts: Total Bill Impact	Survey: Respondents Reporting Being Uncomfortably Hot	Survey: Health Index	Survey: Bill Higher than Expected	Survey: Difficulty Paying Bills	Survey: Economic Index (Range 0-10)	Survey: Understanding TOU Pricing (None-Correct)	Survey: Satisfaction w/ Rate (11 pt. Scale)	Survey: Satisfaction w/ Utility (11 pt. Scale)
Hot	Non-CARE/FERA	3.0% ▼	1.8% ▼	$35.63	-$3.29 -	$32.33 ▲	14% -	12% -	54% ▲	33% -	2.6 -	15%	5.5 ▼	6.5 ▼
	CARE/FERA	-0.1% ▼	0.1% -	$31.56	$1.11 -	$32.67 ▲	26% ▲	29% ▲	49% ▲	73% -	4.4 ▲	29%	6.4 ▼	7.5 ▼
Moderate	Non-CARE/FERA	1.4% -	0.1% -	$20.51	-$0.42 -	$20.10 ▲	14% -	12% -	48% ▲	30% -	2.4 -	16%	6.0 ▼	6.9 -
	CARE/FERA	4.8% ▼	1.9% ▼	$22.38	-$2.01 -	$20.37 ▲	27% -	25% -	40% ▲	64% -	3.9 -	25%	6.9 ▼	7.7 ▼
Cool	Non-CARE/FERA	4.3% ▼	3.4% ▼	$9.29	-$4.24 ▼	$5.05 ▲	13% -	30% -	41% ▲	25% -	2.1 -	13%	6.3 ▼	7.1 -
	CARE/FERA	2.0% ▼	1.1% ▼	$14.18	-$1.08 -	$13.11 ▲	28% -	28% -	31% ▲	65% -	3.9 -	24%	7.4 ▼	7.9 -

Previously it had been speculated that the lower reductions relative to what was observed in PG&E's service territory, especially in the hot climate region, might be due, in part, to the fact that SCE's hot region has significantly more very hot days than PGE&'s hot region combined with the fact that the combined length of peak and shoulder periods at SCE means that customers face higher prices for the majority of the day, especially with Rates 1 and 2, compared with the high priced hours at PG&E. If this hypothesis were true, we would expect to see fewer customers in SCE's service territory reporting that they adjusted their thermostat settings, did precooling or turned their air conditioners off than we would see at PG&E. Evidence from the survey does not strongly support this hypothesis although there are some differences in behavior worth noting.

Table 5.6-4 shows the percent of non-CARE/FERA customers in PG&E's and SCE's hot climate regions reporting that they often increased their thermostat temperature during afternoons and evenings, often turned their units off in afternoons and evenings or often precooled their home by running their air conditioners earlier in the day. These are taken from Tables 4.5-37 for PG&E and 5.5-37 for SCE. The behaviors are not mutually exclusive so we also included a cumulative total at the bottom. As seen at the bottom of the table, it does appear that even in the absence of TOU prices, control customers in PG&E's hot region more frequently report taking one or more of the behaviors than do SCE control customers. Taking averages across the three rates, the one behavior with the biggest difference between the two service territories is turning off air conditioning, where the average for PG&E is 40% and the average for SCE is 32%.

Table 5.6-4: Reported Air Conditioning Behavior

Reported Behavior	PG&E Hot Climate Region (% of customers)				SCE Hot Climate Region Percent of Customers)			
	Control	R1	R2	R3	Control	R1	R2	R3
Often increased thermostat settings	49%	52%	53%	56%	46%	52%	52%	49%
Often turned air conditioning off	39%	38%	41%	42%	28%	32%	33%	31%
Often pre-cooled house earlier in day	28%	36%	34%	41%	30%	36%	35%	39%
All (sum, not average)	116%	126%	128%	139%	104%	120%	120%	119%

Given the small load impacts in the hot climate region, bill impacts due to behavior change were quite small. In the case of Rate 1, the behavioral change actually contributed to a bill increase rather than a reduction in the structural bill increase. Average monthly bill increases in the hot climate region for this customer segment ranged from roughly $29 to more than $36. In the cool climate region, average bill increases ranged from a low of roughly $5 for Rate 3 to a high of more than $11 for Rate 2. Between 10% and 14% of non-CARE/FERA customers reported being uncomfortably hot as a result of trying to save on electricity bills. Oddly, this percent didn't vary materially across climate regions, which is quite different from what was seen in PG&E's service territory, where the percent reporting that they were uncomfortable was around 17% in the hot climate region, 7% in the moderate region, and 2% in the cool region. Importantly, the only instance in which the percent of customers increased by a statistically significant amount for those on the TOU rate compared with the control group was in the hot climate region for CARE/FERA customers on Rate 3. The Rate 3 percent was 26% and the control group percent was 21%. None of the differences were statistically significant for non-CARE/FERA customers in any climate region or rate combination.

The percent of non-CARE/FERA customers reporting that their bills were higher than expected ranged from 40% to 54% in the hot climate region, with the highest percent being for Rate 3. This percent was relatively high even in the moderate and cool regions, ranging from a low of 25% in the cool region for Rate 1 participants to a high of 48% in the moderate region on Rate 3. These percentages were both statistically and materially different from the percent of control customers reporting higher than expected bills, which was roughly half as high as for TOU rate customers. Comparing the simple average of these percentages across climate regions for each rate indicates that many more Rate 3 customers (48%) thought their bills were higher than expected than Rate 1 (33%) or Rate 2 (37%) customers. Recall that Rate 3 is the tariff that does not have a baseline credit.

These findings should be carefully considered when developing ME&O materials for default pricing and when scheduling the roll out for default pricing. Managing customer's expectations around the fact that summer bills might be higher under TOU pricing compared with the historical pattern (while also reminding them that winter bills are expected to be lower) might help reduce the number of customers reporting that their bills were higher than expected (and perhaps improve satisfaction with the rate). Reminding customers about tools they can use to mitigate seasonal variation in bills, such as balanced payment plans, might also help[111]. Finally, avoiding rolling out default pricing just prior to or during early summer would let customers enjoy the lower priced periods before experiencing the higher priced periods.

There was no statistically significant increase (relative to the control group) in customers reporting difficulty paying bills or in the economic index for non-CARE/FERA customers on Rates 1, 2, or 3 in any climate region. For difficulty paying bills, 30% of non-CARE/FERA control group customers in the hot climate region reported having difficulty paying bills while 33% of Rate 3 customers reported difficulty. For the economic index, the control group value is 2.4 and the Rate 3 group value is 2.6.

As in PG&E's service territory, non-CARE/FERA customers scored lower (which is better) on the metric related to understanding TOU rate periods compared with CARE/FERA customers. Taking a simple (not population weighted) average of scores across the three climate regions for each rate, non-CARE/FERA customers had averages of 11.7, 22.7 and 14.7 for Rates 1, 2 and 3, respectively. CARE/FERA customers had averages of 19.3, 34.0 and 26.0. It's not obvious why Rate 1 scored lower than Rates 2 and 3 on this factor, since all three rates have three pricing periods. Rate 2 has a shorter, three-hour peak period compared with Rate 1's six hour period and Rate 3's five hour period. The combination of peak and shoulder periods is the same for Rates 1 and 2 but shorter for Rate 3.

Finally, non-CARE/FERA customers had statistically significant lower satisfaction ratings for the TOU rate compared with the control group for all three rates in the hot climate region. Rate 1 and Rate 3 customers had statistically significantly lower satisfaction ratings for SCE compared with the control group in the hot climate region. The satisfaction rating for the rates was also statistically significantly lower for non-CARE/FERA customers on Rates 1 and 3 in the moderate climate region but not for Rate 2. Non-CARE/FERA customers on Rate 3 in the hot climate region had the lowest average satisfaction

[111] An investigation of whether offering balanced payment programs to TOU customers reduces demand response and/or impacts attrition is planned for the default pilots that will be implemented in 2018.

rating for any segment, climate region, and treatment with a value of 5.5. The control group average value for this segment, at 6.2, was almost a full point higher. The average satisfaction rating for SCE was not significantly lower for non-CARE/FERA customers in the moderate or cool zones for any of the rate treatments.

CARE/FERA Customers

As discussed above, load impacts for CARE/FERA customers are not statistically different from those for non-CARE/FERA customers for a number of climate regions and rates. This is in stark contrast to the findings in the PG&E service territory where the differences were significant in nearly all cases. This contrast is hard to explain. We have reviewed the demographic data for the two service territories and there are some differences that may explain some of the difference in outcomes for the two jurisdictions. For example, there is a smaller differential in the saturation of central air conditioning between CARE/FERA and non-CARE/FERA households in SCE's territory compared with PG&E's territory. In PG&E's territory, 85% of non-CARE/FERA customers in the hot climate region had central air conditioning, while 68% of CARE/FERA customers had central air conditioning, a ratio of 1.3. In the moderate climate region, the saturations are 49% and 32%, a ratio of 1.5. The comparable values in SCE's hot region are 84% and 74% in the hot region (a ratio of 1.1) and in the moderate region, the saturations are 87% and 66%, a ratio of 1.3. It is also worth noting the dramatic difference in air conditioning saturation in the moderate regions for the two utilities, with SCE's being much higher. This difference is even greater in the cool region, where the saturation in PG&E's service territory is around 7% and in SCE's service territory, it is roughly 39%.

Another significant difference is in housing type. In SCE's hot climate region, 76% of non-CARE/FERA households live in single family dwellings while only 65% of CARE/FERA do, a ratio of 1.2, while in PG&E's hot climate region, 84% of non-CARE/FERA customers live in single family dwelling while only 55% of CARE/FERA households do, a ratio of 1.5. This difference is likely due to the fact that SCE screened out all households that did not have at least 12 months' worth of usage data while PG&E did not.

In light of the relatively modest load reductions for CARE/FERA customers, it is not surprising to see that there were few instances where there was a difference in the percent of customers reporting being uncomfortable due to reducing air conditioning use between treatment and control customers. The only instance in which there was a statistically significant difference between control and treatment customers was for customers in the hot climate region on Rate 3. Both Rates 1 and 3 showed differences in the health index that were statistically different between customers on the TOU and OAT rates; meaning more treatment customers that require cooling for a disability and have air conditioning needed to seek medical attention because of the heat when compared to the control group.

Average monthly structural bill increases for CARE/FERA customers in the hot climate region ranged from $25 for Rate 1 to almost $32 for Rate 3. CARE/FERA customers were able to offset only a fraction of that increase through changes in behavior. Average bill increases were in the $20 range in the moderate climate region and a bit over $10 in the cool climate region. In spite of these significant bill increases compared to the OAT, the only case where there was a statistically significant increase in the economic index was in the hot climate region for Rate 3. There were no statistically significant increases in difficulty paying bills for CARE/FERA customers in any climate region on any rate. However, for every rate and climate region, significantly more CARE/FERA customers on TOU rates said their bills were higher than expected relative to those on the OAT.

As was true in PG&E's service territory, the percent of CARE/FERA customers that could not identify any hours that fall within the peak period was significantly higher than for non-CARE/FERA customers. In nearly every climate region for every rate, CARE/FERA customers had statistically significant lower satisfaction with their rate plan compared with those on the OAT but, again, the differences are not large. CARE/FERA customers on Rate 3 were less satisfied with SCE compared to the control group in the hot and moderate climate regions. Satisfaction with SCE was lower than control customer satisfaction for CARE/FERA customers on all three rates in the hot region.

Senior Households

Senior households in the hot climate region had average load reductions comparable to the general population on Rate 2. Load impacts for senior households who are and are not CARE/FERA customers were similar to load impacts for CARE/FERA and non-CARE/FERA households in the hot climate region overall. Given these small reductions in use, it is not surprising that there was no statistically significant difference in the health index percentage or in customers reporting being uncomfortable for TOU customers compared with OAT customers.

Senior households in the hot climate region had the largest average monthly bill increases compared to any other segment on Rate 2, with structural bill increases of nearly $38 per month. Only a small fraction of the structural bill increase was offset by changes in usage behavior for senior households in hot climate regions. Not surprisingly, senior households in the hot climate region said that their bills were higher than expected. As suggested in the discussion above for non-CARE/FERA customers, managing customer's expectations about bill volatility across seasons under TOU rates is an important lesson that can be taken into the design of ME&O materials for default pricing. Senior households on TOU rates were also less satisfied with their rate plan and with SCE than were senior households on the OAT.

Households with Incomes Below 100% of FPG

Households with incomes below 100% of FPG in the hot climate region on Rate 2 had peak period load reductions of around 3% and daily load reductions of 1.3%. These modest load reductions could be attributed, in part, to the fact that 34% of participants could not identify any peak period hours. In alignment with these modest changes in usage during the peak period, households did not experience a statistically significant increase in discomfort, nor did any households show a statistically different percentage of needing medical attention because it was too hot inside their home.

Households with incomes below 100% of FPG in the hot climate region experienced average monthly bill increase of roughly $27 for Rate 2. Surprisingly, these relatively large bill increases did not lead to statistically significant increases in the percent of customers reporting difficulty paying bills or in the economic index.

5.6.2 Key Findings

Key findings pertaining to load impacts from the SCE pilots include:

1. Customers can and will respond to TOU rates with peak periods that extend well into the evening hours – peak period load reductions averaged roughly 4% for Rates 1 and 2 and 3% for Rate 3.
2. For Rate 3, which has the same peak period on weekdays and weekends (although weekend peak period prices are less than weekday prices), peak period load reductions are similar on the two day types.
3. Statistically significant but small reductions in daily electricity use were found for all rates and climate regions except for Rate 1 in the hot climate region.
4. The pattern of load reductions across climate regions in both percentage and absolute terms was not consistent across rates and was quite different from the pattern seen in PG&E's service territory, which showed a significant decline in load reductions in both percentage and absolute terms moving from the hot to the cool climate regions. For SCE, peak period load reductions for customers on Rate 1 were largest in the moderate and cool regions and smallest in the hot region. For Rates 2 and 3, differences across climate regions were not always statistically significant.
5. There is no evidence that households who had previously purchased smart thermostats used these devices to materially change usage patterns in response to TOU rates. Plans for Nest to offer its "Time of Savings" support service next summer could change this outcome.
6. Unlike for PG&E's customers, where CARE/FERA customers had significantly lower peak period load reductions compared with non-CARE/FERA customers, the load impacts for CARE/FERA and non-CARE/FERA customers in SCE's service territory were often not statistically significantly different.
7. Senior households did not have any statistically significant reductions in either peak period or daily usage on Rates 1 and 3. For Rate 2, the load reductions were similar to those for the hot general population.
8. Households with incomes below 100% of FPG on Rate 2 in SCE's hot climate region had no statistically significant reduction in peak period or daily electricity use.

Key findings pertaining to bill impacts include:

1. Average monthly bills were higher under TOU rates than under the OAT for all customer segments and all climate regions – the average monthly bill increase ranged from a low of $5.05 for non-CARE/FERA customers in the cool climate region on Rate 3 to a high of $39.37 for senior households in the hot climate region on Rate 3.
2. These bill impacts represent the three summer months from July through September for Rates 1 and 2 and August and September for Rate 3 and, except for the enrollment bill credits, are most likely the worst that is expected to occur over the course of the pilot.
3. Average bill increases due to the change in the tariff are reduced modestly by changes in usage behavior but no segment is able to come close to offsetting the structural change by changing usage behavior.
4. Over the course of a year, many customers on SCE pilot rates would expect to see a very modest increase or decrease in bills on Rates 1 and 2 although even on these rates, more customers see annual bill increases larger than $3 per month than are in the neutral impact zone of ±3% and relatively few customers see bill reductions that exceed $3 per month – on Rate 3, between 60% and 90% of customers would see bill increases larger than $3 per month even on an annual basis.

Key findings from the survey research include the following:

1. **Hardship:** Rate 3 CARE/FERA customers in the hot region and Rate 2 customers between 100% and 200% of FPG had higher economic index scores when compared to their control groups. This increase in economic index scores is equivalent to a customer noting difficulty paying one additional bill over the summer, or using one additional non-income based method to pay their bills. About 10% more Rate 1 and Rate 3 CARE/FERA customers in the hot climate region sought medical attention due to excessive heat when compared to their control groups.[112]
2. **Satisfaction:** Across most groups, particularly CARE/FERA and low income customers, satisfaction with their rate and with SCE was lower for TOU customers when compared to control group customers. These differences are small and not necessarily meaningful. For example, non-CARE/FERA customers on Rate 1 gave an average rating of 6.0, while control group customers' average rating 6.2. This 0.2 decrease is statistically significant but is not necessarily meaningful.
3. **ME&O and understanding of rates:**
   - Though agreement ratings for "items were easy to understand" were high (generally between 7.3 to 8.2), customer's understanding of their rates indicate a disconnect between customer's rating of understandability and actual understanding (with 9% to 38% of customers unable to identify peak hours). The percent of customers who could not identify any peak period hours was much higher for CARE/FERA customers than for non-CARE/FERA customers.
   - When asked if customers agreed that peak and off peak times were easy to remember, Rate 3 customers provided lower agreement ratings than Rate 1 and 2 customers.
   - Customers on TOU rates were more likely to take time-specific actions than customers in the control condition. For example, while a similar proportion of customers from control and rate groups indicated they turned off their lights to conserve energy, a larger proportion of treatment customers indicated they shifted doing laundry, running the dishwasher, and increased their thermostat during peak hours. This trend suggests that while fewer rate customers understood the nuances of their rates, they did know and act on actions that helped them shift use. This trend is particularly striking for non-CARE/FERA customers in the hot region, but less prominent for CARE/FERA and less than 100% FPG customers in the hot region.

[112] These customers all had air conditioning and noted someone in their household had a disability that required them to keep their house cool.

6 SDG&E Evaluation

This report section summarizes the design and evaluation of the SDG&E pilot. It begins with a summary of the rate and other treatments that were tested in the pilot. This is followed by a brief overview of the pilot implementation process, which includes a discussion of enrollment rates and customer attrition. Section 6.3 presents the load impact estimates for each rate and complementary treatment and Section 6.4 summarizes the bill impacts. Section 6.5 presents the survey results, including key findings regarding hardship for selected customer segments. The final section contains a high level summary and synthesis of the survey and impact findings.

6.1 Pilot Treatments

SDG&E filed its TOU Pilot Plan advice letter on December 30, 2015.[113] In order to address some concerns raised by Energy Division and to clarify items contained in the initial plan, SDG&E filed a revised plan in an advice letter submitted on January 22, 2016[114]. SDG&E's pilot plan was approved with modifications on March 17, 2016.[115]

Emphasis on Evening Peak Periods

SDG&E tested two tariffs, with each having the same peak-period covering late afternoon and evening hours from 4 to 9 PM. Rate 1 is a three-period tariff and Rate 2 has two rate periods.

SDG&E's pilot primarily focused on recruiting customers onto one of two rate options, summarized in Table 6.1-1 and Figures 6.1-1 and 6.1-2. Rate 1 has three rate periods in all seasons and all days of the week. The peak period, from 4 to 9 PM, is constant across all days of the week and seasons. The timing and length of the off-peak and super-off-peak periods are also constant across seasons but differ on weekdays and weekends. The peak to super-off-peak price ratio (without the baseline credit) is roughly 1.9 to 1 in summer and a very modest 1.06 to 1 in spring and winter. The summer peak to off-peak price ratio is roughly 1.6 to 1.

Table 6.1-1: Summary of SDG&E's TOU Rates

Rate Description		Rate 1	Rate 2
Rate Periods	Summer	3	2
	Winter	3	2
Highest Price Differential (¢)	Summer	26.9	23.6
	Winter	2.2	1.5
Peak Period		4-9 PM	4-9 PM
Duration of Peak		5 Hours	5 Hours
Super Off-Peak?		Yes	No
Super On-Peak?		No	No

113 Advice Letter 2835-E.

114 Advice Letter 2835-E-A.

115 Adoption of residential time-of-use pricing pilots pursuant to Decision 15-07-001, Resolution E-4769 (Public Utilities Commission of The State of California March 17, 2016).

Figure 6.1-1: SDG&E Pilot Rate 1[116]

<table>
<tr><th>Tariff</th><th>Season</th><th>1:00</th><th>2:00</th><th>3:00</th><th>4:00</th><th>5:00</th><th>6:00</th><th>7:00</th><th>8:00</th><th>9:00</th><th>10:00</th><th>11:00</th><th>12:00</th><th>13:00</th><th>14:00</th><th>15:00</th><th>16:00</th><th>17:00</th><th>18:00</th><th>19:00</th><th>20:00</th><th>21:00</th><th>22:00</th><th>23:00</th><th>24:00</th></tr>
<tr><td rowspan="2">Weekday</td><td>Summer</td><td colspan="6">Super Off Peak (29.71¢)</td><td colspan="10">Off Peak (34.91¢)</td><td colspan="5">Peak (56.57¢)</td><td colspan="3">Off Peak (34.91¢)</td></tr>
<tr><td>Winter</td><td colspan="6">Super Off Peak (35.12¢)</td><td colspan="10">Off Peak (36.2¢)</td><td colspan="5">Peak (37.31¢)</td><td colspan="3">Off Peak (36.2¢)</td></tr>
<tr><td rowspan="2">Weekend</td><td>Summer</td><td colspan="14">Super Off Peak (29.71¢)</td><td colspan="2">Off Peak (34.91¢)</td><td colspan="5">Peak (56.57¢)</td><td colspan="3">Off Peak (34.91¢)</td></tr>
<tr><td>Winter</td><td colspan="14">Super Off Peak (35.12¢)</td><td colspan="2">Off Peak (36.2¢)</td><td colspan="5">Peak (37.31¢)</td><td colspan="3">Off Peak (36.2¢)</td></tr>
</table>

Figure 6.1-2: SDG&E Pilot Rate 2

<table>
<tr><th>Tariff</th><th>Season</th><th>1:00</th><th>2:00</th><th>3:00</th><th>4:00</th><th>5:00</th><th>6:00</th><th>7:00</th><th>8:00</th><th>9:00</th><th>10:00</th><th>11:00</th><th>12:00</th><th>13:00</th><th>14:00</th><th>15:00</th><th>16:00</th><th>17:00</th><th>18:00</th><th>19:00</th><th>20:00</th><th>21:00</th><th>22:00</th><th>23:00</th><th>24:00</th></tr>
<tr><td rowspan="2">Weekday</td><td>Summer</td><td colspan="16">Off Peak (32.94¢)</td><td colspan="5">Peak (56.57¢)</td><td colspan="3">Off Peak (32.94¢)</td></tr>
<tr><td>Winter</td><td colspan="16">Off Peak (35.77¢)</td><td colspan="5">Peak (37.31¢)</td><td colspan="3">Off Peak (35.77¢)</td></tr>
<tr><td rowspan="2">Weekend</td><td>Summer</td><td colspan="16">Off Peak (32.94¢)</td><td colspan="5">Peak (56.57¢)</td><td colspan="3">Off Peak (32.94¢)</td></tr>
<tr><td>Winter</td><td colspan="16">Off Peak (35.77¢)</td><td colspan="5">Peak (37.31¢)</td><td colspan="3">Off Peak (35.77¢)</td></tr>
</table>

The primary difference between SDG&E's Rate 2 and Rate 1 is that Rate 2 has only two rate periods whereas Rate 1 has three. Rate 2 has the same peak period, from 4 to 9 PM, as Rate 1 and the peak period prices are also the same as Rate 1. The peak period, and peak period prices, are the same all year. In summer, the peak-to-off-peak price ratio for Rate 2 is roughly 1.7 to 1.

Rates 1 and 2 have baseline credits to reflect the tiered structure of the standard rate. The credits for up to 130% of baseline are 20.32¢ and 18.64¢ for the summer and winter seasons respectively. This credit significantly reduces average prices, especially for lower usage customers. For reference, Table 6.1 2 shows the tiered rate that control customers were placed on.

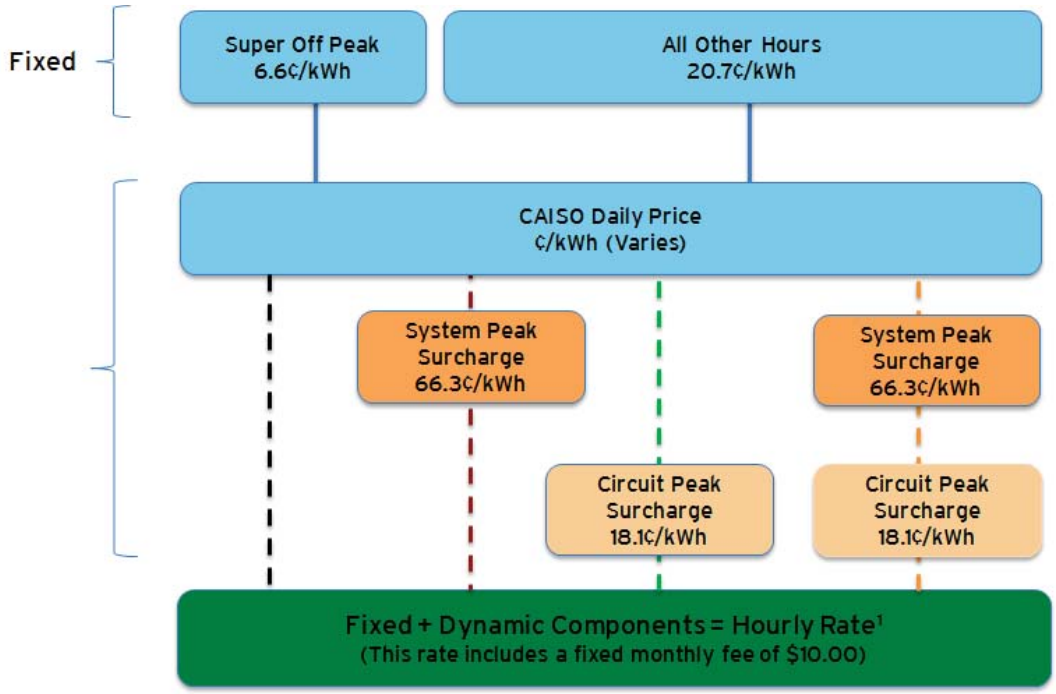
Table 6.1-2: 2016 Schedule DR & Schedule DR-LI Tariffs

Tier	Baseline	Summer		Winter	
		DR	DR-LI	DR	DR-LI
1	0-130%	19.13¢	18.34¢	17.55¢	16.76¢
2	> 130%	39.46¢	38.67¢	36.19¢	35.39¢

SDG&E's pilot plan also calls for testing a third dynamic hourly rate option that is much more complex than Rates 1 and 2. This rate is intended for customers who adopt innovative technology and have an understanding of their energy usage. Figure 6.1-3 shows the different components of the rate, which consist of a fixed monthly service fee, energy usage charges, hourly prices tied to the CAISO wholesale market, and two hourly adders, one tied to system peak and the other tied to local circuit peaks. These hourly adders are called day ahead. Credits can also be applied to encourage increased usage on surplus energy days. Given the complexity of this rate and the narrow, specialized population to which it is targeted, this rate should be thought of as more of a proof of concept than as a rate that would be applicable to a broad cross section of customers. Recruitment onto Rate 3 did not start until September. As such, load impacts for this rate are not included in this report.

[116] The prices shown in the figures are the filed prices. Prices are allowed to fluctuate as rate changes occur over time in the SDG&E's OAT.

Figure 6.1-3: SDG&E Rate 3



In addition to the above rate options, SDG&E's pilot is testing the impact of weekly usage alerts, known as Weekly Alert Emails (WAE), on demand response under TOU rates. The WAE used in summer 2016 provided weekly emails to participants that report the prior week's electricity usage by rate period. A new WAE was launched in mid-October. This version includes a bill-to date forecast, an updated usage chart displaying usage by peak period, and a doughnut chart illustrating the total amount of usage by peak period for the billing period. A random sample of 2,500 Rate 2 customers was chosen to receive the WAEs on a default basis. SDG&E had email addresses on just over 70% of this sample, so WAE's actually were delivered to roughly 1,775 customers out of the target group of 2,500.

A final test being done by SDG&E will assess the take rate for smart thermostats by customers who are already on a TOU rate. SDG&E offered two different rebates, $100, and $200, to both TOU treatment and control customers who purchase a smart thermostat. Marketing for this treatment began on October 1 and ran through the end of December.

6.2 Implementation Summary

The targeting and sampling plan for SDG&E's pilot differs from that of PG&E and SCE in that there is no oversampling of selected customer segments in the hot climate region for purposes of assessing hardship. SDG&E only has about 16,000 accounts in total in its hot climate region, which drops to less than 10,000 when all relevant exclusions are applied. The number of accounts that are senior households or CARE customers above and below 100% of FPG is much fewer. Therefore SDG&E attempted to recruit all remaining customers in their hot climate zone to enroll in its rate 2 to meet the 1,250 enrollment goal. Because of the small population in the "hot" climate zone, no specific targets were set for overall enrollment or for any subpopulations in SDG&E's hot climate zone; the target of 1,250 was a goal, but not a regulatory requirement.

Table 6.2-1 shows the targeted enrollment for SDG&E's pilot rates, including oversampling for usage alerts for Rate 2. An extra 2,500 participants were recruited for the usage alert treatment track and placed on Rate 2 in the moderate and cool climate zones. The target enrollment numbers for SDG&E's moderate and cool climate regions for CARE/FERA and non-CARE/FERA customers are larger than they were for PG&E and SCE because the power analysis done by Nexant for SDG&E showed that larger samples would be needed to obtain the same level of statistical confidence for load impact estimates.[117]

Table 6.2-1: Target Enrollment for SDG&E Pilots

Approved High Scenario All					
Climate Zone	Segment	Rate 1	Rate 2	Control	Total
Hot	Total	0	1250	0	1250
Moderate	non-care	938	1563	938	3439
	Care	938	1563	938	3439
	Total	1876	3126	1876	6878
Cool	non-care	938	1563	938	3439
	Care	938	1563	938	3439
	Total	1876	3126	1876	6878
All	Total	3752	7502	3752	15006

As did SCE and PG&E, SDG&E conducted a pretest to determine expected acceptance rates under different marketing materials, incentive levels, delivery channels and with and without bill protection. The test was conducted in March. Three marketing formats were tested; one with graphics (Letter 1), one with similar content but without graphics (Letter 2), and one without graphics but with a larger font size (Letter 3). Incentive levels of $200 and $300 were tested and the $200 incentive level was tested with and without bill protection. Based in part on the pretest and in part on conforming to what the other utilities were doing, SDG&E based it's recruitment on a $200 incentive with bill protection. SDG&E also concluded from the pretest that it would be cost effective to initially use email solicitation for customers for whom SDG&E had email addresses and to use direct mail as a follow up to those who did not open or click through the email solicitation.

Prior to pulling the recruitment sample for Pilot Rates 1 and 2, selected customers were screened out from participating in the pilot.[118] A detailed accounting of all exclusion criteria is contained in Section 4.1 of Appendix Volume 1. After applying the exclusions, the eligible population equaled roughly 820,000, or about 64% of SDG&E's 1.3 million residential customers.

[117] See power analysis memo in Appendix G of Appendix Volume 1. The request to approve the larger sample sizes was made in a letter from SDG&E to Energy Division dated April 1. This letter did not include a request for additional funding for the pilots. Permission was granted by the Commission in a letter from the Energy Division to SDG&E dated April 8, 2016.

[118] SDG&E did not initially screen out "vulnerable" customers (those requiring an in home visit prior to disconnection) from its first wave recruiting list. That screen was performed after the first wave went out. Vulnerable customers were excluded from the recruiting lists for the second wave.

6.2.1 Customer Recruitment

Recruitment for SDG&E's pilot began on April 19 with an email sent out to all those in the sample for whom SDG&E had email addresses. Customers who had not opened the email or clicked through to view the content were sent a second email solicitation on April 22 and those who did not open or click through the second email were sent a letter solicitation on May 3. The first tranche of customers for whom SDG&E did not have email addresses received a recruitment letter on April 20 and a second tranche of customers were sent a letter on April 25. These letters included a link to the online enrollment form as well as a business reply card. Follow up letters were sent to both groups on April 27.

The emails and letters prominently displayed the $200 incentive that participants could earn by being in the study. They also explained what is meant by TOU rates, without providing specific prices, summarized the requirements of the study, and provided instructions on how to participate and what would happen next if they were accepted into the pilot. The fact that bill protection makes this a no risk offer was also discussed.

Table 6.2-2 shows the number of customers that received solicitations, the number who accepted, and the acceptance rate for each target segment. The overall acceptance rate was 7%. The acceptance rate for CARE customers was twice the rate for non-CARE customers. Acceptance rates did not vary across the moderate and cool climate regions. The acceptance rate in the hot climate region, 9%, was actually higher than in the other two climate regions.

Table 6.2-2: SDG&E Offers and Acceptances by Partition and Strata

Category	Hot Climate Region	Moderate Climate Region		Cool Climate Region		Total
	General	CARE	Non-CARE	CARE	Non-CARE	
Offers	9,444	83,552	125,038	86,060	119,555	423,649
Acceptances	865	8,417	6,322	8,817	6,483	30,904
Acceptance Rate	9%	10%	5%	10%	5%	7%

The first WAEs were sent to customers who were recruited for that treatment on August 12. Due to system issues and rate changes, this was launched slightly later than originally planned. After assigning customers to the control group, alerts went to roughly 1,800 or 72% of the 2,500 randomly selected customers for whom SDG&E had email addresses that were obtained either through the normal course of business or through the enrollment survey. To date, usage alert opt out rates have been minimal (<10).

SDG&E's goal for Rate 3, which is called Whenergy HourX, is to enroll a minimum of 50 customers and a maximum of 200. Recruitment for Rate 3 officially began on September 2, with a targeted group of approximately 300 Sempra employees. These employees are a mix of EV owners as well as solar customers. On September 12, a recruitment email was sent to a randomly selected sample of 100 SDG&E customers. The sample of 100, non-employee, customers included those who have a smart thermostat installed, have previously participated in SDG&E energy efficiency programs, on a residential rate, and have a valid email address on file. A concurrent, non-related, effort around enabling technology was conducted by a third party and has contributed an additional number of HourX participants.

Overall, SDG&E reached out to 435 customers. To be eligible for HourX all customers must currently have AC with a smart thermostat installed on or before October 1, 2016. HourX includes pilot bill protection, three rebate offerings, as well as the $200 in bill credits for responding to a series of surveys as a participant in the pilot (Pay-to Play).[119] Due to the complexity of HourX, a dedicated phone line and dedicated email inbox have been set up for customer inquiries. Similar to Rates 1 and 2, HourX has a microsite and smart app feature that provide HourX specific information. It includes the day ahead forecasted pricing, and tips and tools to help save energy while on the dynamic rate.

As mentioned above, SDG&E also tested whether being on a TOU rate increases the acceptance rate for smart thermostats based on two different incentive levels. Two random samples were drawn from the Rate 1 and Rate 2 treatment groups and from the control group. Initial solicitations were sent on October 1 with follow up communications sent on December 1. If SDG&E had an email address, the solicitations were sent via email—if not, they were sent via direct mail. A total of 14,224 solicitations were sent out, split almost evenly between an offer for a $200 rebate and an offer for a $100 rebate. For the $200 rebate, 2.6% of customers submitted applications for the rebate and incentives were paid to 165 customers (almost 90% of those who applied). The majority of those declined did not qualify, and the second largest group was rejected due to duplication of enrollment. For the $100 incentive group, the application rate was 1.4%, roughly half that for the $200 incentive group, and incentives were paid to 82 customers after turning down those that don't qualify. The application rates for each rate group and for the control group were nearly identical. Put another way, customers on one of the TOU rates did not apply for a smart thermostat incentive at a higher rate than those who remained on the OAT. It should also be noted that the smart thermostat purchase rate nearly doubled when a $200 incentive was offered compared with a $100 incentive.

6.2.2 Rate Assignment and Enrollment

Not all customers who agreed to participate in the pilot were actually enrolled. Table 6.2-3 summarizes the reasons why roughly half of those who accepted the offer were not enrolled in the study.

One reason why some customers were not enrolled was because they became ineligible between when they were selected into the recruitment sample and when they accepted the offer, or between the time when they were assigned to a treatment condition and when enrollment was scheduled to occur. For example, a customer might have closed their account, become a net metered customer, or enrolled into the medical baseline program during this period, all of which would lead to being declared ineligible for the study after acceptance occurred.

As seen in Table 6.2-3, almost a thousand customers were deemed to be ineligible after accepting the recruitment offer but before being assigned to a treatment. This high number of households consisted of customers that had self-certified as seniors/disabled, thus requiring an in person visit prior to electricity being shut off. The intent was to screen these customers out prior to sending out recruitment letters, as PG&E and SCE did, thereby avoiding this exclusion post acceptance. However, during the recruitment process, SDG&E realized this screen had not been applied in the first recruiting wave, thus resulting in the high number of ineligibilities due to self-certification. Prior to sending the second wave of recruitment letters, SDG&E did screen for self-certified seniors/disabled.

[119] Note that SDG&E employees that go onto its Rate 3 (HourX) are not eligible for the $200 PTP incentive.

Table 6.2-3: Distribution of SDG&E Customers from Acceptance to Enrollment

Category	Hot Climate Zones, General	Moderate Climate Zones, CARE Customers	Moderate Climate Zones, Non-CARE Customers	Cool Climate Zones, CARE Customers	Cool Climate Zones, Non-CARE Customers	Total
Offers	9,444	83,552	125,038	86,060	119,555	423,649
Acceptances	865	8,418	6,323	8,817	6,483	30,906
Acceptance Rate	9%	10%	5%	10%	5%	7%
Ineligible Prior to Rate Assignment	35	426	68	394	55	978
Medical	30	392	35	369	27	853
NEM	0	2	5	1	5	13
Other	5	32	28	24	23	112
Opt-Out Prior to Rate Assignment	0	0	0	0	0	0
Number of customers whose acceptance cards were received after enrollment deadline	398	4,382	2,309	4,615	2,420	14,124
Customers Assigned to a Pilot Rate	432	3,610	3,946	3,808	4,008	15,804
Rate 1	0	977	1,064	1,029	1,084	4,154
Rate 2	432	1,659	1,817	1,750	1,843	7,501
Control	0	974	1,065	1,029	1,081	4,149
Target Enrollment	1,250	3,439	3,439	3,439	3,439	15,006
% of Target Achieved	35%	105%	115%	111%	117%	105%
Customers Transitioned to a Pilot Rate	423	3,470	3,856	3,680	3,911	15,340

By far the most significant reason why customers were not enrolled in the study was due to over recruitment. As seen in Table 6.2-3, SDG&E targeted to enroll roughly 15,000 customers but had almost 31,000 accept the offer. Due to the compressed recruitment schedule (SDG&E started recruiting customers later than PG&E and SCE), a large number of reply cards had not been received and processed prior to a determination to send a second tranche of recruitment letters. Given the impending launch date, once all target cells were exceeded, SDG&E chose a cutoff date after which all enrollees were declined. This cutoff was imposed in all treatment cells and climate regions.

Given the very small number of customers in SDG&E's hot climate region, SDG&E's original pilot plan was to accept all customers in the hot climate region, assign all to Rate 2, and then create a statistically matched control group from those who did not enroll for purposes of estimating load impacts. Reply cards for roughly half of the hot climate region customers were received and processed after the enrollment cut-off date, resulting in these customers being declined from participating in the study. After confirming that the pretreatment load shapes for both the accepted and declined groups were nearly identical, Nexant determined that this group could be used as a control for estimating load impacts. Customers who were declined participation in the study were sent a letter thanking them for their interest and directing them to SDG&E's website where they could learn more about TOU pricing plans that were available outside of the pilot. Unlike the control groups for the other rates, the control group in the hot region was not surveyed nor given an enrollment incentive since they were not officially enrolled in the pilot.

The roughly 15,800 customers who were accepted into SDG&E's rate pilot were notified and informed about their rate assignment through a multi-step process that resulted from several pricing changes for the pilot tariffs. Prior to the June 1 launch, SDG&E filed and received approval for its pilot tariffs. After further review and discussion with ORA and Energy Division, it was determined that SDG&E would make adjustments to its previously approved tariffs. The new pricing became effective June 23, 2016. At the same time, SDG&E was also implementing its next step in the tier collapse component of rate reform, moving from three tiers to two tiers. This created an additional pricing change beginning July 1, 2016.[120]

As a result of these price changes, customers were informed about their rate assignment and provided with detailed information through a three step process. Between May 16 and June 2, customers received a letter welcoming them to the study, indicating their treatment assignment (e.g., Rate 1, Rate 2, or control) and informing them of the timing associated with the peak rate period. The letters also indicated that more details would follow and reminded participants of some of the requirements and features of the study, including the incentive amount they would receive if they stayed in the pilot over the course of the study.

Welcome packages were originally planned to be sent out in mid-June but because of the multiple rate changes in June, they were put on hold and, instead, customers were sent another communication on July 5 indicating the prices being charged in each rate period. The letters indicated that welcome kits would be arriving soon. Welcome Kits were sent out starting on July 29 and most had been distributed by August 15. Spanish version Welcome Kits were sent on September 9.

[120] 1 SDG&E AL 2890-E-D; SDG&E AL 2861-E-A.

6.2.3 Customer Attrition

> **Opt-Out Rates Were Quite Low**
>
> Only about 1.6% of customers dropped off the pilot rates at SDG&E over the roughly six month period from enrollment in June through the end of December. Opt-out rates were slightly higher in the hot and moderate climate regions compared with the cool region. There was no significant difference in opt-out rates across the two tariffs.

Table 6.2-4 shows customer attrition from the SDG&E pilot between when customers were assigned to a rate and when the most recent data update was received by Nexant on December 31, 2016. Attrition over that period was the result of changes in eligibility, customers closing their account due to moving, and customers dropping out of the pilot. Attrition is divided into three periods: the time between rate assignment and when customers were notified of their rate assignment; the time between notification and being transferred onto the new rate according to each customer's next billing cycle; and the time between transfer onto the rate and December 31, 2016.

Over this period, 1,178 customers, or just under 7.5%, left the pilot due either to ineligibility or proactively dropped out. Of the 1,178, roughly 65% left because they moved location. Only 248 customers, or roughly 1.6% of the total enrolled population, proactively dropped out of the pilot over this period.

Table 6.2-4: Customer Attrition

Attrition Reason	Hot Climate Zones, General	Moderate Climate Zones, CARE Customers	Moderate Climate Zones, Non-CARE Customers	Cool Climate Zones, CARE Customers	Cool Climate Zones, Non-CARE Customers	Total
Customers assigned to rate treatment or control	432	3,610	3,946	3,808	4,008	15,804
Customers transitioned to pilot rate (or control customers)	423	3,470	3,856	3,680	3,911	15,340
Customers enrolled as of 12-31-2016	399	3,313	3,642	3,527	3,745	14,626
Ineligible Post-Rate Assignment	**7**	**26**	**71**	**13**	**50**	**167**
Ineligibles, Pre-Notification	0	7	12	0	15	34
Ineligibles, Pre-Rate Change	2	3	14	2	3	24
Ineligibles, Post-Rate Change	5	16	45	11	32	109
Moved Post-Rate assignment	**12**	**208**	**144**	**235**	**164**	**763**
Moves, Pre-Notification	7	91	53	87	68	306
Moves, Pre-Rate Change	0	26	2	29	1	58
Moves, Post-Rate Change	5	91	89	119	95	399
Opt-Out Post-Rate Assignment	**14**	**63**	**89**	**33**	**49**	**248**
Opt-Outs, Pre-Notification	0	11	6	8	9	34
Opt-Outs, Pre-Rate Change	0	0	2	0	0	2
Opt-Outs, Post-Rate Change	14	52	81	25	40	212
Total	33	297	304	281	263	1,178
Attrition rate	8%	8%	8%	7%	7%	7%

Figures 6.2-1 through 6.2-3 show the cumulative opt-out rates over time for each test cell and climate region. The cumulative number of opt-outs is similar in the hot and moderate climate regions, between 2.5% and 3.5%. The control group in the hot climate region is made up of customers who were turned away from the pilot, therefore they cannot opt out. The opt-out rate in the cool climate region is very low for all customer segments, only reaching about 1.5% by the end of 2016. In the moderate and cool climate regions, non-CARE/FERA customers had slightly higher opt-out rates than CARE/FERA customers. Opt-out rates appear to level off near the beginning of November, when customers were transitioned to the winter rate period.

Figure 6.2-1: SDG&E Opt Outs by Month – Hot Climate Region

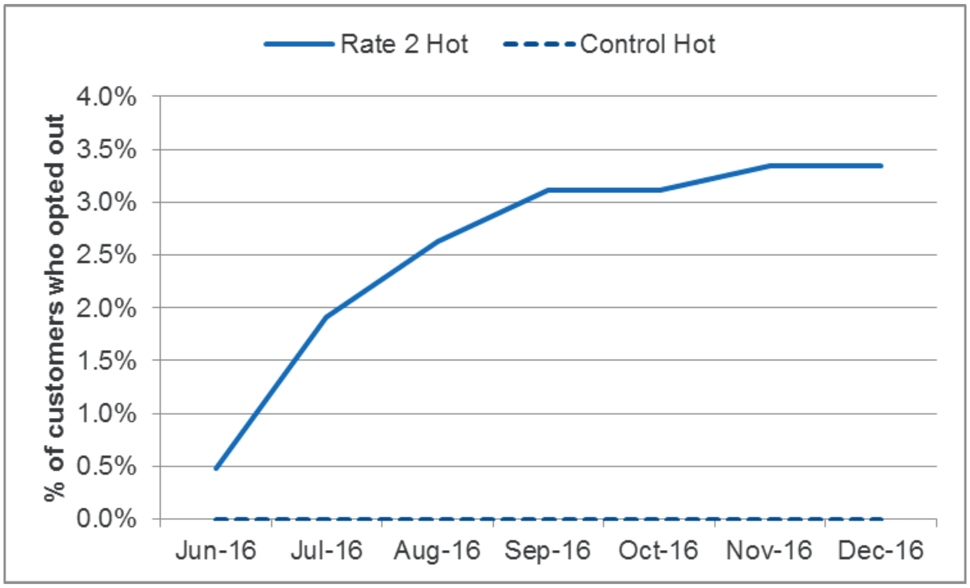


Figure 6.2-2: SDG&E Opt Outs by Month – Moderate Climate Region

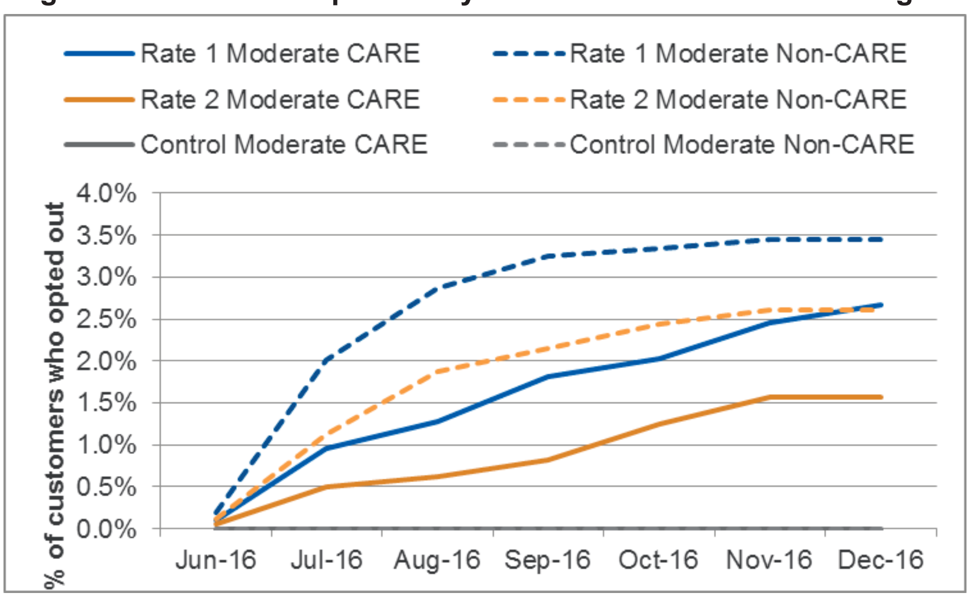
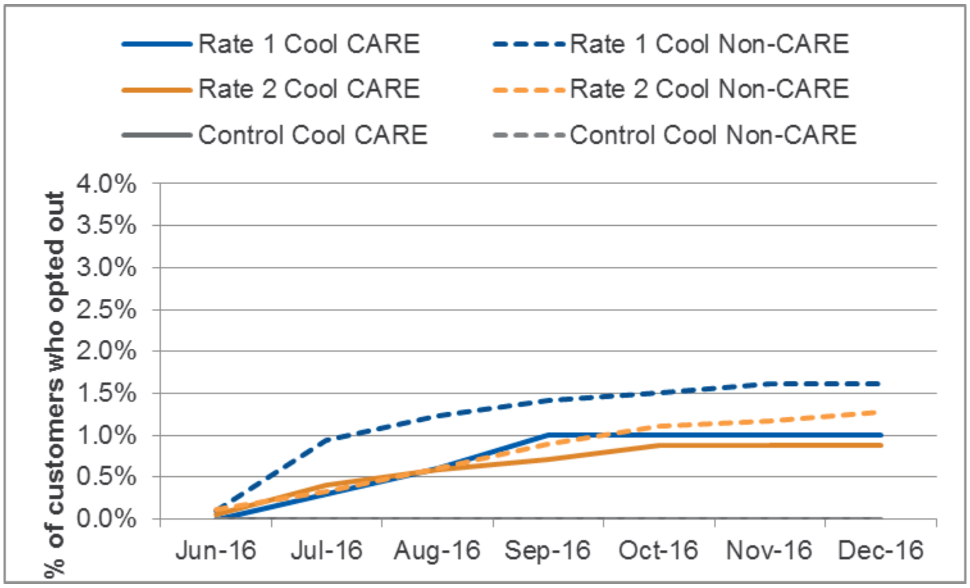


Figure 6.2-3: SDG&E Opt Outs by Month – Cool Climate Region



Figures 6.2-4 through 6.2-6 show the overall attrition rate over time for each climate region, customer segment, and TOU rate. Generally attrition rates are fairly steady in the time period between June 2016 and December 2016. Attrition rates are greatest among the control groups in the moderate and cool climate regions because account closure data is currently not complete for Rate 1 and Rate 2 customers. Among treated customers, those in the moderate and hot climate region have similar attrition rates. Attrition rates are lowest in the cool climate region.

Figure 6.2-4: SDG&E Attrition by Month – Hot Climate Region

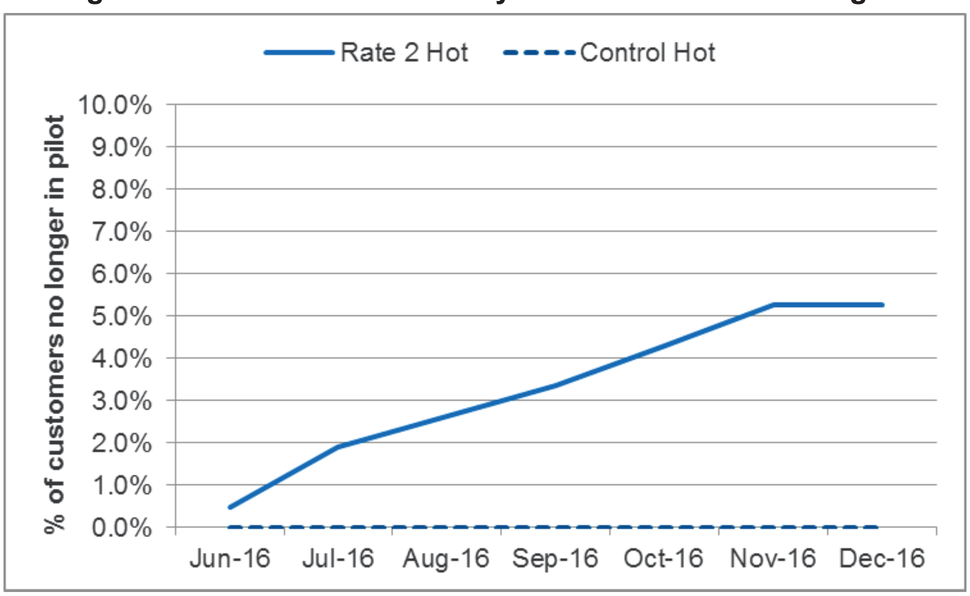


Figure 6.2-5: SDG&E Attrition by Month – Moderate Climate Region

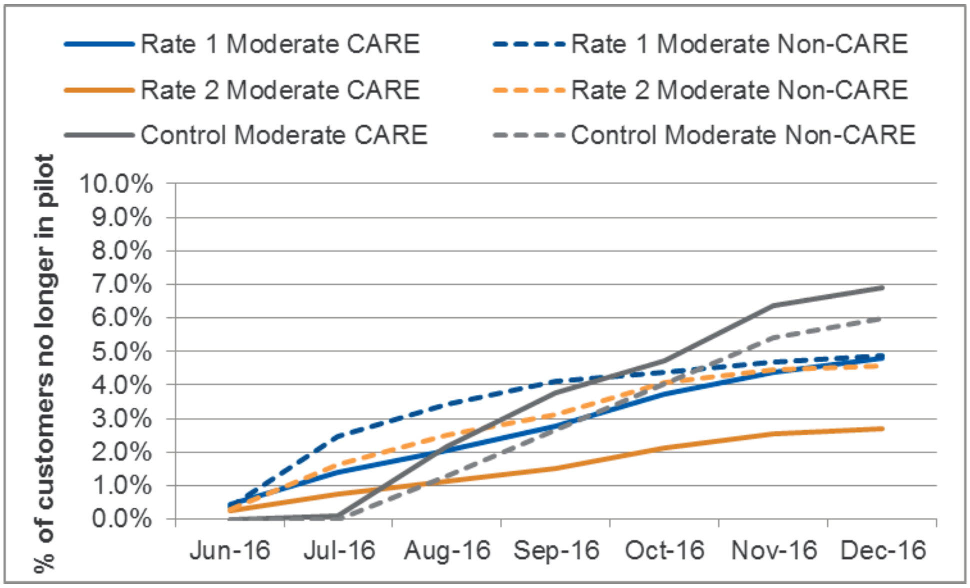
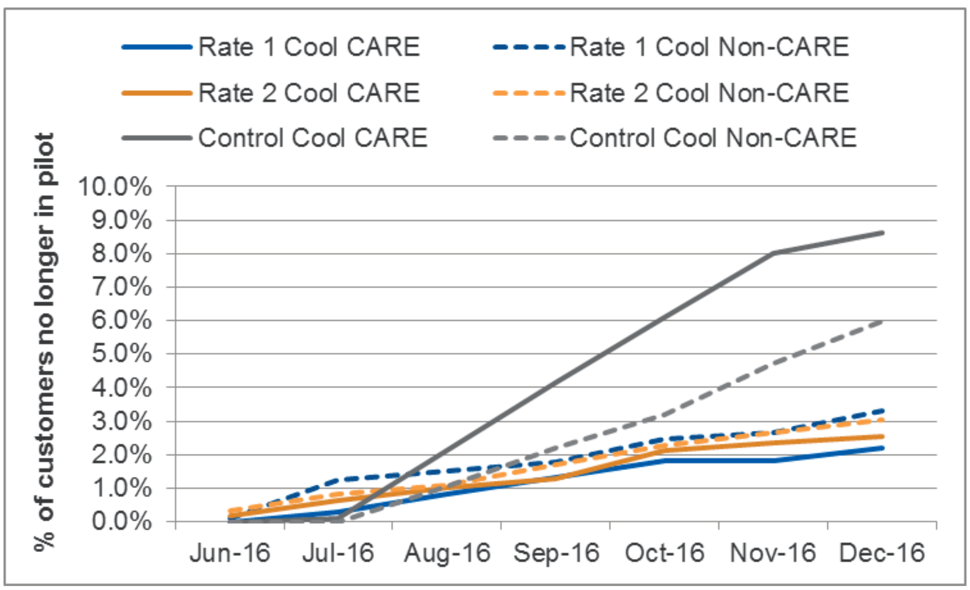


Figure 6.2-6: SDG&E Attrition by Month – Cool Climate Region



6.2.4 Pilot Outreach and Education

Whether in person, over the phone, via the microsite, smartphone app, email, or direct mail — messaging that clearly explains the pilot and its purpose, the specific pilot rates and possible behavior modifications that can ultimately lead to bill savings opportunities is critical to customer acceptance not only of the pilot, but of time-of-use in general. In addition to the notification and welcome kit information that was sent to pilot customers, SDG&E made plans to communicate with pilot customers every 6 to 8 weeks in what is called Whenergy Updates. These updates were sent via email, direct mail or both.

As smartphones are a key communication channel, SDG&E has implemented an option for pilot customers to subscribe to receive push notifications from their smartphone app to remind them of TOU period changes. In the August Whenegy Update, customers received a personalized PIN so they would receive notifications and information specific to their assigned pilot rate. In addition to these notifications, app users could also go to their MyAccount to review their energy usage and pay their bill online.

In order to tailor communications to pilot customers, SDG&E segmented customers into twelve (12) categories as shown below. Splitting customers between the high and low usage groups, SDG&E was able to create three communication segments—High Usage, Low Usage and Techie.

Segment	Summer	AC Prediction	Tech Prediction
1	Higher Use	AC	Higher Tech
2	Higher Use	AC	Low/Avg Tech
3	Higher Use	No AC	Higher Tech
4	Higher Use	No AC	Low/Avg Tech
5	Medium Use	AC	Higher Tech
6	Medium Use	AC	Low/Avg Tech
7	Medium Use	No AC	Higher Tech
8	Medium Use	No AC	Low/Avg Tech
9	Low Use	AC	Higher Tech
10	Low Use	AC	Low/Avg Tech
11	Low Use	No AC	Higher Tech
12	Low Use	No AC	Low/Avg Tech

6.2.5 Operational Challenges and Lessons Learned

SDG&E began enrolling pilot participants in June 2016. Since that time, SDG&E has gained important regarding key operational challenges that may arise when transitioning residential customers to TOU rates. This report section identifies some of the operational challenges that SDG&E experienced during the opt-In pilots and the lessons learned that can be applied to residential TOU transition efforts. SDG&E's challenges and learnings are grouped into three key themes:

- Customer Experience
- SDG&E Business Processes
- Rates and Products

Each of these themes is discussed in greater detail below with examples that provide situations, behaviors, outcomes, and applicability to residential TOU transition efforts.

Customer Experience

Below is a brief summary of key customer experience challenges and their corresponding lessons learned:

- **Challenge:** Manually managing customer exceptions consumed project time and resources, while not providing the best possible customer experience
  - **Lesson Learned:** Pre-identifying any exceptions and developing standardized work plans will allow SDG&E to minimize the impact of exceptions during default enrollment
- **Challenge:** Resource constraints necessitated involving third parties to help implement the rollout, increasing risk of customer confusion
  - **Lesson Learned:** To enroll customers on a much larger scale, additional resources will be required to complete the tasks in-house, or closely manage any third parties
- **Challenge:** Delays in creating, designing, and producing educational materials led to customer confusion
  - **Lesson Learned:** Ensure that all educational content is widely available through many channels and allow greater time for the conceptualization of new education and outreach materials.

These challenges and lessons learned are explained in greater detail below.

The majority of customers participating in SDG&E's TOU Opt-In Pilots had a positive customer experience and several shared positive feedback directly with SDG&E. However, SDG&E did experience some difficulty anticipating and managing customer exceptions throughout the TOU Opt-In Pilots, and certain exception management and systems challenges impacted a small percentage of customers.

As noted above, exception management challenges included issues with alerts, notifications, and customer tracking. SDG&E learned that it will be impossible to individually manage and resolve exceptions for a large scale transition. As a result, SDG&E will be dedicating time and resources to pre-identify these exceptions (and any others that may occur) to develop standardized processes to prevent or mitigate customer impact. Additionally, SDG&E faced some exceptions as a result of gaps in operational readiness. Certain customers incorrectly triggered credit strategies as a result of current credit processes. While these issues did not have a large impact on overall customer satisfaction, they did require a large amount of manual time and resource dedication to resolve. Many of these issues required custom solutions, which took unexpected time and effort from the team.

Risks to the consistency of SDG&E customer experience were introduced by internal bandwidth constraints. Due to existing workloads of internal resources, third parties were required to help implement the rollout, introducing risks to the pilot customer experience (which SDG&E effectively managed with close scrutiny). While this third party use was effective, there are other instances where a third party's involvement may confuse customers, especially if there is any discrepancy in messaging or branding. SDG&E will need to ramp up a third party for customer messaging and branding in future TOU transition efforts.

Another challenge to the customer experience occurred with the creation and rollout of the customer Welcome Kit. Due to issues with suppliers, Welcome Kits were delayed for the first wave of Opt-In Pilot customers. This caused some confusion as customers were looking for educational materials on their new rate, and some customers called the contact center requesting introductory information. SDG&E learned that it is important to have a mitigation plan to handle any potential communication delays, including having back-up education content that is easily accessible. This lesson can be carried forward for residential TOU transition planning.

SDG&E Business Processes

Below is a brief summary of key business process challenges and their corresponding lessons learned:

- **Challenge:** Unanticipated manual processing and billing strained project resources and timelines
  - **Lesson Learned:** Invest more time and resources in implementing new systems, testing current systems, and designing processes to reduce manual effort
- **Challenge:** More detail was needed for process design than SDG&E initially anticipated
  - **Lesson Learned:** A workflow management system would allow for greater automation and introduce fewer opportunities for error through the transition's lifecycle

These challenges and lessons learned are explained in greater detail below:

During the opt-In pilots, SDG&E learned the importance of minimizing the manual time and attention required per customer. For future programs, SDG&E is planning to dedicate more time for project design, more thoroughly test systems, and improve current billing processes and procedures.

With any project, managing time and quality is always a challenge. The compressed timeline to implement the opt-in pilot led to a shortage of time for planning, project design, and customer recruitment. Having a longer project lead time would allow for improved business processes that produce greater accuracy, improved customer clarity, and an overall improvement in customer experience. Investing more time and resources in planning would improve efficiency later in the project, alleviating resourcing pressure and mitigating the risk of missing deadlines. The ability to use that time to conduct more frequent knowledge sharing sessions among cross-functional teams would help ensure that all departments fully understood and are synchronized with the pilot's goals, objectives, and schedule. These are lessons that SDG&E is already taking into account for residential TOU transition planning.

Due to timing constraints, a workflow management system (WMS) to manage the customer journey could not be fully implemented. While SDG&E's processes worked well, a dedicated WMS would have provided an operational benefit throughout the entire pilot lifecycle. With respect to recruitment and enrollment, a WMS system would allow for hardcopy scanning into an electronic database to supplement online customer enrollment. Without a scanning feature, paper customer applications had to be manually entered, which was a time-consuming process. SDG&E continued to receive new Opt-In Pilot applications past the deadline for enrollment. These applications also had to be manually handled, and the functionality of a WMS would allow for greater accuracy and efficiency. By incorporating the time needed to implement a WMS into the planning phases of future programs, SDG&E will have flexibility to augment business processes with a workflow management system.

SDG&E underestimated the scope and magnitude of this pilot and was not able to perform full end-to-end testing of existing systems or establish and test new processes for exceptions. Due to system limitations at the onset of the pilot, various manual processes (or semi-manual processes) had to be developed to support billing functions such as rate changes, calculation and application of bill protection, bill messaging and application of policy adjustments and bill credits (i.e., from survey participation), and identification and resolution of system issues that could cause delayed bills. For the pilot, SDG&E was able to monitor the known issues and deploy semi-standardized work-arounds, but this is not sustainable for the scale of residential TOU transition. Knowing these issues ahead of time will allow for appropriate planning, resourcing, and mitigation efforts.

Rates and Products

The points below are key rate and product challenges and their corresponding lessons learned:

- **Challenge:** Some customers did not immediately understand how to manage their energy in response to the TOU concept
    - **Lesson Learned:** Some customers will require additional educational and personalized attention along with simple energy saving tips

These challenges and lessons learned are explained in greater detail below.

While many customers were interested in the Opt-In Pilot and expressed a desire to be in a pilot group, some customers had difficulty understanding the TOU concept and time periods. SDG&E did have customers call into the contact center to ask about the on-peak and off-peak time periods, as well as the best ways to conserve energy. This feedback indicated a lack of clarity around TOU rates, so SDG&E identified a need for additional education and personalized solutions during the upcoming residential TOU transition. By increasing the availability of relevant educational information on digital and self-service platforms, customers can gain answers and information without overloading the contact center. During residential TOU transition planning, this enhancement will be critical due to the high volume of impacted customers and the limited contact center resources.

SDG&E has also benefited from the opportunity to collaborate with SCE and PG&E. SDG&E has found it beneficial to regularly meet with SCE and PG&E to raise issues and collaborate on solutions to common problems given the parallel schedule and nature of the IOUs’ pilot projects. This opportunity to work jointly would be valuable for similar projects in the future.

6.3 Load Impacts

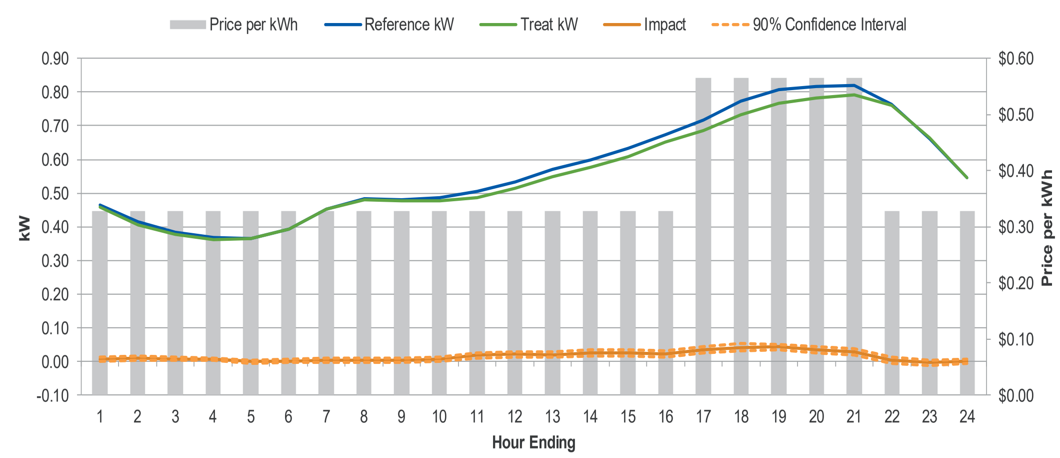
This section summarizes the load impact estimates for the two rate treatments tested by SDG&E. Load impacts are reported for each rate period for the average weekday, average weekend, and for the average monthly peak day for the summer months of July, August, September, and October for CARE/FERA and non-CARE/FERA customers in SDG&E’s moderate and cool climate regions. As discussed previously, SDG&E's hot climate region is quite small and the sample of customers recruited into the pilot is not large enough to support estimation of load impacts separately for CARE/FERA and non-CARE/FERA customers nor to support segmentation of the sample into seniors or various income groups as was done in the hot regions for PG&E and SCE. All customers in the hot region were placed on Rate 2 or were in the control group.

As with PG&E and SCE, electronic tables that contain estimates for each hour of the day for each day type and climate zone and for each month separately are also available upon request through the CPUC. Figure 6.3-1 shows an example of the content of these tables for SDG&E Rate 2 for all eligible customers in the service territory. Pull down menus in the upper left hand corner allow users to select different climate regions, day types (e.g., weekdays, weekends, monthly peak day) and time period (individual months or the average of July through October).

Figure 6.3-1: Example of Content of Electronic Tables Underlying Load Impacts Summarized in this Report (SDG&E Rate 2, Average Summer Weekday, All Customers)

Segment	All
Rate	Rate 2
Month	Summer 2016
Day Type	Average Weekday
Treated Customers	7,206

Period	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval	
Peak	0.79	0.75	0.036	4.6%	0.03	0.04
Partial Peak	N/A	N/A	N/A	N/A	N/A	N/A
Off-Peak	0.51	0.51	0.01	1.8%	0.01	0.01
Super Off-Peak	N/A	N/A	N/A	N/A	N/A	N/A
Daily kWh	13.71	13.36	0.35	2.6%	0.32	0.39



Hour Ending	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval		Price	Period
1	0.47	0.46	0.01	1.4%	0.00	0.01	$0.33	Off-Peak
2	0.41	0.41	0.01	2.2%	0.00	0.01	$0.33	Off-Peak
3	0.38	0.38	0.01	1.7%	0.00	0.01	$0.33	Off-Peak
4	0.37	0.36	0.01	1.7%	0.00	0.01	$0.33	Off-Peak
5	0.36	0.37	0.00	-0.1%	0.00	0.00	$0.33	Off-Peak
6	0.39	0.39	0.00	0.1%	0.00	0.01	$0.33	Off-Peak
7	0.45	0.45	0.00	0.6%	0.00	0.01	$0.33	Off-Peak
8	0.48	0.48	0.00	0.5%	0.00	0.01	$0.33	Off-Peak
9	0.48	0.48	0.00	0.7%	0.00	0.01	$0.33	Off-Peak
10	0.49	0.48	0.01	1.4%	0.00	0.01	$0.33	Off-Peak
11	0.50	0.49	0.02	3.5%	0.01	0.02	$0.33	Off-Peak
12	0.53	0.51	0.02	3.8%	0.01	0.03	$0.33	Off-Peak
13	0.57	0.55	0.02	3.5%	0.01	0.03	$0.33	Off-Peak
14	0.60	0.58	0.02	4.0%	0.02	0.03	$0.33	Off-Peak
15	0.63	0.61	0.02	3.9%	0.02	0.03	$0.33	Off-Peak
16	0.67	0.65	0.02	3.2%	0.01	0.03	$0.33	Off-Peak
17	0.72	0.68	0.03	4.7%	0.02	0.04	$0.56	Peak
18	0.77	0.73	0.04	5.4%	0.03	0.05	$0.56	Peak
19	0.81	0.77	0.04	5.2%	0.03	0.05	$0.56	Peak
20	0.82	0.78	0.03	4.3%	0.03	0.04	$0.56	Peak
21	0.82	0.79	0.03	3.5%	0.02	0.04	$0.56	Peak
22	0.76	0.76	0.00	0.3%	-0.01	0.01	$0.33	Off-Peak
23	0.66	0.66	0.00	-0.5%	-0.01	0.00	$0.33	Off-Peak
24	0.55	0.55	0.00	0.1%	-0.01	0.01	$0.33	Off-Peak
Daily kWh	**13.71**	**13.36**	**0.35**	**2.6%**	**0.32**	**0.39**	**N/A**	**N/A**

As was true for PG&E and SCE, when aggregating across CARE/FERA and non-CARE/FERA customers within a climate region to produce regional values, or when aggregating across climate regions to produce service territory level estimates, weights representing the share of each segment or region among pilot eligible customers were constructed. Table 6.3-1 shows the weights population counts and weights that were used for aggregating across segments and climate regions.

Table 6.3-1: Weights Used for Aggregating up to Climate Region and Service Territory

Segment		Eligible for Pilot Participation	Population Weight	Climate Region Weight
Hot		9,141	1%	100%
Moderate	CARE	75,910	9%	24%
	Non-CARE	243,241	30%	76%
Cool	CARE	78,756	10%	17%
	Non-CARE	398,139	49%	83%
Total		805,187	100%	n/a

The remainder of this section is organized by rate treatment—that is, load impacts are presented for each relevant climate region and each customer segment for each of the two rates. Following the summary for each rate, load impacts are compared across rates.

As discussed at the outset of Section 6, in addition to the two rate treatments, SDG&E tested the incremental impact of Weekly Alert Emails (WAEs) sent to customers on a default basis. Results of this analysis are presented in Section 6.7.3.

6.3.1 Rate 1

SDG&E's Rate 1 is a three-period rate with a peak period from 4 to 9 PM on weekdays and weekends. On weekdays, the off-peak (or shoulder) period runs from 6 AM to 4 PM and 9 PM to midnight. On weekends, this period is much shorter, running from 2 to 4 PM and 9 PM to midnight. In summer, for electricity usage above 130% of the baseline quantity, prices equal roughly 56.6 ¢/kWh in the peak period, 34.9 ¢/kWh in the off-peak (or shoulder) period and 29.7 ¢/kWh in the super off-peak period. For usage below 130% the baseline quantity, a credit of 20.3 ¢/kWh is applied.

Key Findings for SDG&E Rate 1

On average, SDG&E customers on Rate 1 reduced peak period usage by 5.4% in the moderate/cool climate regions combined. The absolute load reduction was nearly twice as large in the moderate region compared with the cool region. The average reduction in daily electricity use equaled more than 2%. Both percentage and absolute load reductions were smaller for CARE/FERA customers than for non-CARE/FERA customers for the cool and moderate climate regions combined.

Figure 6.3-2 below shows the average peak-period load reduction in percentage terms for Rate 1 for customers in the moderate and cool climate regions, separately and combined. Figure 6.3-3 shows the absolute load impacts for each region. As with the other IOUs, the lines bisecting the top of each bar in the figures show the 90% confidence band for each estimate.

Figure 6.3-2: Average Percent Load Impacts for Peak Period for SDG&E Rate 1[121] (Positive values represent load reductions)

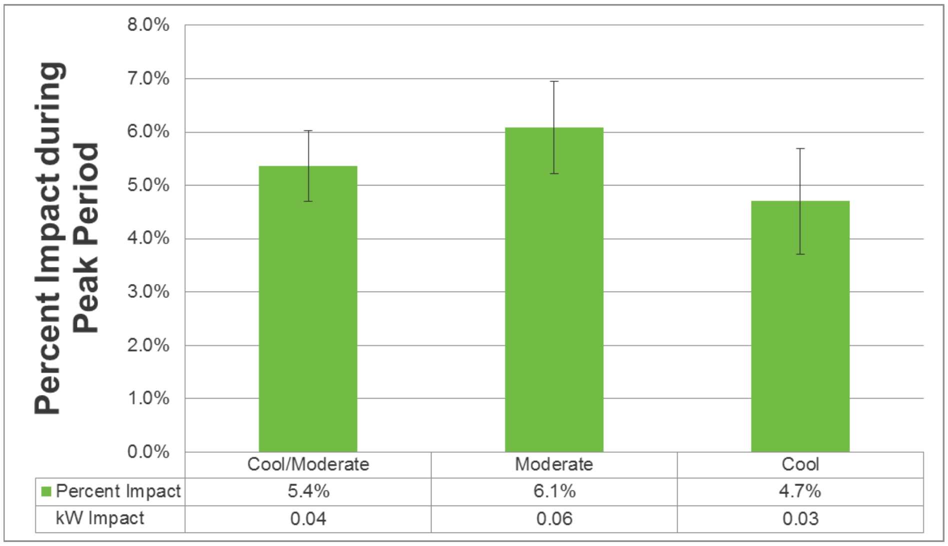
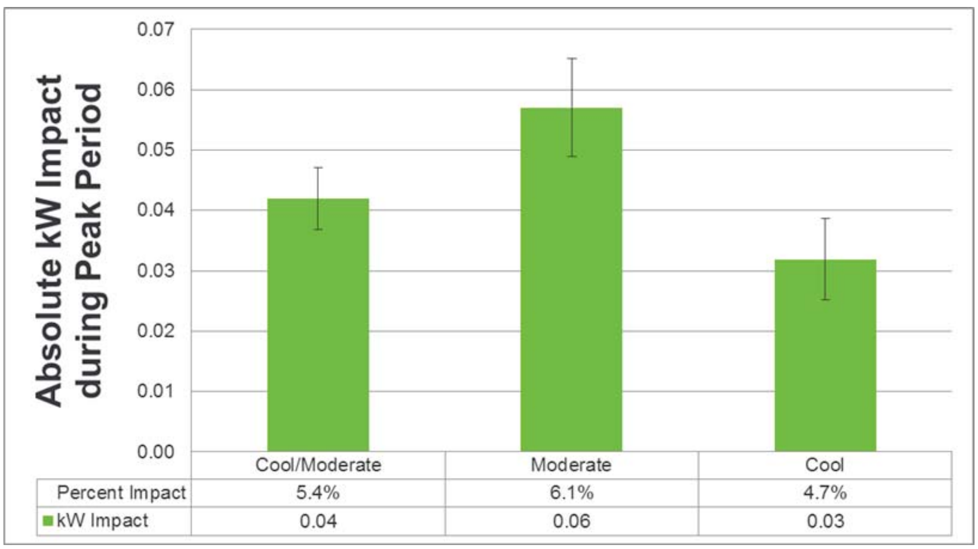


Figure 6.3-3: Average Absolute Load Impacts for Peak Period for SDG&E Rate 1 (Positive values represent load reductions)



As seen in the figures, the average peak load impacts for the cool and moderate climate regions, separately and combined, are statistically significant at the 90% level of confidence in both percentage and absolute terms. On average, pilot participants in both climate regions combined reduced electricity use by 5.4% or 0.04 kW across the five hour peak period from 4 to 9 PM. Customers in the moderate climate region reduced their usage by 6.1% or 0.06 kW, which is an absolute impact twice as large as the cool climate region. This difference is statistically significant at the 90% confidence level in absolute terms although not in percentage terms. The difference in percentage impacts across the moderate and cool climate regions is also statistically significant.

[121] SDG&E Rate 1 summer impacts represent July through October 2016

Table 6.3-1 shows the average percent and absolute load impacts for Rate 1 for each rate period for weekdays and weekends and for the average monthly system peak day for the cool and moderate climate regions. The percent reduction equals the load impact in absolute terms (kW) divided by the reference load. Shaded cells in the table contain load impact estimates that are not statistically significant at the 90% confidence level. The percentage and absolute values in the first row of Table 6.3-1, which represent the load impacts in the peak period on the average weekday, equal the values shown in Figures 6.3-2 and 6.3-3, discussed above.

The reference loads shown in Table 6.3-1 represent estimates of what customers on the TOU rate would have used if they had not responded to the price signals contained in the TOU tariff. As seen in the table, average hourly usage during the peak period is roughly 0.78 kW for the moderate and cool climate regions combined and around 0.57 kW for the 24 hour average weekday. In the moderate climate region, average usage in the peak period is larger at 0.94 kW than in the cool climate region (0.68 kW).

As seen in Table 6.3-1, on the average weekday, there were statistically significant reductions in usage during the peak and off-peak periods and for the day for both climate regions, and statistically significant increases in usage in the super-off-peak period from midnight to 6 AM on weekdays and the monthly system peak day. On weekends, there was decrease in super off-peak usage in the moderate climate region and an increase in usage in the cool region. For the two regions combined, the change in usage in the super off-peak period was not statistically significant, as highlighted in gray. Load impacts were greatest for customers in the moderate climate region during the peak period on monthly system peak days, at 6.5% or 0.09 kW.

For the moderate and cool climate regions combined, there was a 2.4% reduction in daily electricity use on the average weekday. In the moderate climate region it is 3.3% and in the cool climate region it is 1.6%. While the daily reduction in energy use for Rate 1 is small in percentage and absolute terms, this average is spread over 24 hours each day, so the average reduction in electricity use on weekdays equals roughly 0.24 kWh. Over four months, this adds up to about 19 kWh per customer.

Table 6.3-1: Rate 1 Load Impacts by Rate Period and Day Type (Positive values represent load reductions, negative values represent load increases)

Rate 1											
Day Type	Period	Hours	Cool/Moderate			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.78	0.04	5.4%	0.94	0.06	6.1%	0.68	0.03	4.7%
	Off-Peak	6 AM to 4 PM, 9 PM to 12 AM	0.56	0.01	2.1%	0.65	0.02	3.4%	0.51	0.01	1.0%
	Super Off-Peak	12 AM to 6 AM	0.40	-0.01	-1.6%	0.44	-0.01	-1.8%	0.37	0.00	-1.4%
	Day	**All Hours**	0.57	0.01	2.4%	0.66	0.02	3.3%	0.51	0.01	1.6%
Average Weekend	Peak	4 PM to 9 PM	0.78	0.04	5.6%	0.93	0.05	5.9%	0.68	0.04	5.4%
	Off-Peak	2 PM to 4 PM, 9 PM to 12 AM	0.67	0.01	1.6%	0.79	0.01	1.9%	0.60	0.01	1.3%
	Super Off-Peak	12 AM to 2 PM	0.48	0.00	0.4%	0.54	0.01	1.8%	0.44	0.00	-0.8%
	Day	**All Hours**	0.58	0.01	2.1%	0.67	0.02	3.0%	0.52	0.01	1.4%
Monthly System Peak Day	Peak	4 PM to 9 PM	1.12	0.05	4.2%	1.40	0.09	6.5%	0.92	0.02	1.8%
	Off-Peak	6 AM to 4 PM, 9 PM to 12 AM	0.72	0.02	2.7%	0.87	0.03	3.8%	0.63	0.01	1.6%
	Super Off-Peak	12 AM to 6 AM	0.44	-0.01	-1.7%	0.49	-0.01	-2.0%	0.40	-0.01	-1.4%
	Day	**All Hours**	0.73	0.02	2.5%	0.88	0.03	3.9%	0.63	0.01	1.2%

* Gray shaded cells are not statistically significant

Figures 6.3-4 and 6.3-5, respectively, show the percentage and absolute peak period load impacts for Rate 1 for CARE/FERA and non-CARE/FERA customers for the moderate and cool climate regions combined and separately. In the combined region, both the percent and absolute load impacts were greater for non-CARE/FERA customers than for CARE/FERA customers and the differences are statistically significant. The difference between the two segments is statistically significant in absolute terms in both climate regions but the difference in percentage terms is not statistically significant in the moderate region. The largest load reduction came from non-CARE/FERA customers in the moderate climate region, with impacts of 6.3% or 0.06 kW, while the impact for CARE/FERA customers in the same region was equal to 5.2% or 0.04 kW.

Figure 6.3-4: Average Percent Load Impacts for Peak Period for SDG&E Rate 1 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)

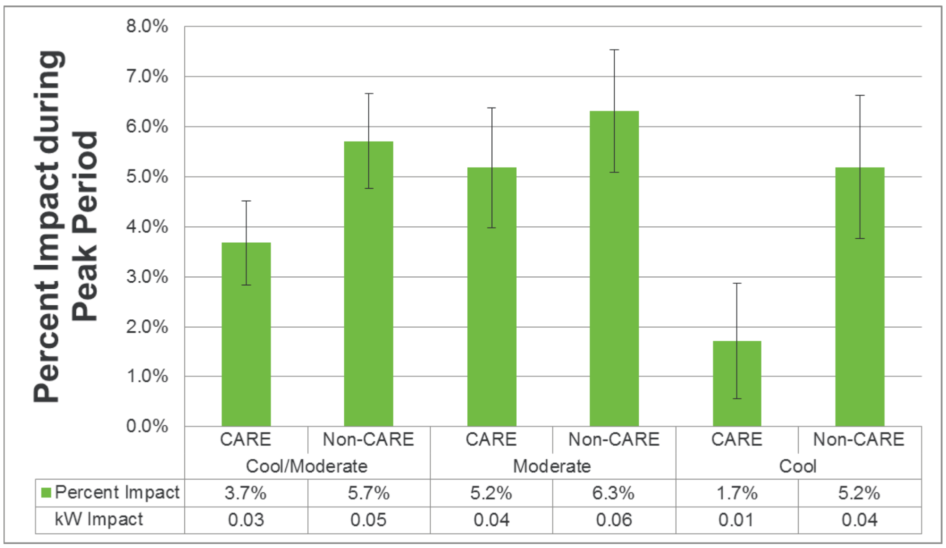


Figure 6.3-5: Average Absolute Load Impacts for Peak Period for SDG&E Rate 1 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)

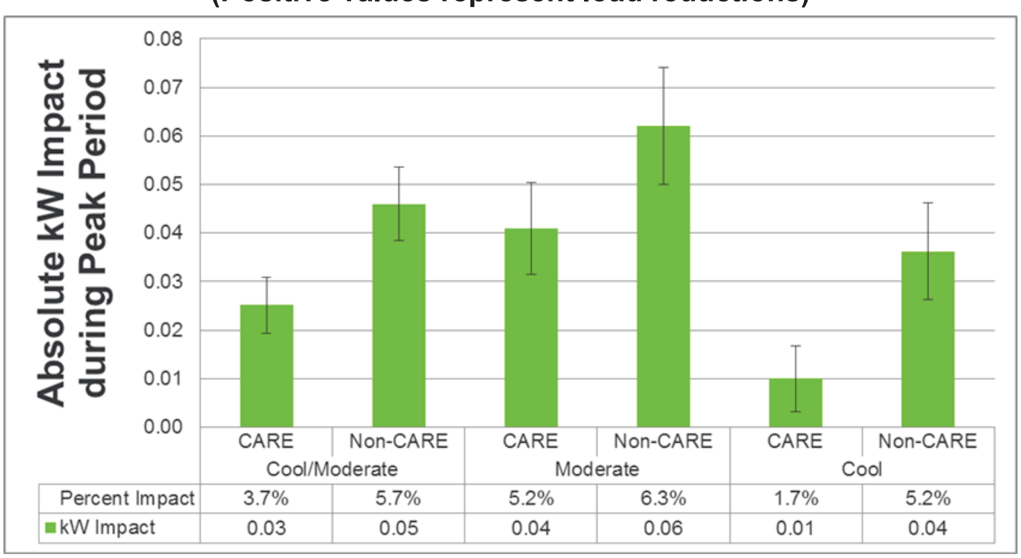


Table 6.3-2 shows the estimated load impacts for each rate period and day type for the moderate and cool climate zones separately and combined for non-CARE/FERA customers. Table 6.3-3 shows the same but for CARE/FERA customers. For both climate regions, non-CARE/FERA customers have greater peak period demand than CARE/FERA customers. For example, on the average weekday in the two climate zones combined, peak period demand is equal to 0.81 kW for non-CARE/FERA customers and 0.68 kW for CARE/FERA customers. Average overall weekday consumption is similar between the two groups, 0.58 kW and 0.52 kW for non-CARE/FERA and CARE/FERA customers, respectively. This indicates that non-CARE/FERA customers have a higher concentration of electricity use in the peak period, which may have made it easier to reduce their consumption during that time.

Customers in the CARE/FERA and non-CARE/FERA segments had load impacts of 2.1% during the off-peak period on average weekdays, and 1.9% and 1.5% (respectively) on the average weekend. Both non-CARE/FERA and CARE/FERA customers were able to reduce their overall daily consumption on all three day types by about 2% or more. In the moderate climate region, CARE/FERA and non-CARE/FERA customers reduced their average weekend electricity consumption by 3% (about 0.02 kW).

Table 6.3-2: Rate 1 Load Impacts by Rate Period and Day Type – Non-CARE/FERA (Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 1								
			Cool/Moderate, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.81	0.05	5.7%	0.98	0.06	6.3%	0.70	0.04	5.2%
	Off-Peak	6 AM to 4 PM, 9 PM to 12 AM	0.58	0.01	2.1%	0.67	0.02	3.7%	0.52	0.00	0.9%
	Super Off-Peak	12 AM to 6 AM	0.40	-0.01	-1.7%	0.45	-0.01	-2.4%	0.37	0.00	-1.3%
	Day	**All Hours**	0.58	0.01	2.5%	0.68	0.02	3.5%	0.52	0.01	1.7%
Average Weekend	Peak	4 PM to 9 PM	0.80	0.05	6.1%	0.98	0.06	6.2%	0.70	0.04	6.0%
	Off-Peak	2 PM to 4 PM, 9 PM to 12 AM	0.69	0.01	1.5%	0.82	0.01	1.6%	0.61	0.01	1.5%
	Super Off-Peak	12 AM to 2 PM	0.49	0.00	0.3%	0.56	0.01	1.7%	0.45	0.00	-0.8%
	Day	**All Hours**	0.60	0.01	2.2%	0.70	0.02	3.0%	0.54	0.01	1.6%
Monthly System Peak Day	Peak	4 PM to 9 PM	1.16	0.05	4.0%	1.49	0.10	6.5%	0.96	0.02	1.7%
	Off-Peak	6 AM to 4 PM, 9 PM to 12 AM	0.74	0.02	2.9%	0.90	0.04	4.4%	0.64	0.01	1.6%
	Super Off-Peak	12 AM to 6 AM	0.44	-0.01	-1.5%	0.50	-0.01	-1.7%	0.41	-0.01	-1.3%
	Day	**All Hours**	0.75	0.02	2.6%	0.92	0.04	4.2%	0.65	0.01	1.2%

* Gray shaded cells are not statistically significant

Table 6.3-3: Rate 1 Load Impacts by Rate Period and Day Type –CARE/FERA (Positive values represent load reductions, negative values represent load increases)

Rate 1											
Day Type	Period	Hours	Cool/Moderate, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.68	0.03	3.7%	0.79	0.04	5.2%	0.58	0.01	1.7%
	Off-Peak	6 AM to 4 PM, 9 PM to 12 AM	0.52	0.01	2.1%	0.58	0.01	2.6%	0.45	0.01	1.6%
	Super Off-Peak	12 AM to 6 AM	0.37	0.00	-0.8%	0.41	0.00	0.0%	0.34	-0.01	-1.8%
	Day	**All Hours**	0.52	0.01	2.0%	0.58	0.02	2.9%	0.45	0.00	1.0%
Average Weekend	Peak	4 PM to 9 PM	0.67	0.02	3.4%	0.78	0.04	4.7%	0.57	0.01	1.7%
	Off-Peak	2 PM to 4 PM, 9 PM to 12 AM	0.60	0.01	1.9%	0.70	0.02	3.0%	0.52	0.00	0.4%
	Super Off-Peak	12 AM to 2 PM	0.44	0.00	0.9%	0.49	0.01	2.1%	0.39	0.00	-0.4%
	Day	**All Hours**	0.52	0.01	1.8%	0.59	0.02	3.0%	0.46	0.00	0.3%
Monthly System Peak Day	Peak	4 PM to 9 PM	0.93	0.05	5.2%	1.11	0.08	7.0%	0.74	0.02	2.6%
	Off-Peak	6 AM to 4 PM, 9 PM to 12 AM	0.64	0.01	1.9%	0.75	0.01	1.9%	0.53	0.01	1.9%
	Super Off-Peak	12 AM to 6 AM	0.41	-0.01	-2.4%	0.46	-0.01	-2.9%	0.36	-0.01	-1.9%
	Day	**All Hours**	0.64	0.01	2.2%	0.76	0.02	2.7%	0.54	0.01	1.4%

* Gray shaded cells are not statistically significant

6.3.2 Rate 2

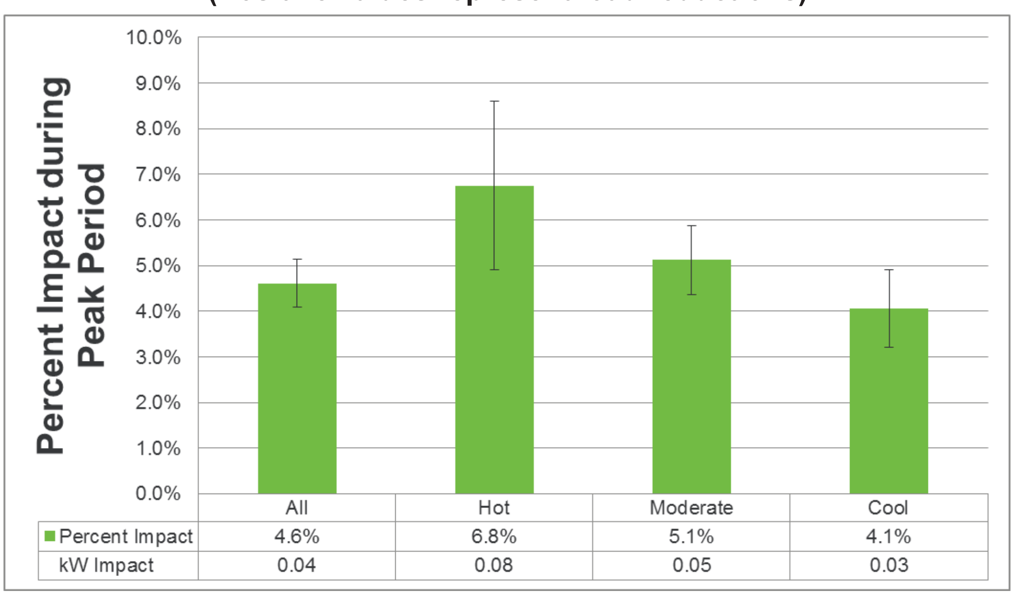
Key Findings for SDG&E Rate 2

On average, SDG&E customers on Rate 2 reduced peak period usage by 4.6%. In the hot climate region, the average reduction was almost 7%. Absolute load reductions were largest in the hot climate region, second largest in the moderate region and smallest in the cool region. CARE/FERA customers had lower absolute load impacts than non-CARE/FERA customers in the two climate regions combined, but in percentage terms, there was no statistically significant difference between the two segments in the combined climate regions.

SDG&E's Rate 2 differs from Rate 1 in that it is a two-period rate, rather than a three-period rate. Like Rate 1, the peak period is from 4 to 9 PM on weekdays and weekends. In summer, for electricity usage above 130% of the baseline quantity, prices equal roughly 56.6 ¢/kWh in the peak period and 32.9 ¢/kWh in the off-peak period. Like Rate 1, a credit of 20.3 ¢/kWh is applied to usage below 130% the baseline quantity.

Figures 6.3-6 and 6.3-7 show the percent and absolute load impacts for the weekday peak period for Rate 2 for SDG&E's service territory as a whole and for each climate region. For the service territory as a whole, load impacts were equal to 4.6% or 0.04 kW. Like Rate 1, customers in the moderate climate region had greater peak-period load reductions, at 5.1% or 0.05 kW, than customers in the cool climate region (4.1% and 0.03 kW). The differences in impacts between climate regions were statistically significant in absolute terms but not in percentage terms. Customers in the hot climate region had the greatest load impacts, 6.8%, or 0.08 kW. Although the confidence bands in the hot region are significantly larger than in the moderate or cool regions, the absolute impacts in the hot region were still statistically significantly larger than in the moderate or cool regions.

Figure 6.3-6: Average Percent Load Impacts for Peak Period for SDG&E Rate 2[122]
(Positive values represent load reductions)



[122] SDG&E Rate 2 summer impacts represent July through October 2016

Figure 6.3-7: Average Percent Load Impacts for Peak Period for SDG&E Rate 2 (Positive values represent load reductions)

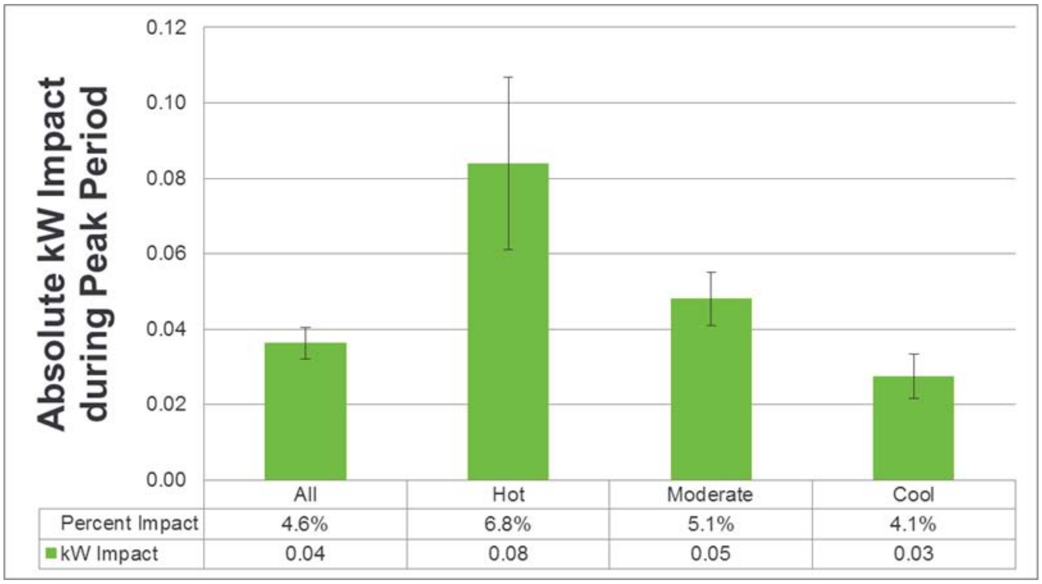


Table 6.3-4 contains estimates of load impacts for all relevant rate periods and day types. Reference loads and load impacts in each rate period and over the course of the day were similar between weekends and weekdays for the service territory as a whole and also for each climate region. The overall conservation effect (e.g., the reduction in daily usage) was between 2.5% and 3.0% in nearly all regions. This conservation affect applied in the off-peak period in all regions. In the hot climate region, customers did not reduce their weekend off-peak electricity consumption by a significant amount.

Table 6.3-4: Rate 2 Load Impacts by Rate Period and Day Type (Positive values represent load reductions, negative values represent load increases)

Rate 2														
Day Type	Period	Hours	All			Hot			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.79	0.04	4.6%	1.24	0.08	6.8%	0.94	0.05	5.1%	0.68	0.03	4.1%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.51	0.01	1.8%	0.78	0.02	2.0%	0.58	0.01	1.5%	0.47	0.01	1.9%
	Day	**All Hours**	0.57	0.01	2.6%	0.87	0.03	3.4%	0.66	0.02	2.6%	0.51	0.01	2.5%
Average Weekend	Peak	4 PM to 9 PM	0.79	0.04	5.1%	1.29	0.10	7.5%	0.93	0.05	5.3%	0.68	0.03	4.8%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.53	0.01	2.2%	0.81	0.01	1.0%	0.60	0.01	2.0%	0.48	0.01	2.5%
	Day	**All Hours**	0.59	0.02	3.0%	0.91	0.03	3.0%	0.67	0.02	3.0%	0.52	0.02	3.1%
Monthly System Peak Day	Peak	4 PM to 9 PM	1.12	0.04	3.6%	1.49	0.13	8.4%	1.40	0.06	4.6%	0.92	0.02	2.5%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.63	0.01	1.6%	0.89	0.03	3.0%	0.75	0.01	1.4%	0.55	0.01	1.6%
	Day	**All Hours**	0.74	0.02	2.2%	1.02	0.05	4.7%	0.88	0.02	2.5%	0.63	0.01	1.9%

* Gray shaded cells are not statistically significant

Figures 6.3-8 and 6.3-9 show the peak period load reductions on weekdays for non-CARE/FERA and CARE/FERA customers and Tables 6.3-5 and 6.3-6 show the load impacts for each rate period and day type for the two segments. There are not enough customers in the hot climate region to segment between CARE/FERA and non-CARE/FERA, so these tables only include customers in the moderate and cool climate regions, separately and combined.

Like Rate 1, non-CARE/FERA customers in the cool climate region had greater impacts (4.3% and 0.03 kW) than their CARE/FERA counterparts (2.6% and 0.02 kW) and these differences are statistically significant in both absolute and percentage terms. This is not the case in the moderate climate region, where load impacts for CARE/FERA and non-CARE/FERA customers were very similar. The difference in load impacts for the cool/moderate climate region combined is statistically significant in absolute terms but not in percentage terms. Percentage impacts reflect the share or proportion of total load that customers are shifting or reducing. In this case, the proportion of load being shifted or reduced was similar between CARE/FERA and non-CARE/FERA customers in the combined cool/moderate climate region. However, non-CARE/FERA customers generally used more energy than CARE/FERA customers. Load impacts of a similar percentage or proportion, but from a higher level of load, will produce larger load impacts in absolute (kW) terms. As an example, consider two houses—one uses twice as much energy as the other. Each house has air conditioning that is 25% of the total household energy demand. The large house has an average demand of 4 kW, and an air conditioning load of 1 kW (25%); the small house has an average demand of 2 kW, and an air conditioning load of 0.5 kW (also 25%). If both houses were to respond to TOU peak period prices solely by adjusting their air conditioning use, the large house would have a load impact of 1 kW and the small house would have an impact of 0.5 kW. However, both of those impacts are 25% of the total household energy demand. While the kW impact from the larger house is twice the size of the impact from the smaller house, both impacts are identical in percentage terms, or in the proportion of household load that was reduced.

As seen in Table 6.3-5 and 6.3.2-6, non-CARE/FERA customers had greater on-peak and average weekday demand than CARE/FERA customers. Both groups reduced their overall consumption as well as their off-peak demand. For example, non-CARE/FERA customers in the moderate and cool climate regions combined reduced their average weekday electricity demand by 2.4% or 0.01 kW. CARE/FERA customers reduced their average weekday electricity demand by 3.1% or 0.02 kW. Reductions in daily electricity use were similar on weekends. CARE/FERA and non-CARE/FERA segments were not available in the hot climate region due to the small population of customers, resulting in insufficient sample size to allow for segmentation.

Figure 6.3-8: Average Percent Load Impacts for SDG&E Rate 2 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)

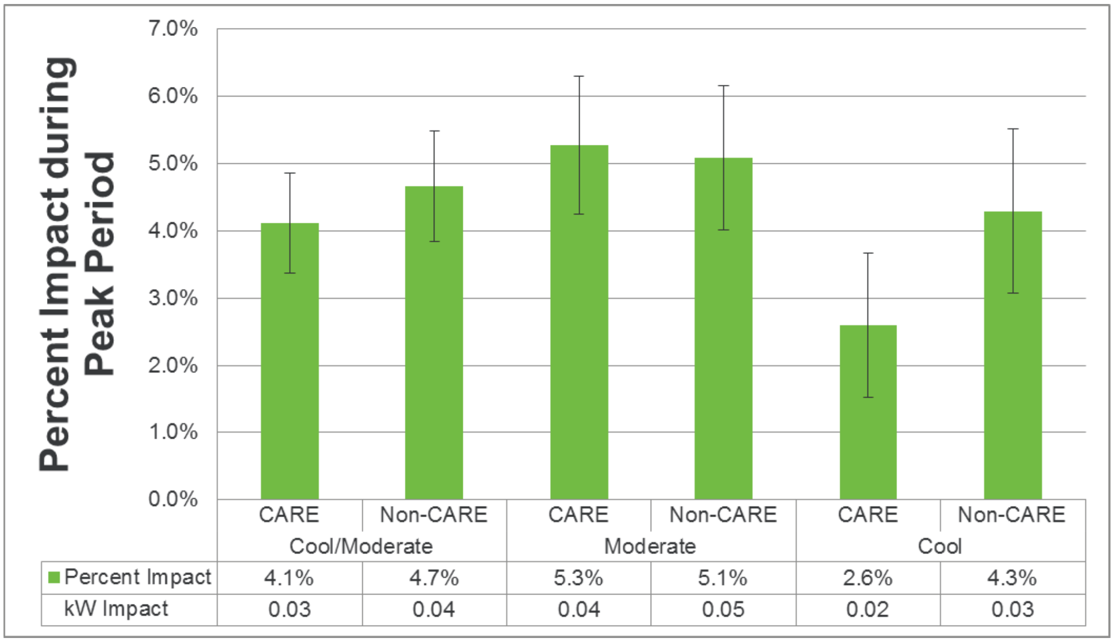


Figure 6.3-9: Average Absolute Load Impacts for SDG&E Rate 2 for CARE/FERA and non-CARE/FERA Customers (Positive values represent load reductions)

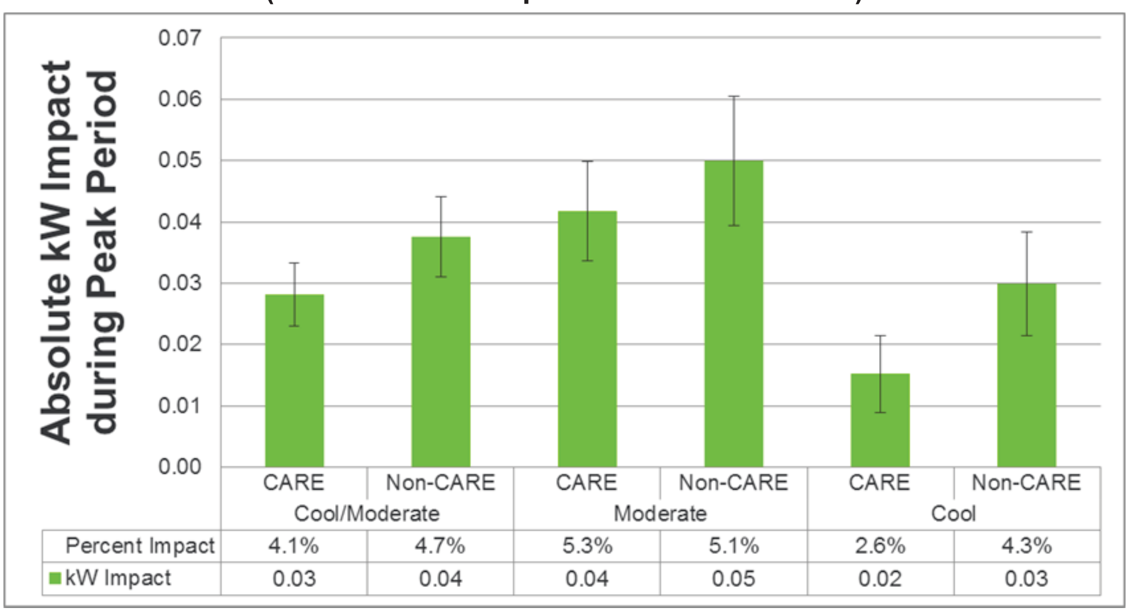


Table 6.3-5: Rate 2 Load Impacts by Rate Period and Day Type – Non-CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

Rate 2											
Day Type	Period	Hours	Cool/Moderate, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.81	0.04	4.7%	0.98	0.05	5.1%	0.70	0.03	4.3%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.52	0.01	1.5%	0.60	0.01	1.1%	0.47	0.01	1.9%
	Day	**All Hours**	0.58	0.01	2.4%	0.68	0.02	2.3%	0.52	0.01	2.5%
Average Weekend	Peak	4 PM to 9 PM	0.80	0.04	5.2%	0.98	0.05	5.2%	0.70	0.04	5.2%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.54	0.01	2.1%	0.62	0.01	1.5%	0.49	0.01	2.5%
	Day	**All Hours**	0.60	0.02	3.0%	0.70	0.02	2.6%	0.54	0.02	3.2%
Monthly System Peak Day	Peak	4 PM to 9 PM	1.16	0.04	3.5%	1.49	0.07	4.4%	0.96	0.03	2.6%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.65	0.01	1.5%	0.78	0.01	1.3%	0.57	0.01	1.6%
	Day	**All Hours**	0.75	0.02	2.1%	0.92	0.02	2.3%	0.65	0.01	1.9%

* Gray shaded cells are not statistically significant

Table 6.3-6: Rate 2 Load Impacts by Rate Period and Day Type –CARE/FERA Customers (Positive values represent load reductions, negative values represent load increases)

Rate 2											
Day Type	Period	Hours	Cool/Moderate, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.68	0.03	4.1%	0.79	0.04	5.3%	0.58	0.02	2.6%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.47	0.01	2.8%	0.53	0.02	3.0%	0.42	0.01	2.4%
	Day	**All Hours**	0.52	0.02	3.1%	0.58	0.02	3.7%	0.45	0.01	2.4%
Average Weekend	Peak	4 PM to 9 PM	0.67	0.03	4.3%	0.78	0.05	5.9%	0.57	0.01	2.3%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.48	0.02	3.2%	0.54	0.02	4.0%	0.43	0.01	2.1%
	Day	**All Hours**	0.52	0.02	3.5%	0.59	0.03	4.5%	0.46	0.01	2.2%
Monthly System Peak Day	Peak	4 PM to 9 PM	0.93	0.04	3.9%	1.11	0.06	5.3%	0.74	0.01	1.8%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.57	0.01	1.9%	0.66	0.01	1.9%	0.48	0.01	1.9%
	Day	**All Hours**	0.64	0.02	2.5%	0.76	0.02	2.9%	0.54	0.01	1.9%

* Gray shaded cells are not statistically significant

6.3.3 Weekly Alert Emails

As mentioned earlier in this section, SDG&E's pilot tested whether offering Weekly Alert Emails increased load reductions for customers on TOU rates. These emails were offered on a default basis to the roughly 70% of customers for whom SDG&E had email addresses. Although customers could opt-out from receiving the alerts, almost no one did. The incremental impact was estimated by using the subset of customers on the TOU rates for whom SDG&E had email addresses but who did not receive the WAE's as the control group for those who do. Table 6.3-7 shows peak period impacts for customers who are not receiving alerts ("controls") and those who are ("recipients") and Table 6.3-8 contains estimated impacts for all rate periods and day types. As seen, the incremental impacts during the peak period were very small and, as shown by the fact that the 90% confidence interval includes 0, none of the incremental impacts were statistically significant. It is worth noting that the incremental impact for the combined cool/moderate climate region is very close to being statistically significant at the 90% confidence level and certainly would be significant based on an 90% confidence level. It should also be noted that, although the % increase in the impact is large in percentage terms, this is a bit misleading since the estimated values are based on a very small impact to begin with. That is, the denominator in the calculation is quite small so that even very small incremental effects represent a reasonably large percent of the impact.

As seen in Table 6.3-7, there are small but statistically significant increases in electricity use during the off-peak period in the cool/moderate regions combined on both weekdays and weekends and also in the cool region. In the moderate region, there is a slight decrease in usage in the off-peak period on weekdays and small decrease in the same period on weekends.

In October, SDG&E modified the WAE content and formatting. This new format may be more effective in impacting customer behavior.

Table 6.3-7: Incremental Impacts of SDG&E Weekly Alert Emails

Climate Zone	Number of Customers		kW Impact during Peak Period					% Increase in Impact
	Controls	Recipients	Controls	Recipients	Incremental	90% Confidence Interval		
Cool	1,784	953	0.023	0.028	0.005	-0.004	0.013	21%
Moderate	1,647	864	0.051	0.057	0.007	-0.004	0.017	13%
Cool/Moderate	3,431	1,816	0.034	0.040	0.006	-0.001	0.012	16%

Table 6.3-8: Incremental Impacts of SDG&E Weekly Alert Emails by Rate Period and Day Type

Rate 2											
Day Type	Period	Hours	WAE - Cool/Moderate			WAE - Moderate			WAE - Cool		
			Non-WAE Impact	Inc. Impact	% Inc. Impact	Non-WAE Impact	Inc. Impact	% Inc. Impact	Non-WAE Impact	Inc. Impact	% Inc. Impact
Average Weekday	Peak	4 PM to 9 PM	0.034	0.006	16.0%	0.051	0.007	12.9%	0.023	0.005	20.6%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.011	-0.004	-32.4%	0.008	0.004	55.8%	0.014	-0.009	-65.0%
	Day	**All Hours**	0.016	-0.002	-10.7%	0.017	0.005	28.3%	0.016	-0.006	-38.4%
Average Weekend	Peak	4 PM to 9 PM	0.039	-0.003	-6.5%	0.052	0.002	3.6%	0.029	-0.005	-18.7%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.015	-0.008	-54.5%	0.014	-0.005	-36.8%	0.015	-0.010	-65.2%
	Day	**All Hours**	0.020	-0.007	-35.0%	0.022	-0.004	-16.7%	0.018	-0.009	-49.6%
Monthly System Peak Day	Peak	4 PM to 9 PM	0.041	-0.005	-13.2%	0.075	-0.022	-28.5%	0.019	0.005	28.2%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.013	-0.004	-34.8%	0.013	-0.003	-21.8%	0.013	-0.006	-44.0%
	Day	**All Hours**	0.019	-0.005	-24.9%	0.026	-0.007	-25.8%	0.014	-0.003	-23.7%

* Gray shaded cells are not statistically significant

6.3.4 Comparison Across Rates

Comparison Across Rates

Both SDG&E tariffs have the same peak period, from 4 to 9 PM. There are no statistically significant differences in the average peak period or daily load reductions between Rates 1 and 2.

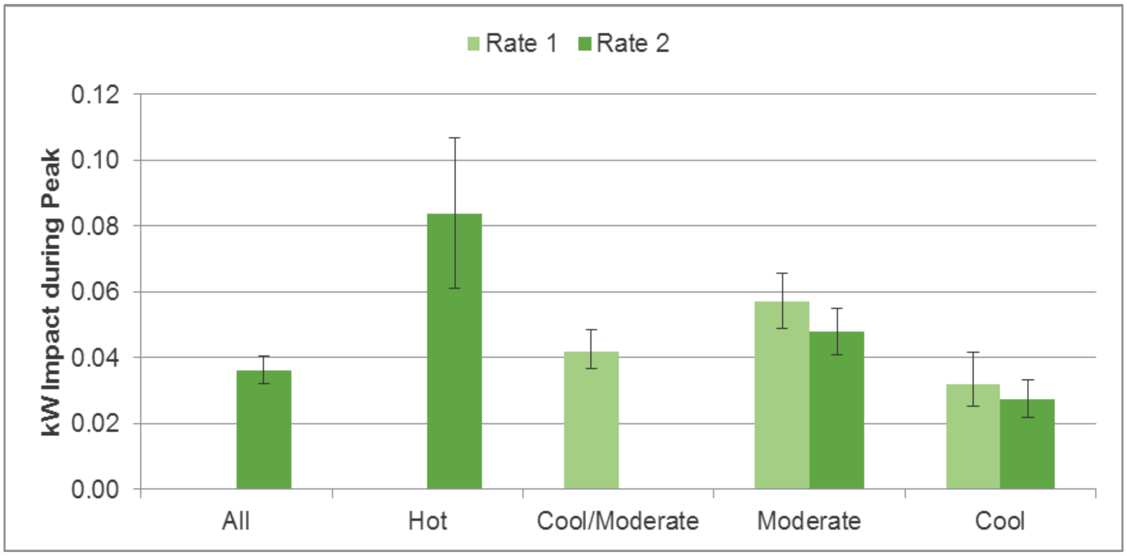
SDG&E's two pilot rates have the same peak period, from 4 to 9 PM, and the same peak-period prices. The primary difference between the two rates is that Rate 1 is a three period rate, with a shoulder period from 6 Am to 4 PM and 9 PM to midnight while Rate 2 is a two-period rate. Prices in the shoulder period for Rate 2 are 2 ¢/kWh higher than the off-peak price for Rate 2 and the super-off-peak price for Rate 1 is roughly 3 ¢/kWh less than the off-peak price for Rate 2. Given these differences, one might expect to see more load shifting away from the peak-period for Rate 2 than for Rate 1, since it should be easier to shift most loads in the hours surrounding the peak period than to shift from the peak to the super-off-peak period or from the shoulder to the super-off-peak period.

The comparisons across rates and climate regions is complicated for SDG&E because customers were placed on Rate 2 in all three climate regions but Rate 1 customers are only present in the moderate and cool regions. As such, when all participants are combined, Rate 2 impacts are based on customers in all three climate regions whereas Rate 1 impacts are only based on the moderate and cool regions combined. Having said that, the number of customers in SDG&E's hot region is so small relative to the other regions, when the hot region is combined with the moderate and cool regions using population weights, the impact of the hot region is minimal. As such, there is little bias in comparing the impacts for all participants combined for Rate 2 with the impacts for participants in the moderate/cool regions combined in the following figures.

As seen in Figures 6.3-10 and 6.3-11, the hypothesis that there would be more load shifting for Rate 2 compared with Rate 1 is not born out by the evidence. Indeed, the observed difference is in the other direction, although none of the differences are statistically significant.

Figure 6.3-10: Average Percent Peak Period Impacts Across Rates

Figure 6.3-11: Average Absolute Peak Period Impacts Across Rates



Figures 6.3-12 and 6.3-13 show the reduction in daily electricity use under each rate option by climate region and for the service territory as a whole. As with the peak period impacts, none of the observed differences are statistically significant.

Figure 6.3-12: Average Percent Daily kWh Impacts Across Rates

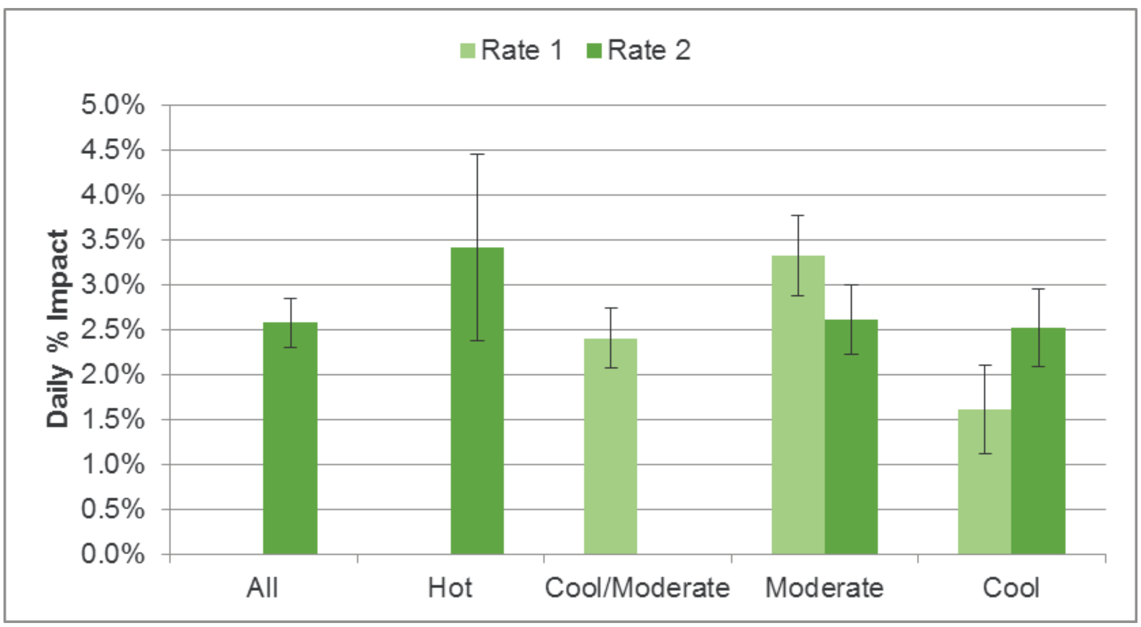
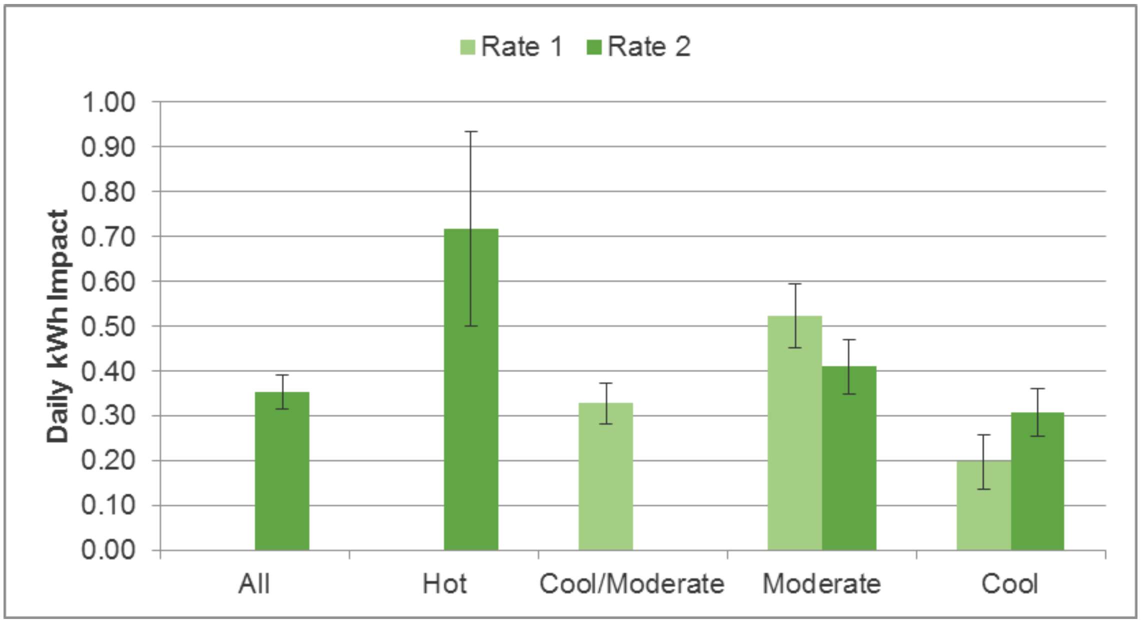


Figure 6.3-13: Average Absolute Daily kWh Impacts Across Rates



6.4 Bill Impacts

Bill Impacts Were Quite Small for the Majority of Pilot Participants

On an annual basis, a significant majority of pilot participants would see very modest structural changes in their bills. Unlike for PG&E and SCE, even during the summer period, the majority of pilot participants saw very modest changes in bills both with and without changes in usage. This difference results from the fact that SDG&E's OAT has prices that vary across seasons whereas PG&E and SCE do not.

This section summarizes the bill impact estimates for the two rate treatments tested by SDG&E. Bill impacts are reported for each climate region separately and combined, and for CARE/FERA and non-CARE/FERA customers in the moderate and cool climate regions. As discussed previously, SDG&E's hot climate region is quite small and the sample of customers recruited into the pilot is not large enough to support estimation of load impacts separately for CARE/FERA and non-CARE/FERA customers nor to support segmentation of the sample into seniors or various income groups as was done in the hot regions for PG&E and SCE. All customers in the hot region were placed on Rate 2 or were in the control group.

Bill impacts are reported as the average monthly impact for the summer months of July, August, September, and October[123] for each rate, climate zone, and customer segment summarized above. As described in Section 3.2, the following four analyses were conducted:

[123] Estimates were not produced for the month of June because enrollment changed dramatically from the beginning to the end of the month and the estimates would not be comparable to those for other months.

- **Structural benefiter/non-benefiter analysis based on pretreatment usage-** Displaying the proportions of structural benefiters and non-benefiters for each rate and relevant customer segment based on pretreatment data on an annual and summer season basis;
- **Estimation of the average bill impact due to changes in usage-** Displaying the average bill impact resulting from changes in behavior in response to the new price signals for each rate and relevant customer segment (after controlling for exogenous factors);
- **Estimation of the total bill impact due to both the difference in the tariffs (holding usage constant) and behavior change-** Displaying the bill impact for each rate and relevant customer segment due to structural differences in the rate mitigated by changes in behavior; and
- **Change in the distribution of bill impacts due to behavior change-** Displaying the distribution curves of bill impacts (percentage of customers with bill impacts within $10 incremental bins) with and without behavior change in the same graph to illustrate if the distribution for participants shifted to the left or changed shape compared with the distribution for control customers without behavior change.

A more detailed explanation of each type of analysis and how the analysis was conducted is contained in Section 3.2. The remainder of this section is organized according to the four analysis types summarized above—that is, bill impacts are presented for each rate, relevant customer segment, and climate region for each of the four analyses.

6.4.1 Structural Benefiter/Non-Benefiter Analysis Based on Pretreatment Usage

As with PG&E and SCE, the structural benefiter analysis was conducted for the summer and annual time periods using pretreatment data from the treatment group for each rate and relevant customer segment. Annual impacts were based on hourly load data from May 2015 through April 2016. Summer impacts were based on June 2015 through October 2015. Monthly bills were estimated for each treatment group customer on the OAT and TOU rate using the hourly load data. The difference in bills based on the TOU rate and the OAT determines if a customer is a structural benefiter, a structural non-benefiter, or falls in a neutral range defined as having a structural bill impact between ±$3.[124]

Final results from the structural benefiter / non-benefiter analysis are presented in column graphs and shown as percentages for the summer season and on an annual basis. For each rate and relevant segment, the percentage of customers who are non-benefiter, neutral (+/- $3), or benefiters based on their average monthly bills for the time period of interest are shown as individual columns. The three columns within each rate and segment combination total to 100%, thus showing the distribution of structural benefiters and non-benefiters for each rate and segment of interest.

Figure 6.4-1 presents the outcome of the structural benefiter analysis for Rate 1 for the cool and moderate climate regions combined for all customers as well as for CARE/FERA and non-CARE/FERA customers. The graph on the left presents the analysis on an annual basis, and the graph on the right presents the findings for the summer period. In the two climate regions combined, a large proportion of customers are in the neutral category and very few are benefiters. Over 90% of CARE/FERA customers in the cool and moderate climate regions have bill impacts in the neutral range. The pattern is similar on a

[124] See section 3.2.1 for additional details on the methodology.

summer basis, which is quite different from what was seen in the other utilities, where most customers were non-benefiters in the summer time frame.

Figure 6.4-1: Rate 1 Structural Benefiter / Non-Benefiter Analysis
All | CARE/FERA | non-CARE/FERA

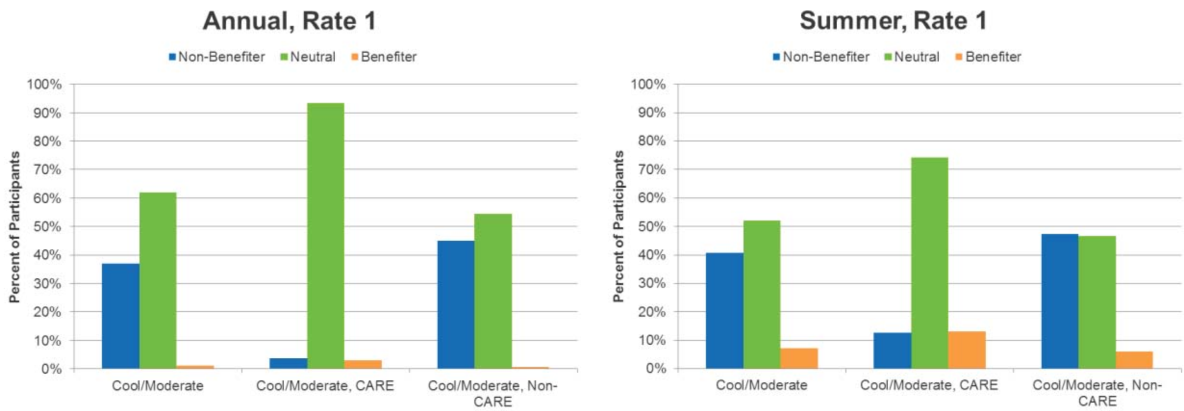


Figure 6.4-2 presents the outcome of the structural benefiter analysis for Rate 1 at the detailed segment level for the cool and moderate climate regions, separately. The findings at the aggregate level still hold, with most CARE/FERA customers in the neutral category, and a very small percentage of non-CARE/FERA customers in the benefiter category on an annual basis. About 15% of CARE/FERA customers in the moderate climate region are benefiters in the summer period.

Figure 6.4-2: Rate 1 Structural Benefiter / Non-Benefiter Analysis
Detailed Segments by Climate Region

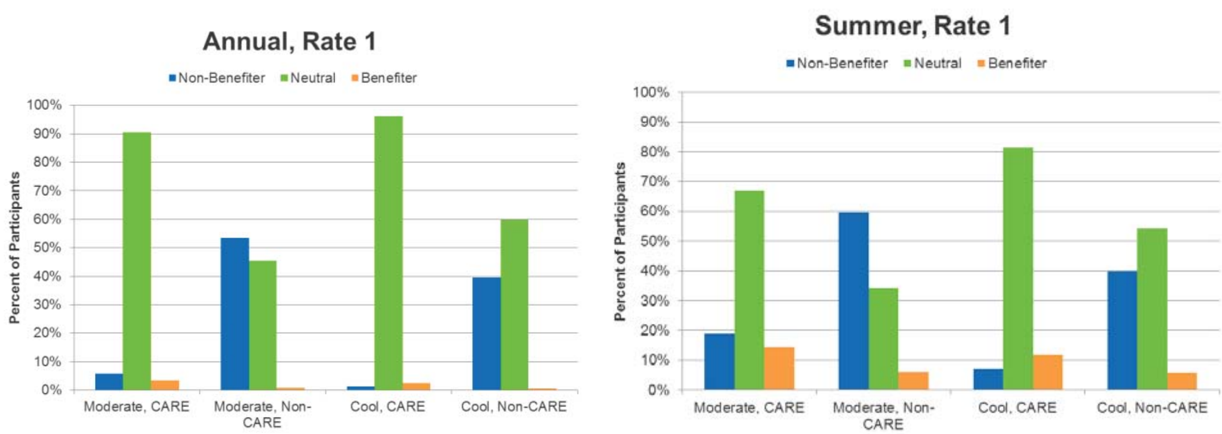


Figure 6.4-3 presents the outcome of the structural benefiter analysis for Rate 2 at the aggregate level across climate regions, and by CARE/FERA and non-CARE/FERA for the cool and moderate climate regions combined. The results are nearly identical to those for Rate 1. Once again, most CARE/FERA customers in the cool and moderate climate regions are in the neutral category on an annual basis. About half of non-CARE/FERA customers fall into the neutral band during the summer period, and about 45% fall into the non-benefiter category. The outcome is similar in the summer period.

Figure 6.4-3: Rate 2 Structural Benefiter / Non-Benefiter Analysis All | CARE/FERA | Non-CARE/FERA

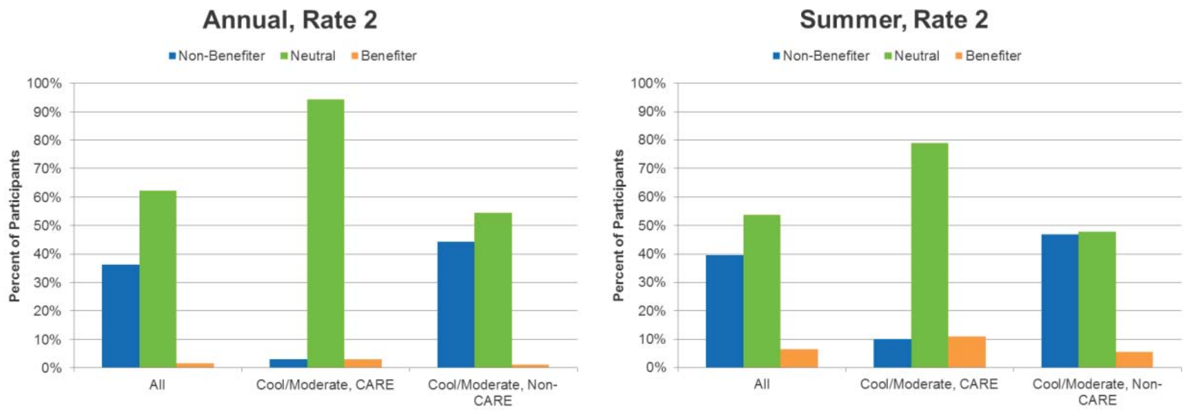
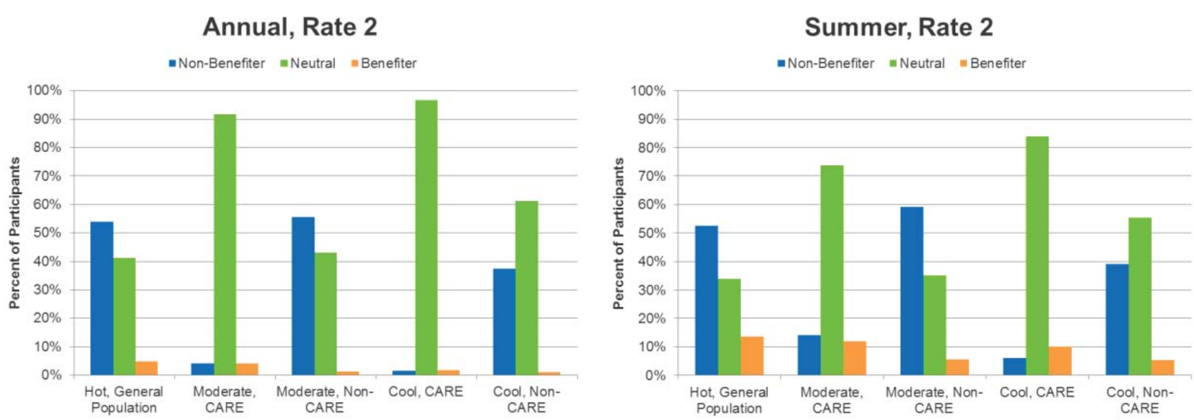


Figure 6.4-4 presents the outcome of the structural benefiter analysis for Rate 2 at the detailed segment level by climate region. As mentioned previously, the hot climate region is too small to segment by CARE/FERA status. Just over 50% of customers in the hot climate region are non-benefiters in the summer and annual time frames. As with Rate 1, most CARE/FERA customers in the cool and moderate climate regions fall into the neutral category on an annual and summer basis.

Figure 6.4-4: Rate 2 Structural Benefiter / Non-Benefiter Analysis Detailed Segments by Climate Region



Overall, a general pattern of structural benefiters and non-benefiters emerged that was constant across rates. Generally, CARE/FERA customers tend to have very small bill impacts compared to non-CARE/FERA customers, as shown by their larger share of customers in the neutral category on an annual and summer basis. These results stand in contrast to those from PG&E and SCE who had very large proportions on non-benefiters in nearly all customer segments during the summer period.

The next section presents the analysis showing how much customers were able to reduce their bills as a result of behavior change. Section 6.4.3 combines the findings from the structural benefiter analysis with the average bill impact findings to provide the full picture of how much of the structural loss customers were able to offset based on changing their energy usage behavior.

6.4.2 Estimation of the Average Bill Impact Due to Changes in Usage

As described in Section 3.7.2, the average bill impact due to customers changing their energy usage in response to the TOU rate was estimated by calculating the difference in bills calculated using the TOU rate and post-enrollment usage for both the control and treatment group minus the difference in bills on the TOU rate using pretreatment usage for both the control and treatment groups. The control group bill calculated on the TOU rate represents the bill that would be expected if a customer was billed on the TOU rate, but didn't change their energy use behavior. The bill for the treatment group customers on TOU rate reflects any behavioral changes in response to being on the TOU rate. By subtracting the treatment group's average bill from the control group's average bill—and removing any pre-existing differences—we are able estimate the average bill impact attributable to the treatment group's change in behavior resulting from exposure to the pilot rate, after controlling for exogenous factors. [125] A positive impact indicates that customers successfully reduced their bills relative to the control group who did not respond to a TOU rate.

Bill impacts due to behavior change are presented on a column graph and shown as dollar impacts for the average summer monthly bill for July, August, September, and October 2016 for Rates 1 and Rate 2. The error bars on the graph represent the 90% confidence interval. Therefore, any impacts with error bars that cross below zero are not statistically significant at the 90% confidence level. Impacts are organized by rate, climate region, and segment. The bill impact in percentage terms that corresponds to the dollar amount is also included in the figure to provide context.

As with PG&E and SCE's bill impacts, aggregate level results were weighted following the same approach as used in the load impacts.[126] The weights are representative of the mix of customers eligible to participate in the pilot, not just those who enrolled. Consequently, some of the individual segments shown in the detailed findings section may have more or less weight than other segments when they are combined together to develop the aggregate results. As described earlier, it is important to note that small bill impacts do not necessarily indicate customers did not change their behavior. As seen in the load impact section, load reductions in peak or shoulder periods, which would lead to lower bills all other things equal, are sometimes offset by load increases in the off-peak period. Depending on the relative magnitude of each change, bill impacts could go up, down, or remain largely unchanged even though customers made significant changes in behavior. It is also important to note that the values shown here represent changes in bills due to change in behavior – they do not represent the total change in the bill. The total changes in the bill will be presented in the next section.

[125] See section 3.2.2 for additional details on the methodology.

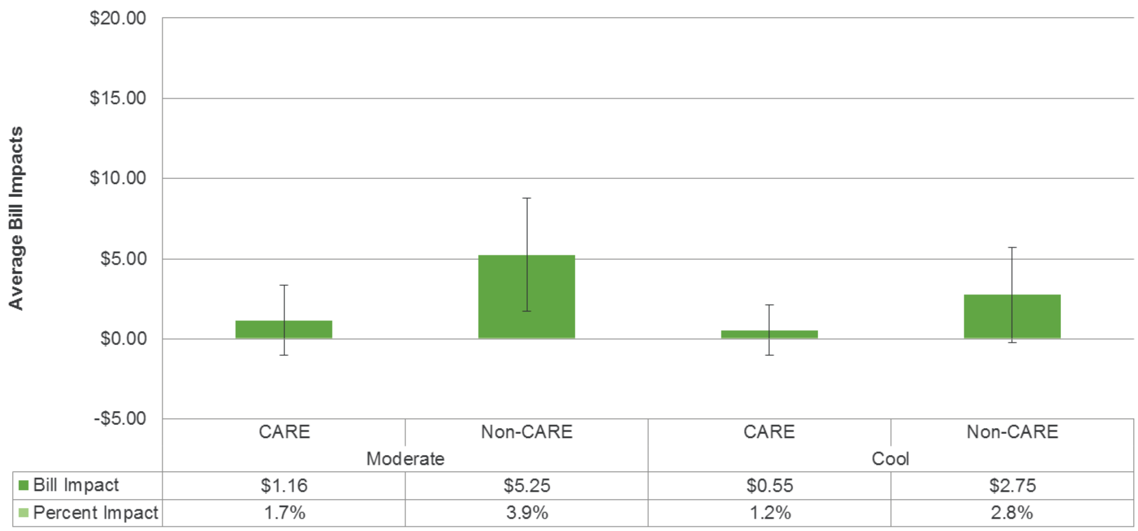
[126] See section 3.1 for a detailed discussion of the weighting approach.

Figure 6.4-5 provides the overall results for customers in the cool and moderate climate regions on Rate 1. Through changing their energy use the average Rate 1 customer was able to reduce what their average monthly bill would have otherwise been by $3.14, or 3.1%. Though small, this result is statistically significant at the 90% confidence level. Average hourly peak period load impacts for Rate 1 customers were 5.4% or 0.04 kW. For the five hour peak period, the average daily energy savings is approximately 0.2 kWh (5 hours times 0.04 kW). If we assume four weeks in a month, and five days a week, the result is twenty days where we would expect to observe the peak period reductions. Multiplying 20 days by the 0.2 kWh we expect to find about 4 kWh savings from the peak period per month. When factoring in both the CARE/FERA and non-CARE/FERA rates, the average summer weekday peak period price per kWh on Rate 1 is about $0.56. An impact of 4 kWh per month at $0.56 per kWh equals a total estimated peak period bill reduction of $2.24. When factoring in slight decreases in energy use during off-peak hours, the $3.14 monthly bill impact appears quite reasonable. Bill impacts due to behavior change for CARE/FERA customers are much smaller than the territory-wide average customer impact at $0.85 (1.4%) and were not statistically significant. Non-CARE/FERA customer bill impacts were statistically significant at $3.70 (3.3%) per month.

Figure 6.4-5: Rate 1 Average Bill Impacts from Behavior Change
All | CARE/FERA | Non-CARE/FERA
(Positive values represent bill reductions)

Figure 6.4-6 presents the detailed results by climate region and segment for customers on Rate 1. CARE/FERA customers did not have significant bill reductions over the months of July through October in the cool and moderate climate regions. Non-CARE/FERA customers in the moderate climate region had the greatest impacts, $5.25, or 3.9%.

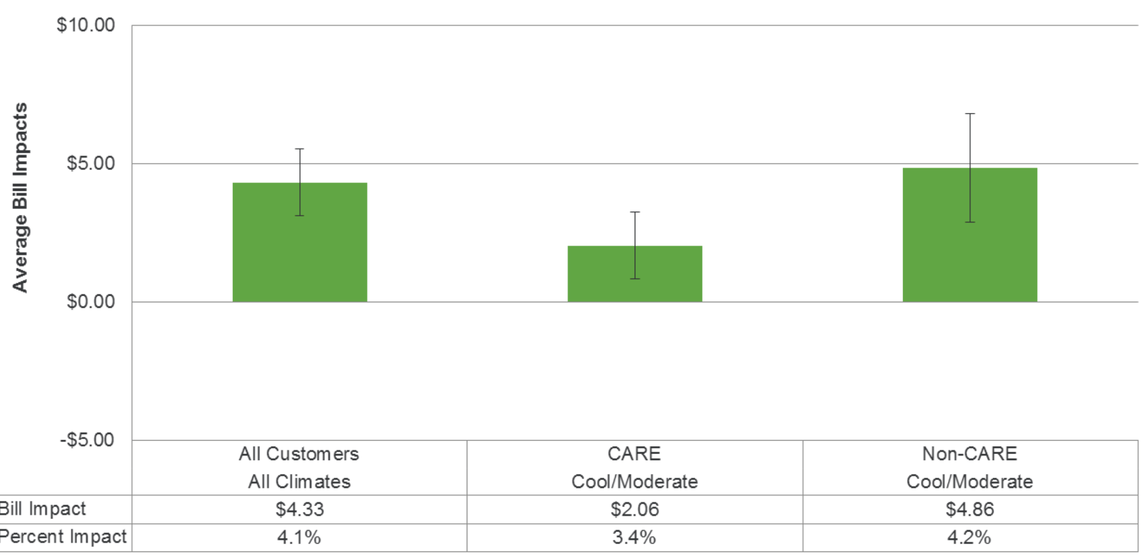
Figure 6.4-6: Rate 1 Average Bill Impacts from Behavior Change Detailed Segments by Climate Region
(Positive values represent bill reductions)



	Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE
Bill Impact	$1.16	$5.25	$0.55	$2.75
Percent Impact	1.7%	3.9%	1.2%	2.8%

Figure 6.4-7 provides the overall results for customers on Rate 2, which includes customers in the hot climate region. Non-CARE/FERA customers in the moderate and cool climate regions exhibited similar bill impacts to those on Rate 1, with reductions of $4.86 or 4.2% attributable to behavior change. The bill reductions for CARE/FERA customers in the cool and moderate climate regions were statistically significant for customers on Rate 2 and were equal to $2.06 or 3.4%.

Figure 6.4-7: Rate 2 Average Bill Impacts from Behavior Change All | CARE/FERA | Non-CARE/FERA
(Positive values represent bill reductions)



	All Customers All Climates	CARE Cool/Moderate	Non-CARE Cool/Moderate
Bill Impact	$4.33	$2.06	$4.86
Percent Impact	4.1%	3.4%	4.2%

Figure 6.4-8 provides the detailed level results by climate region and CARE/FERA status for customers on Rate 2. Customers in the hot climate region exhibited large bill reductions due to behavior change of over $5, however these reductions were not statistically significant, likely due to the small sample size of customers in that region. Similar to what was seen on Rate 1, CARE/FERA customers in the cool climate region did not reduce their bills by a significant amount due to behavior change. The two segments in the moderate climate region exhibited similar bill reductions on an absolute basis, $3.12 for CARE/FERA customers and $4.30 for non-CARE/FERA customers.

Figure 6.4-8: Rate 2 Average Bill Impacts from Behavior Change Detailed Segments by Climate Region
(Positive values represent bill reductions)

Generally speaking, non-CARE/FERA customers exhibited larger bill reductions due to changes in energy usage behavior, compared to CARE/FERA customers. Bill reductions fell between about 1% and 5% across all customer segments and rates, but many were not statistically significant.

6.4.3 Estimation of the Total Bill Impact Due to Differences in the Tariffs (Holding Usage Constant) and Behavior Change

Total bill impacts experienced by customers on a TOU rate can be decomposed into two components: the structural impact, and the behavioral impact. The structural impact represents the change in customer bills based solely on the change in the underlying structure of the rate. In this case, it is the change from the OAT to the time-differentiated TOU pilot rates. The behavioral impact represents how the customer changed their energy usage in response to the new pricing structure of the rate—which includes higher prices in the afternoon and evening and lower prices at other times of the day. During the summer period, many customers on the TOU rates experienced a structural increase in their bills. However, customers also had an opportunity to offset that increase by changing their energy use behavior in response to the new price signals. As noted above, it is the combination of structural and behavioral bill impacts that produces the total bill impact experienced by the average study participant on each rate.

The results from this analysis represent the average monthly bill across the summer months of July, August, September, and October 2016. Three different bills were calculated for each customer segment:[127]

- **No Change in Behavior or Tariff [1]:** This represents what the treatment group bills would have been in the post-treatment period if they were on the OAT and had not changed their behavior
- **No Change in Behavior, Change in Tariff [2]:** This represents what the treatment group bills would have been in the post-treatment period if they were on the TOU rate and had not changed their behavior
- **Change in Behavior and in Tariff [3]:** This represents what the treatment group bills were in the post-treatment period on the TOU rate with a change in behavior

Based off of components defined above, the following metrics were calculated:

- The difference between **[1]** and **[2]** is the structural bill impact (based on post-treatment usage after adjusting for any pretreatment difference between control and treatment customers);
- The difference between **[1]** and **[3]** is the bill impact due to structural differences in the rates, but mitigated by changes in behavior; and
- The difference between **[2]** and **[3]** is the amount customers were able reduce their bills by changing their behavior.

In the bill impact analysis, a major policy question was to better understand the relationship between the structural bill impacts, and how customers were able to respond. This relationship is represented by the “percentage of structural loss mitigated by change in behavior” shown in the data table at the bottom of the figures below. Put differently, this percentage represents how much of the structural bill increase from the TOU rate the average customer was able to offset. Results are organized by rate, climate region, and segment; similarly to the other bill impact analysis sections.

Figure 6.4-9 presents a set of three average monthly bills as defined above for all customers, CARE/FERA customers, and non-CARE/FERA customers on Rate 1 in the cool and moderate climate regions combined. The blue bar represents a typical summer monthly bill for a customer still on the OAT and not responding to a TOU rate— noted as “No Change in Behavior or Tariff.” For the average customer on Rate 1, this dollar amount was $98.09 per month. The green bar represents what a typical summer monthly bill would be for a customer who was billed on a TOU rate, but didn’t change their energy use behavior— noted as “No Change in Behavior, Change in Tariff.” This dollar amount is $102.07 for the average Rate 1 customer. The difference between the two values, $3.98, is the average increase a customer would see in their bills by changing from the OAT to Rate 1, and not changing their energy use behavior; this is also referred to as the customer’s structural loss. The orange bar represents the average Rate 1 customer’s bill after factoring in the change in rate from the OAT to the Pilot Rate 1, and then also taking into account any changes in energy use behavior— noted as “With Change in Behavior and Tariff.” This bill amount averaged $98.93 for the typical Rate 1 customer. Based off these values, it is possible to estimate the total change in bills including both the change in tariff and in behavior, which

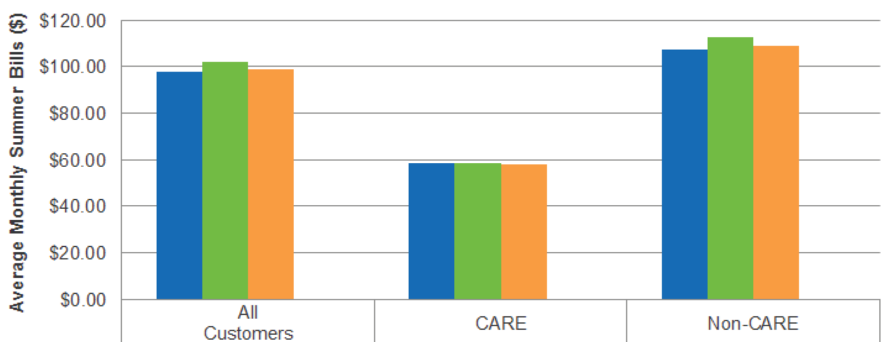
[127] See section 3.2.3 for additional details on the methodology.

was a bill increase of $0.84 per month (less than 1%). The total change in bill is calculated by subtracting the blue ($98.09) from the orange ($98.93).

An additional important metric is the percent of the structural loss—increase in the bills due strictly to the change in tariff—that can be offset or mitigated by customers changing their energy use behavior. As noted above, the average structural loss for Rate 1 customers was $3.98. The amount customers were able to reduce their bills by changing their behavior—compared to what it would have been without any behavior change—is obtained by subtracting the orange bar (“With Change in Behavior and Tariff”: $98.93) from the green bar (“No Change in Behavior, Change in Tariff”: $102.07), which equals $3.14. Based on these values, customers were able to offset $3.14out of the $3.98 structural loss, or 78.9%. This value is provided at the bottom of the data table in each figure for convenience.

Non-CARE/FERA customers were able to avoid nearly all of their structural loss, which was equal to about $4.96. The structural losses experienced by customers in SDG&E’s Rate 1 are much smaller than those experienced by participants in PG&E and SCE’s pilots. As such, the percent of structural loss mitigated by changes in behaviors are quite large (over 70%) even though the dollar amounts are rather small.

Figure 6.4-9: Rate 1 Total Bill Impact Due to Differences in the Tariff and Behavior Change (All | CARE/FERA | Non-CARE/FERA)

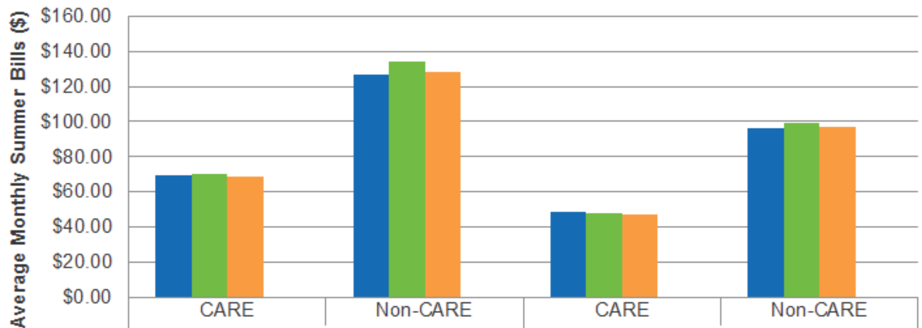


	All Customers	CARE	Non-CARE
		Cool/Moderate	
No Change in Behavior or Tariff	$98.09	$58.74	$107.57
No Change in Behavior, Change in Tariff	$102.07	$58.69	$112.53
With Change in Behavior and Tariff	$98.93	$57.84	$108.84
% of structural loss mitigated by change in behavior	78.9% *	-1657.4%	74.6% *

* Indicates statistically significant result

Figure 6.4-10 presents the three sets of average monthly bills as defined above for the detailed segments for the cool and moderate climate regions on Rate 1. CARE/FERA customers in the moderate climate region were able to completely avoid any structural loses with changes in behavior – however the structural loss these customers faced was very small and not statistically significant. CARE/FERA customers in the cool climate region experienced a structural gain and were able to gain even more by changing their energy usage behavior, but again these results were not statistically significant.

Figure 6.4-10: Rate 1 Total Bill Impact Due to Differences in the Tariff and Behavior Change (Detailed Segments by Climate Region)

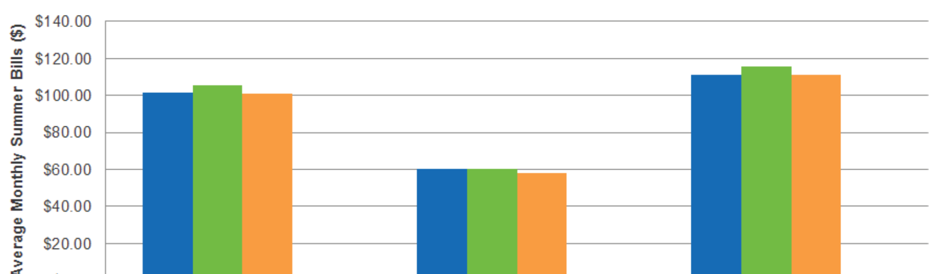


	Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$69.36	$126.45	$48.50	$96.04
No Change in Behavior, Change in Tariff	$69.86	$133.89	$47.92	$99.49
With Change in Behavior and Tariff	$68.71	$128.64	$47.36	$96.73
% of structural loss mitigated by change in behavior	228.0%	70.5% *	-94.1%	79.9%

* Indicates statistically significant result

Figure 6.4-11 presents the three sets of average monthly bills for all customers, and for CARE/FERA and non-CARE/FERA customers in the cool and moderate climate region combined. On average, customers on Rate 2 faced a structural bill increase of $3.81 or 3.8%. Rate 2 customers were able to completely avoid the structural losses through changes in behavior and reduced their bills from $105.48 to $101.15. Non-CARE/FERA customers in the moderate and cool climate region were able to do the same, and reduced their structural loss of $4.71 to a gain of $0.15.

Figure 6.4-11: Rate 2 Total Bill Impact Due to Differences in the Tariff and Behavior Change (All | CARE/FERA | Non-CARE/FERA)



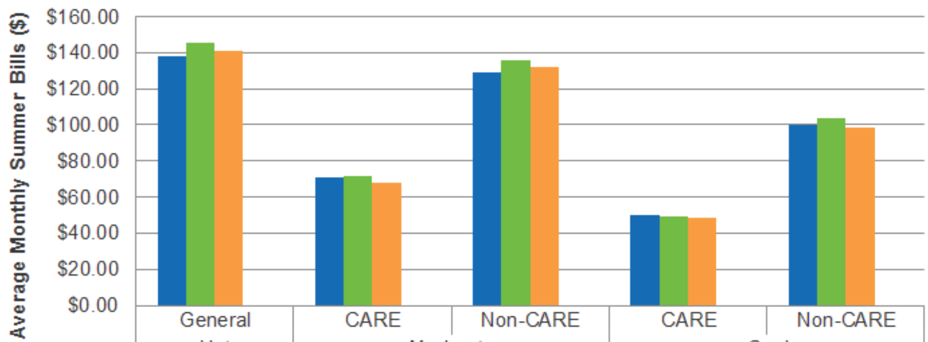
	All Customers All Climates	CARE Cool/Moderate	Non-CARE Cool/Moderate
No Change in Behavior or Tariff	$101.67	$60.38	$111.11
No Change in Behavior, Change in Tariff	$105.48	$60.24	$115.82
With Change in Behavior and Tariff	$101.15	$58.18	$110.95
% of structural loss mitigated by change in behavior	113.5% *	-1516.8% *	103.2% *

* Indicates statistically significant result

Figure 6.4-12 presents the three sets of average monthly bills for the detailed segments by climate region on Rate 2. Customers in the hot climate region experienced the largest potential structural losses, $7.52, or 5.4%. Through behavior change, these customers were able to reduce their TOU bills from

$145.78 to $140.65, which was a 68% reduction of their structural loss. CARE/FERA customers in the cool and moderate climate regions experienced structural gains and then were able to gain even more.

Figure 6.4-12: Rate 1 Total Bill Impact Due to Differences in the Tariff and Behavior Change (Detailed Segments by Climate Region)



	Hot	Moderate		Cool	
	General	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$138.26	$71.07	$129.15	$50.07	$100.09
No Change in Behavior, Change in Tariff	$145.78	$71.36	$136.01	$49.52	$103.48
With Change in Behavior and Tariff	$140.65	$68.24	$131.71	$48.49	$98.27
% of structural loss mitigated by change in behavior	68.2%	1084.0% *	62.6% *	-190.3%	153.3% *

* Indicates statistically significant result

Generally, structural losses were very small for customers on SDG&E's Rate 1 and Rate 2. This is very different from what customers in the other two utilities' pilots experienced. Structural bill impacts for customers in PG&E and SCE's pilots were closer to $20, while those in SDG&E's pilot are generally just over $3.00. Because of this, many customers in SDG&E's pilot were able to save money by moving to a TOU tariff and changing their behavior.

6.4.4 Change in the Distribution of Bill Impacts Due to Behavior Change

The fourth analysis presents the distribution of bill impacts[128] for customers with and without behavioral change, and is designed to show how the distribution shifts when customers respond to the rates by changing behavior. Similar to the other analyses, impact distributions are based on the average summer monthly bills for July, August, September, and October. Bill impacts were estimated for two cases—with and without behavior change. Both are based on the structural bill impact calculations; however, impacts with behavior change show how behavioral impacts are able to affect the structural impact distribution. Customers were segmented into ranges of bill impacts. The percentage of customers in each $10 increment from negative $100 to positive $100 per month (with and without behavior change) was determined with and without behavior change. The underlying calculations used to develop the distributions are based off of a difference-in-differences approach that compares the treatment and control customers based on both pre- and post-treatment bill impacts.[129]

[128] Bill impacts without behavior change represent the structural bill impact distribution; bill impacts with behavior change show how behavioral impacts affect the structural bill impact distribution.

[129] See section 3.2.4 for additional details on the methodology.

The two distributions are presented on a line graph, with the height of the line at any given $10 increment representing the percentage of customers experiencing a bill impact of the corresponding dollar amount. In this case, the bill impact is measured as the difference between the TOU bill and the OAT bill. If the line for the group with changes in behavior is to the left of the line representing the group with no change in behavior, it shows that at least some customers were able to modify their energy usage such that they had lower total bill impacts compared to if they had not changed their behavior.

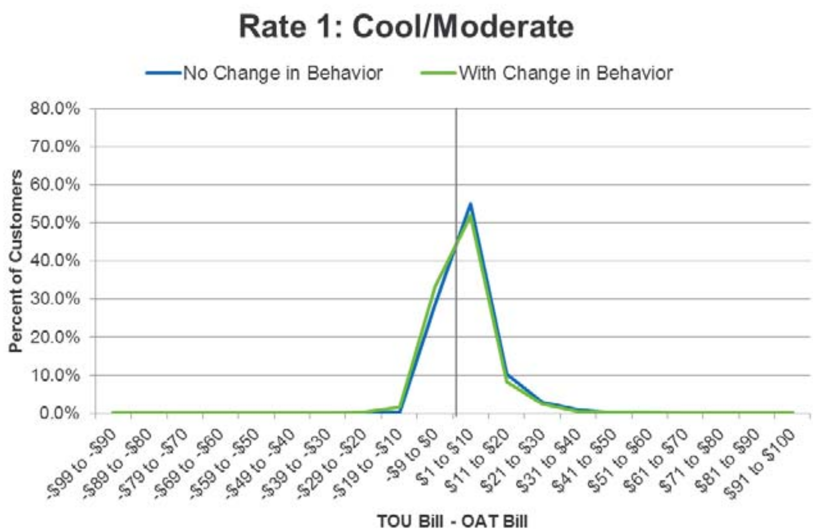
Figure 6.4-13 presents the distribution of bill impacts with and without energy use behavior change. The blue line represents the structural bill impacts that result when customers are billed on the TOU rate and do not change their energy use behavior. The green line shows the total bill impacts when customers have responded to the TOU rate and, in some cases, changed their energy use behavior. Bill impacts are calculated as the difference between the TOU bill and the OAT bill. Each point along the line graph represents the percentage of customers within a specific bill impacts bin or range. For example, on Rate 1, approximately 3% of the customers have structural bill impact of $21 to $30 per month—the blue line. In other words, approximately 3% of the Rate 1 customers would experience an increase of $21 to $30 per month on Rate 1 compared to the OAT without changing their behavior. The green line represents the total bill impacts when customers have had the opportunity to respond to the TOU rate. In this case, the percent of customers experiencing an increase of $21 to $30 per month on Rate 1 compared to the OAT is 2.5%, showing a slight decrease.

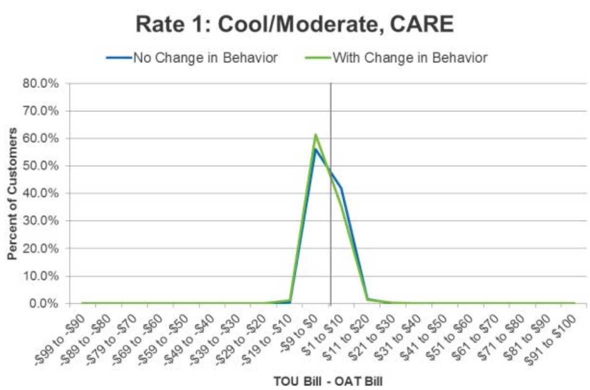
It is important to note that customers could move up or down through the incremental impact bins, and could potentially move more than one bin—meaning that a customer could potentially experience a bill increase due to their behavioral response, or they could jump down several bins and go from a $31 to $40 per month bill impact down to $11 to $20 impact, for example. In the case of the average Rate 1 customers, there is an increase in the percent of customers with a total bill decrease of between $0 and $9 per month. With no change in behavior, 28% of customers were in this bin and with behavior change 33% of customers are now in this bin.

As noted in the previous section, most customers did not face large structural bill increases. This is also apparent in the graph below, where the distribution is very narrow compared to those for PG&E and SCE. The shifts are also rather small compared to the other two utilities. It’s important to remember that instances where the green line is to the right of or above the blue line in the lower bill impact ranges indicate more customers have moved into that bin, likely from higher impact bins.

Figure 6.4-13: Rate 1 Change in the Distribution of Bill Impacts Due to Behavior Change All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0.0%	0.0%
-$89 to -$80	0.0%	0.0%
-$79 to -$70	0.0%	0.0%
-$69 to -$60	0.0%	0.0%
-$59 to -$50	0.0%	0.0%
-$49 to -$40	0.0%	0.0%
-$39 to -$30	0.0%	0.0%
-$29 to -$20	0.1%	0.2%
-$19 to -$10	0.3%	1.5%
-$9 to $0	28.6%	33.4%
$1 to $10	55.1%	51.9%
$11 to $20	10.3%	8.3%
$21 to $30	3.0%	2.5%
$31 to $40	1.0%	0.6%
$41 to $50	0.1%	0.2%
$51 to $60	0.1%	0.2%
$61 to $70	0.1%	0.0%
$71 to $80	0.0%	0.0%
$81 to $90	0.0%	0.0%
$91 to $100	0.0%	0.0%





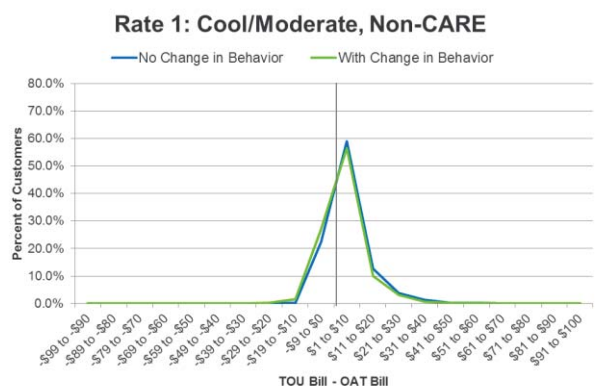


Figure 6.4-14 provides the distribution of bill impacts for the detailed segmetns by climate zone. It is interesting to note that most of the distribution of bill impacts due to behavior change for CARE/FERA customers in the cool climate region falls to the left of the gray line, indicating that most customers are structural benefiters of the TOU rate. This is in line with what was presented in Section 6.4.1, where most customers in this segment were in the nuetral or structural benefiter category. The opposite is true for non-CARE/FERA customers in both climate region, which shows that most customers are non-benefiters, although there bill impacts are quite small, both with and without changes in behavior.

Figure 6.4-14: Rate 1 Change in the Distribution of Bill Impacts Due to Behavior Change Detailed Segments by Climate Region

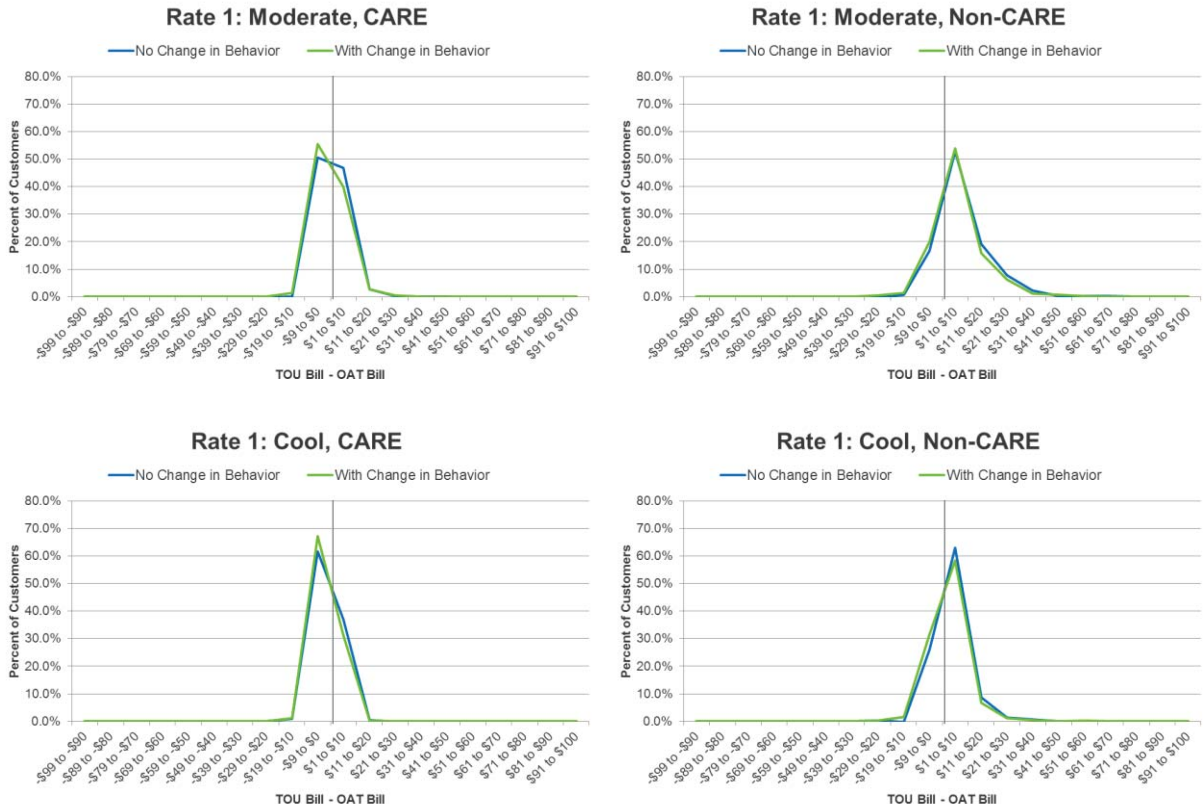
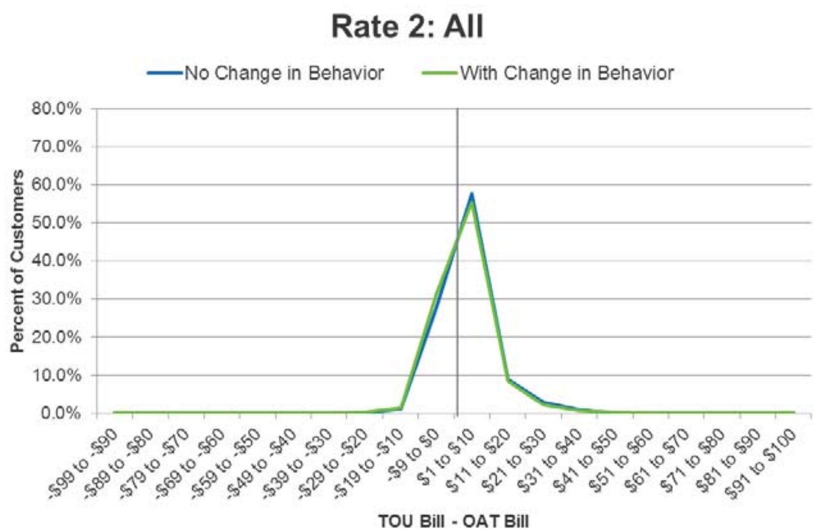
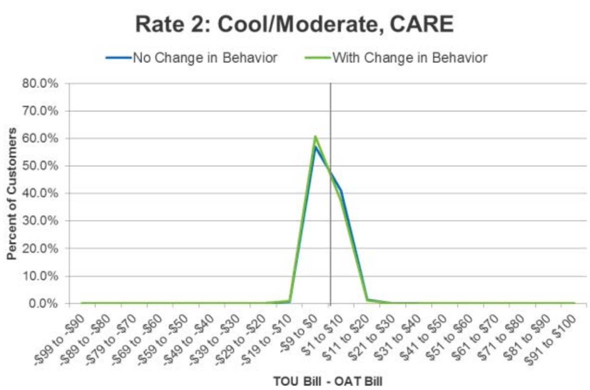


Figure 6.4-15 provides the distribution of bill impacts for all customers and CARE/FERA and non-CARE/FERA customers in the moderate and cool climate regions on Rate 2. Without changes in behavior, 58% of customers faced bill impacts between $1 and $10. With changes in behavior, this was reduced to 55% of customers. A similar shift occurred in the $11 to $20 range. The distributions of bill impacts for CARE/FERA and non-CARE/FERA customers in the cool and moderate climate regions are very similar to those for Rate 1.

Figure 6.4-15: Rate 2 Change in the Distribution of Bill Impacts Due to Behavior Change All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0.0%	0.0%
-$89 to -$80	0.0%	0.0%
-$79 to -$70	0.0%	0.0%
-$69 to -$60	0.0%	0.0%
-$59 to -$50	0.0%	0.0%
-$49 to -$40	0.0%	0.0%
-$39 to -$30	0.0%	0.0%
-$29 to -$20	0.0%	0.2%
-$19 to -$10	1.2%	1.5%
-$9 to $0	27.8%	31.3%
$1 to $10	57.7%	55.4%
$11 to $20	8.9%	8.4%
$21 to $30	3.0%	2.2%
$31 to $40	0.9%	0.8%
$41 to $50	0.1%	0.2%
$51 to $60	0.1%	0.1%
$61 to $70	0.0%	0.0%
$71 to $80	0.0%	0.0%
$81 to $90	0.0%	0.0%
$91 to $100	0.0%	0.0%





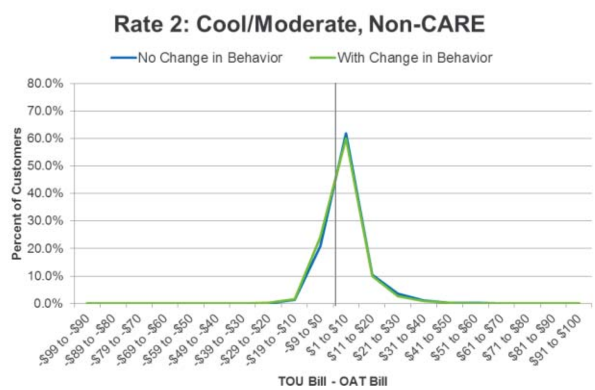
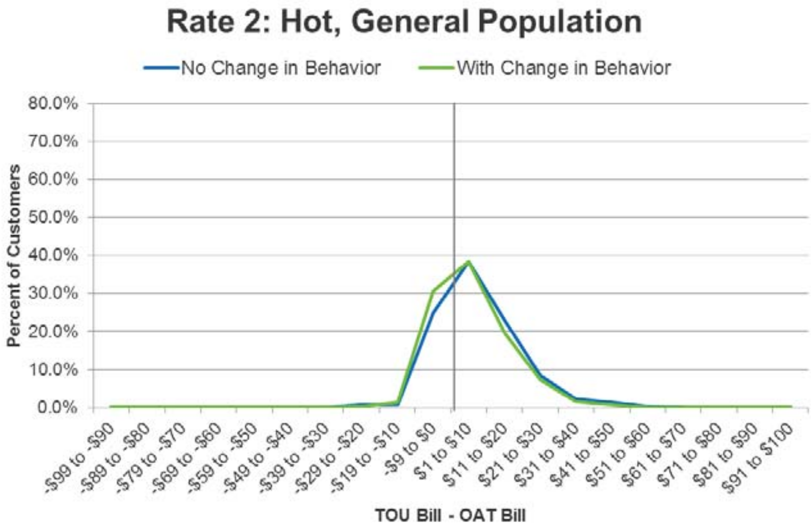
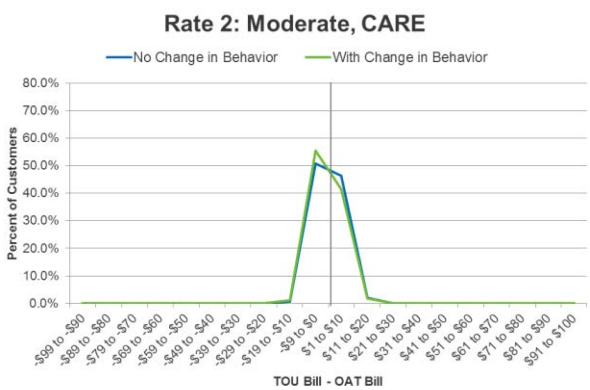
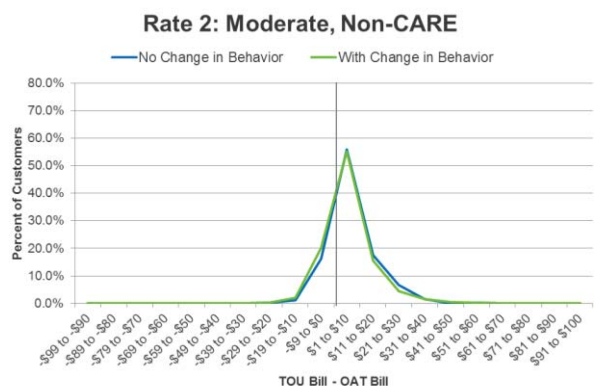


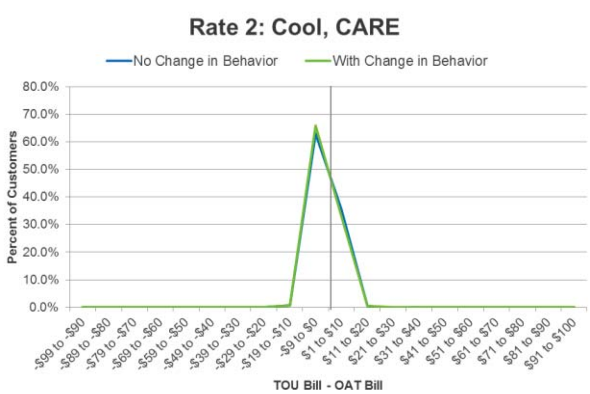
Figure 6.4-16 shows the distributions of bill impacts for the detailed segments by climate region for Rate 2. In the hot climate region, the percent of customers facing structural bill decreases of $0 to $9 increased from 25% to 31%. The shifts in the cool climate region were very small for CARE/FERA and non-CARE/FERA customer. With and without behavior change, over 60% of non-CARE/FERA customers in the cool climate region faced bill impacts of $1 to $10, which is rather small.

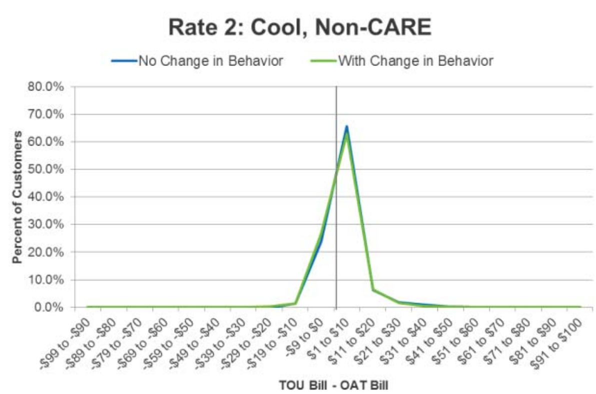
Figure 6.4-16: Rate 2 Change in the Distribution of Bill Impacts Due to Behavior Change Detailed Segments by Climate Region











6.5 Survey Findings

This section summarizes the survey findings for the three rate treatments tested by SDG&E. The CPUC resolution approving SDG&E's pilot requires that survey findings be reported for CARE/FERA and non-CARE/FERA customers for each rate for moderate and cool climate regions.

Sub-Appendix D in Appendix 1 describes the reporting requirements for SDG&E's opt-in pilot.

6.5.1 Findings Relevant to 745c Decision

Descriptive Statistics of Economic/Health Scores

To assess whether any of the pilot TOU rates caused economic difficulty, differences in average economic index scores were compared between the rate treatment and control groups for the segments shown in Table 6.5-1.

Table 6.5-1: Segments Tested by Rate

Climate	Segment	Control vs. Rate 1	Control vs. Rate 2
Moderate	Non-CARE/FERA	X	X
	CARE/FERA	X	X
	CARE/FERA – on or eligible	X	X
Cool	Non-CARE/FERA	X	X
	CARE/FERA	X	X
	CARE/FERA – on or eligible	X	X

[1] Higher mean index scores = more economic difficulty.

[2] Values are shown for all respondents combined, including control and treatment customers, with no weighting used to adjust for oversampling of sub-segments in the hot climate region or oversampling of CARE/FERA customers in all climate regions.

Values for descriptive statistics provided in Table 6.5-2**Error! Reference source not found.** and Figure 6.5-3 are shown for all respondents combined, including control and treatment customers, with no weighting applied. Unlike for SCE and PG&E, there was no oversampling of selected segments in the hot climate region at SDG&E. As such, the CARE/FERA and non-CARE/FERA statistics represent the population of enrolled customers even without weighting. However, since CARE/FERA customers were oversampled relative to their share of the general population, and since the SDG&E population is not evenly distributed across climate regions, the "All SDG&E Sample" statistics do not represent the general population without weighting.

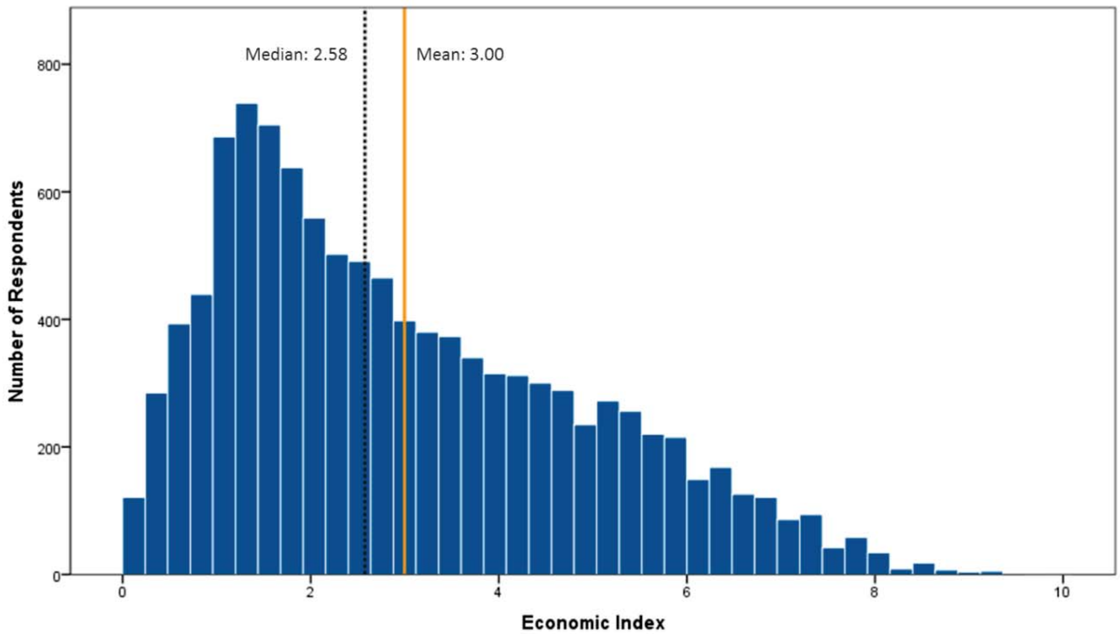
Table 6.5-2: Measures of Central Tendency for Economic Index Scores[1]

Statistic	All SDG&E Sample	Non-CARE/FERA	CARE/FERA	Seniors
Mean	3.00	2.31	4.01	2.56
25th Percentile	1.47	1.14	2.54	1.22
Median	2.58	1.85	3.94	2.14
75th Percentile	4.32	3.13	5.38	3.65

[1] Higher mean index scores = more economic difficulty.

Figure 6.5-1 shows the histogram of economic index scores for all SDG&E respondents. The dotted line on the histogram shows the median, while the orange line shows the mean. Economic index scores can range from a low of zero to a high of 10. The higher the score the more economic difficulty a respondent has. SDG&E pilot participants had a mean economic index score of 3.0 and median score of 2.6. The distribution of economic index scores is positively skewed.

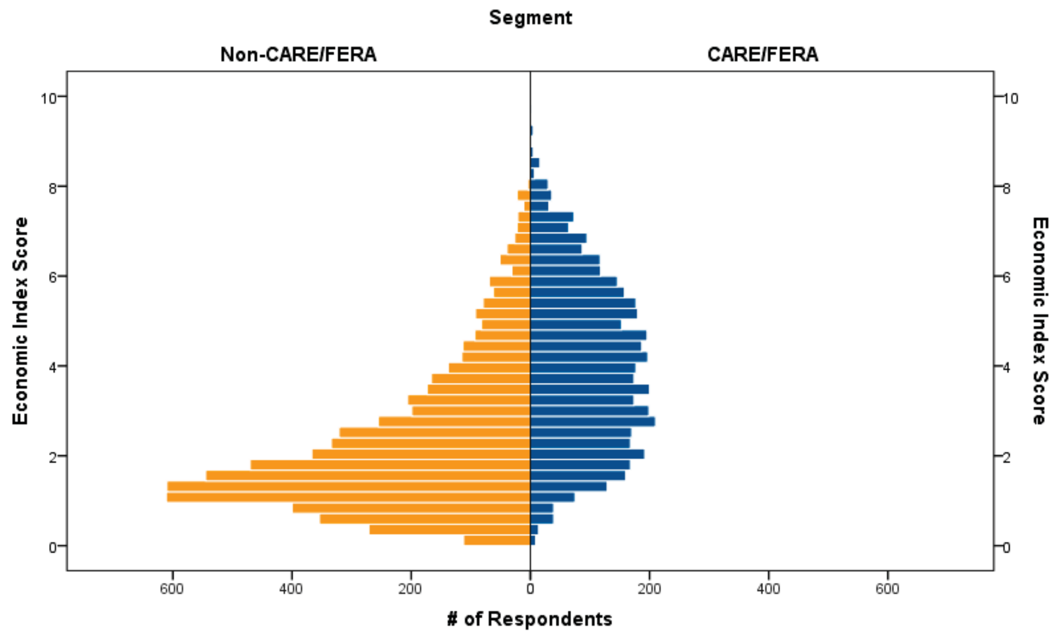
Figure 6.5-1: Histogram of Economic Index Scores[1, 2]



[1] Higher index scores = more economic difficulty.
[2] Values are shown for all respondents combined, including control and treatment customers, with no weighting applied.

As shown in Figure 6.5-2, the distribution of economic index scores is different for CARE/FERA and non-CARE/FERA groups. Both groups show a large spread of economic index scores, but the distribution of CARE/FERA scores is normally distributed, with equal distribution around the average score of 40.1.

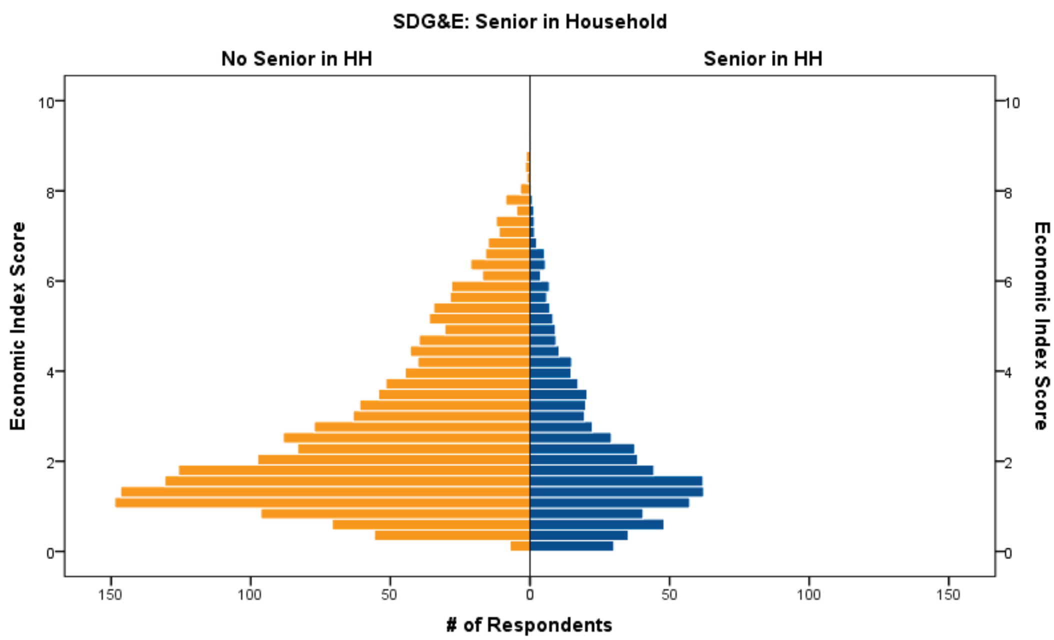
Figure 6.5-2: Histogram of Economic Index Scores for CARE/FERA and non-CARE/FERA Segments[1, 2]



[1] Higher index scores = more economic difficulty.
[2] Values are shown for all respondents combined, including control and treatment customers, with no weighting applied.

As shown in Figure 6.5-3, the distribution of economic index scores is very similar between households with a senior as a head of household versus a non-senior as a head of household. Both groups show a large spread of economic index scores and the distributions are both positively skewed.

Figure 6.5-3: Histogram of Economic Index Scores for Seniors and Non-Seniors[1, 2]



[1] Higher index scores = more economic difficulty.
[2] Values are shown for all respondents combined, including control and treatment customers, with no weighting applied.

Health Index: Table 6.5-3 shows the percent of respondents who reported a household member who sought medical attention due to excess heat from among the small minority of respondents who indicated that a household member had a medical condition that required keeping their house cool in the summer. All respondents in each segment also indicated that their home has some form of air conditioning. A minority of respondents reported that someone in their household required medical attention because it was too hot. As such, sample sizes for the health index are quite small. CARE/FERA and CARE/FERA eligible customers were more likely than non-CARE/FERA customers to report that someone in their household sought medical attention because of the heat.

Table 6.5-3: Distribution of Health Index Responses from Customers with AC and a Disability that Requires Cooling by Segment[1]

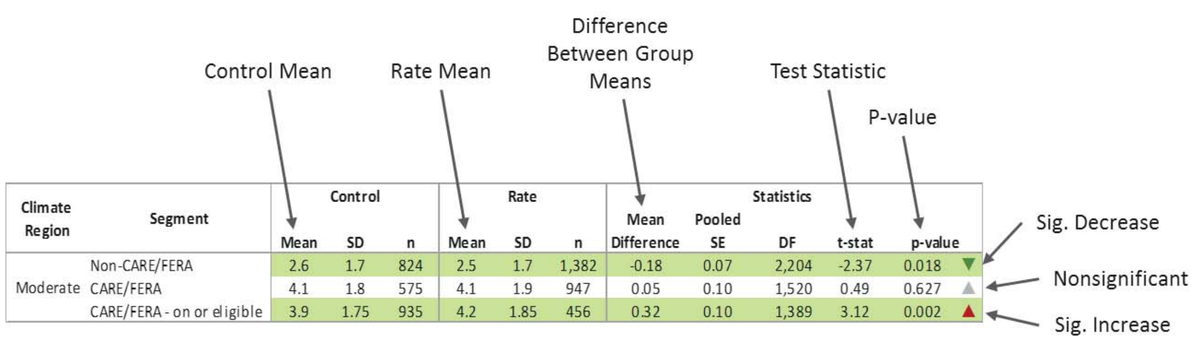
Climate Region	Segment	Total in segment	Total seeking medical attention	% seeking medical attention
Moderate	Non-CARE/FERA	57	8	14%
	CARE/FERA	87	32	37%
	CARE/FERA - on or eligible	111	34	31%
Cool	Non-CARE/FERA	48	15	31%
	CARE/FERA	75	29	39%
	CARE/FERA - on or eligible	94	35	37%

[1] Table includes all respondents who indicated someone in their household had a disability that required they keep their home cool during the summer and had a form of air conditioning in their home. Totals include all control and treatment respondents by segment.

Economic and Health Changes – Control versus Rate Comparisons

This section compares the average values for the economic and health indices for control and TOU treatment customers for each customer segment, rate, and climate region. Given the RCT design, any statistically significant differences between control and treatment customers can be attributed to the TOU rates (or random chance). Statistically significant differences between control and rate groups are highlighted in green. Color-coded triangles are also provided to facilitate interpretation of the results as shown in Figure 6.5-4.

Figure 6.5-4: Example of Results Table with Color Coding



Climate Region	Segment	Control Mean	Control SD	Control n	Rate Mean	Rate SD	Rate n	Mean Difference	Pooled SE	DF	t-stat	p-value
Moderate	Non-CARE/FERA	2.6	1.7	824	2.5	1.7	1,382	-0.18	0.07	2,204	-2.37	0.018 ▼
	CARE/FERA	4.1	1.8	575	4.1	1.9	947	0.05	0.10	1,520	0.49	0.627 ▲
	CARE/FERA - on or eligible	3.9	1.75	935	4.2	1.85	456	0.32	0.10	1,389	3.12	0.002 ▲

Rate 1

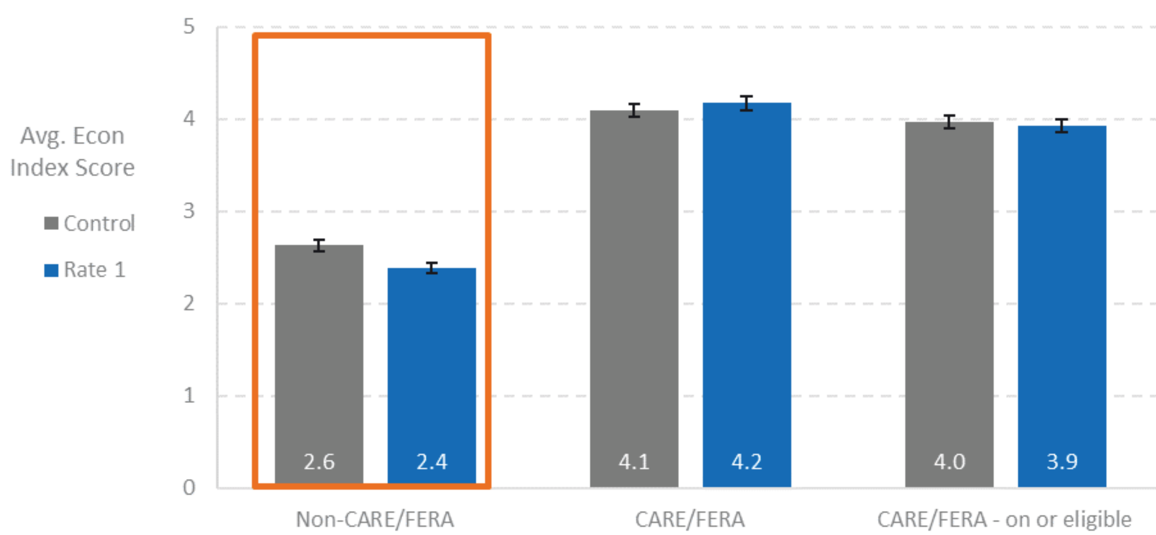
Economic Index: Table 6.5-4 shows the economic index scores for Rate 1 and control group customers by segment and climate region. The results indicate that SCE rates do not cause an increase in economic index scores. Non-CARE/FERA households in rate 1 show a reduction in economic index scores, with Rate 1 households showing slightly but significantly lower economic index scores (on average) by about 2 tenths compared to control households. CARE/FERA customers in both the control and treatment groups had substantially higher average economic index scores compared with non-CARE/FERA households, as shown in the table and Figure 6.5-5 .

Table 6.5-4: Comparison of Economic Index Means, Control vs. Rate 1[1]

Climate Region	Segment	Control			Rate 1			Statistics				
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value
Moderate	Non-CARE/FERA	2.6	1.7	824	2.4	1.6	806	-0.25	0.08	1,628	-2.97	0.003 ▼
	CARE/FERA	4.1	1.8	575	4.2	1.8	545	0.08	0.11	1,118	0.71	0.477 ▲
	CARE/FERA - on or eligible	4.0	1.8	822	3.9	1.9	761	-0.04	0.09	1,581	-0.45	0.655 ▼
Cool	Non-CARE/FERA	2.2	1.56	885	2.0	1.39	868	-0.24	0.07	1,751	-3.42	0.001 ▼
	CARE/FERA	4.0	1.82	626	3.9	1.88	600	-0.09	0.11	1,224	-0.84	0.402 ▼
	CARE/FERA - on or eligible	3.8	1.85	842	3.7	1.88	787	-0.11	0.09	1,627	-1.18	0.239 ▼

[1] Higher mean index scores = more economic difficulty.

Figure 6.5-5: Mean Economic Index Scores, Control vs. Rate 1 for Key Segments in Moderate Region[1]



[1] Higher mean index scores = more economic difficulty.

Health Index: Table 6.5-5 shows the health index proportions for control and treatment customers on Rate 1. The values in the table represent customers in the samples that have air conditioning and who reported a household member who required cooling due to a disability. The proportions shown in the table represent the percent of this population who reported a household member who sought medical attention because of excess heat. The percentage of respondents across all segments in Rate 1 who reported a household member needed to seek medical attention is not statistically different from the percentage of respondents in corresponding control groups. In addition, the health index is higher for

CARE/FERA and CARE/FERA eligible customers compared to non-CARE/FERA. However, the sample sizes are too small to provide accurate results.

Table 6.5-5: Comparison of Health Index, Control vs. Rate 1[1, 2]

Climate Region	Segment	Control % with Event	Control Total N	Rate 1 % with Event	Rate 1 Total N	Statistics % Difference	SE	Z-stat	p-value	
Moderate	Non-CARE/FERA	13%	15	29%	14	15%	0.15	1.01	0.31	▲
	CARE/FERA	35%	26	40%	20	5%	0.14	0.38	0.71	▲
	CARE/FERA - on or eligible	33%	30	36%	25	3%	0.13	0.21	0.84	▲
Cool	Non-CARE/FERA	23%	13	30%	10	7%	0.18	0.37	0.71	▲
	CARE/FERA	48%	23	45%	22	-2%	0.15	0.16	0.87	▼
	CARE/FERA - on or eligible	42%	31	42%	26	0.4%	0.13	0.03	0.98	▲

[1] Table shows health index results for respondents who indicated someone in their household had a disability that required they keep their home cool during the summer and had air conditioning in their home.

[2] The number of total customers that require cooling for a disability and have air conditioning in the moderate and cool climate region are very small. Data are included here for completeness, but the statistical outcomes are not valid due to small sample sizes.

Rate 2

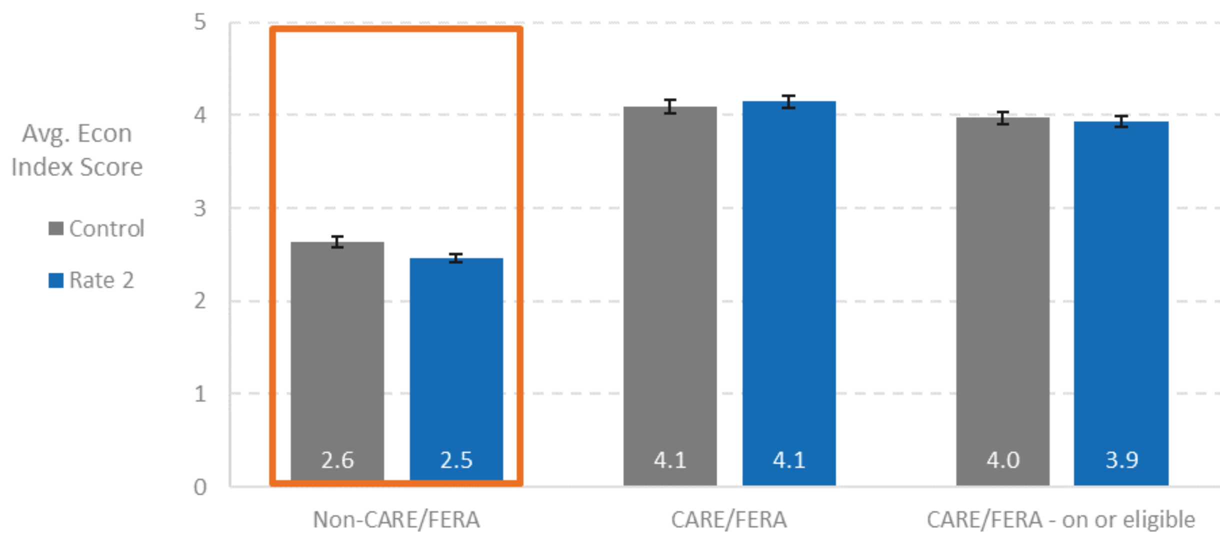
Economic Index: Table 6.5-6 shows the economic index scores for Rate 2 and control group customers by segment and climate region. There was no statistically significant increase in the economic index for customers on Rate 2 in any segment or climate region. Indeed, as with Rate 1, Rate 2 causes a decrease in average economic index scores for non-CARE/FERA respondents in the moderate region when compared to control households. CARE/FERA segments in both the control and treatment groups had substantially higher economic index scores than compared with non-CARE/FERA households, as shown in the table and Figure 6.5-6.

Table 6.5-6: Comparison of Economic Index Means, Control vs. Rate 2[1]

Climate Region	Segment	Control Mean	Control SD	Control n	Rate 2 Mean	Rate 2 SD	Rate 2 n	Statistics Mean Difference	Pooled SE	DF	t-stat	p-value	
Moderate	Non-CARE/FERA	2.6	1.7	824	2.5	1.7	1,382	-0.18	0.07	2,204	-2.37	0.018	▼
	CARE/FERA	4.1	1.8	575	4.1	1.9	947	0.05	0.10	1,520	0.49	0.627	▲
	CARE/FERA - on or eligible	4.0	1.8	822	3.9	1.9	1,349	-0.04	0.08	2,169	-0.45	0.650	▼
Cool	Non-CARE/FERA	2.2	1.56	885	2.1	1.53	1,447	-0.12	0.07	2,330	-1.76	0.078	▼
	CARE/FERA	4.0	1.82	626	3.8	1.78	1,023	-0.16	0.09	1,647	-1.76	0.079	▼
	CARE/FERA - on or eligible	3.8	1.85	842	3.7	1.82	1,349	-0.13	0.08	2,189	-1.56	0.119	▼

[1] Higher mean index scores = more economic difficulty.

Figure 6.5-6: Mean Economic Index Scores, Control vs. Rate 2 for Key Segments in Moderate Region[1]



[1] Higher mean index scores = more economic difficulty.

Health Index: Table 6.5-7 shows the health index, or the proportion of households reporting at least one medical event due to heat in the summer. The percentage of respondents across all segments in Rate 2 who reported a household member needed to seek medical attention is not statistically different than the percentage of respondents in corresponding control groups. In addition, the health index is higher for low-income segments compared to non-CARE/FERA and senior segments. However, the samples sizes are too small for most segments to provide accurate results.

Table 6.5-7: Comparison of Health Index, Control vs. Rate 2[1, 2]

		Control		Rate 2		Statistics			
Climate Region	Segment	% with Event	Total N	% with Event	Total N	% Difference	SE	Z-stat	p-value
Moderate	Non-CARE/FERA	13%	15	7%	28	-6%	0.09	0.67	0.51 ▼
	CARE/FERA	35%	26	37%	41	2%	0.12	0.16	0.87 ▲
	CARE/FERA - on or eligible	33%	30	27%	56	-7%	0.10	0.64	0.52 ▼
Cool	Non-CARE/FERA	23%	13	36%	25	13%	0.16	0.81	0.42 ▲
	CARE/FERA	48%	23	27%	30	-21%	0.13	1.59	0.11 ▼
	CARE/FERA - on or eligible	42%	31	30%	37	-12%	0.12	1.05	0.29 ▼

[1] Table shows health index results for respondents who indicated someone in their household had a disability that required they keep their home cool during the summer and had air conditioning in their home.

[2] The number of total customers that require cooling for a disability and have air conditioning in the moderate and cool climate region are very small. Data are included here for completeness, but the statistical outcomes are not valid due to small sample sizes.

Cross-Group Analysis

While not all comparisons between TOU treatment rates and control conditions were significant, all but CARE/FERA participants in the moderate region showed decreased economic index scores. Further, non-CARE/FERA Rate

No Increase in Economic or Health Index Scores

Overall, there is no evidence that TOU rates increased economic or health index scores on average for any customer segment in SDG&E's service territory, including CARE/FERA customers.

segments showed significantly lower economic index scores than corresponding control segments. CARE/FERA segments showed higher economic and health index scores compared to non-CARE/FERA segments.

Question-Level Findings

The following sections compare responses between treatment and control customers for individual questions that underlie the economic and health indices. Results are presented for both rates to enable cross-rate comparisons and to facilitate identification of patterns in the results. Because of the random assignment of customers to treatment and control conditions, statistically significant differences in values between the two groups can be attributed to the TOU rates. Statistically significant differences between the control and rate groups are shaded in grey as shown in the example Table 6.5-8.

Table 6.5-8: Example of Question-Level Results Table

Climate Region	Segment	C	R1	R2
Moderate	Non-CARE/FERA	6%	4% ▼	4% ▼
	CARE-FERA	16%	17% ▲	17% ▲
Cool	Non-CARE/FERA	4%	3% ▼	4% ▼
	CARE-FERA	13%	14% ▲	11% ▼

Grey shading = statistical significance

Customers Worried About Having Enough Money to Pay Electricity Bill

Respondents rated their agreement with six statements designed to measure respondents' attitudes towards adopting energy saving behaviors using an 11-point scale with 0 meaning "do not agree at all" and 10 meaning "completely agree". One of these statements, "I often worry whether there is enough money to pay my electricity bill" is used to create the economic index (Table 6.5-9).

Respondents provided low to moderate ratings, 1.7 to 4.9, to this statement. When comparing responses between Control and Rate treatment groups, the Rate 1 and 2 non-CARE/FERA segment in the moderate climate region rated this statement lower than their Control group. Respondents in the CARE/FARE segments provided higher agreement ratings to the statement compared to those in the non-CARE/FERA segments. All significant differences were small, with differences between Control and treatment group ratings being 0.4 or less on the 11-point rating scale.

Table 6.5-9: Percentage of Respondents Reporting They Often Worry About Having Enough Money To Pay Their Electricity Bill[1]

Climate Region	Segment	I often worry whether there is enough money to pay my electricity bill		
		C	R1	R2
Moderate	Non-CARE/FERA	2.6	2.2	2.3
	CARE/FERA	4.8	4.8	4.9
Cool	Non-CARE/FERA	1.7	1.5	1.7
	CARE/FERA	4.4	4.1	4.1

[1] Used t-test, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Customers Experiencing Issues with Paying Their Bills

Respondents reported the number of times – since participating in the pilot – that their household struggled to pay: a) electricity bills, and b) bills for other basic needs such as food, housing, medicine, and other important bills. Respondents answered on a 4-point scale ranging from "none" to "3 or more times".

Table 6.5-10 shows the percent of respondents who reported having difficulty paying either their electricity bill or some other bill at least once during the summer. As shown, three of the four customer segment/climate region groups on Rate 1 had statistically significantly lower percentages reporting difficulty paying bills compared with control group customers. A lower percentage of Rate 2 customers also reported having difficulty paying bills than control customers but these differences were not statistically significant. In addition, the percent of respondent segments noting difficulty with paying bills differed segment, with much higher percentages of CARE/FERA respondents reporting difficult compared to non-CARE/FERA respondents.

Table 6.5-10: Percentage of Respondents Reporting Difficulty Paying Bills Since June 2016 [1, 2]

Climate Region	Segment	C	R1		R2	
Moderate	Non-CARE/FERA	35%	28%	▼	31%	▼
	CARE-FERA	70%	70%	▼	69%	▼
Cool	Non-CARE/FERA	27%	22%	▼	25%	▼
	CARE-FERA	71%	65%	▼	65%	▼

[1] Grey shading indicates a significant difference in the responses between control and rate group for that segment (using z-test for proportions and an alpha level of .05).

[2] Table shows the percent of respondents who either had difficulty paying their electricity bill or other bills at least one time during the summer.

Financial Well-Being (CFPB)

To gauge respondents' financial health, customers were asked about five items sourced from the Consumer Financial Protection Bureau (CFPB). For the first three items, respondents are asked how each describes their situation using a scale including "not at all," "very little," "somewhat," "very well," and "completely." For the last two items, respondents were asked how often each applies to them using a scale including "never," "rarely," "sometimes," "often," and "always." The CFPB items are:

- Because of my money situation, I feel like I will never get the things I want in life.
- I am just getting by financially.
- I am concerned that the money I have won't last.
- I have money left over at the end of the month.
- My finances control my life.

Using answers to these five items, each respondent's financial well-being score was calculated, with values ranging from 19 (low financial well-being) to 90 (high financial well-being).[130]

As shown in Table 6.5-11, SDG&E respondents demonstrated a relatively tight range of financial well-being scores, with average scores ranging from roughly 46 to 59 (higher scores indicate higher financial well-being). Both Rate 1 and 2 non-CARE/FERA TOU segments had statistically significantly higher financial well-being scores than their corresponding control groups, although the differences are small in absolute and percentage terms. Further, within each climate region and rate, CARE/FERA customers reported lower financial well-being, on average, than non-CARE/FERA customers.

Table 6.5-11: Average Financial Well-Being Scores[1]

Climate Region	Segment	C	R1		R2	
Moderate	Non-CARE/FERA	55.1	57.0	▲	56.7	▲
	CARE-FERA	46.8	46.2	▼	46.9	▲
Cool	Non-CARE/FERA	57.3	59.4	▲	58.6	▲
	CARE-FERA	46.9	48.1	▲	47.6	▲

[1] Grey shading indicates a significant difference in the responses between control and rate group for that segment (using t-test and an alpha level of .05)

Number of Alternative Methods Used to Pay Bills

Respondents reported how they afforded to pay electricity bills and/or other basic needs over the summer. Respondents could select as many of the following options that applied to their household:

- Use your household's current income
- Use your household's savings or other investments
- Cut back on non-essential spending for things your household wants
- Reduce your household energy usage
- Borrow money from family, friends, or peers
- Borrow money using a short-term loan
- Use a credit card that you can't pay off right away
- Leave rent/mortgage unpaid
- Leave some household bills unpaid past the due date
- Received emergency assistance from [IOU NAME]
- Received emergency assistance from other city or regional programs

Reducing household energy usage and cutting back on non-essential spending are included in the percent of respondents (by rate and segment) that reported using any of the options other than 'current income.' This metric, therefore, measured the maximum number of customers in each segment, by rate that took some type of action, however small, to help pay their bills.

[130] The financial well-being score is a methodologically rigorous scale from the Consumer Financial Protection Bureau that measures a customer's financial well-being. The Consumer Financial Protection Bureau's methods for the abbreviated version of their "Financial Well-Being Scale" was followed. See the following documentation for full methodological details: http://files.consumerfinance.gov/f/201512_cfpb_financial-well-being-user-guide-scale.pdf

As shown in Table 6.5-12, about half to three-fourths of each segment on each rate plan reported using non-income strategies to afford bill payments. Neither TOU rate was associated with increases in use of non-income strategies. CARE/FERA customers were the most likely to report non-income strategies to afford bill payments.[131]

Table 6.5-12: Percentage of Respondents Reporting Affording Summer Bill Payments Using Sources Other than Current Income [1]

Climate Region	Segment	C	R1		R2	
Moderate	Non-CARE/FERA	57%	57%	▼	57%	▼
	CARE-FERA	76%	76%	▼	74%	▼
Cool	Non-CARE/FERA	50%	48%	▼	48%	▼
	CARE-FERA	74%	77%	▲	74%	▲

[1] Grey shading indicates a significant difference in the responses between control and rate group for that segment (using z-test for proportions and an alpha level of .05)

6.5.2 Other Research Topics

The remainder of this section summarizes findings from the other research topics that were covered by the survey.

Motivations for Participating in the Study

Participation Recall Rate

Nearly all surveyed SDG&E customers (between 91% and 98%) recalled participating in the study (Table 6.5-13). When comparing responses between Control and Rate treatment groups the CARE FERA and non-CARE/FERA segments in the moderate climate region and the CARE/FERA segment in the cool climate region showed significant differences. While statistically significant, these differences between responses are 5% or less. In addition, slightly fewer respondents in the CARE/FERA segments recalled participating in the study compared to those in the non-CARE/FERA segments (differences of 5% or less).

Table 6.5-13: TOU Study Participation Recall Rates[1]

		Recalls participating in the study		
Climate Region	Segment	C	R1	R2
Moderate	Non-CARE/FERA	96%	98%	98%
	CARE/FERA	91%	95%	94%
Cool	Non-CARE/FERA	97%	98%	98%
	CARE/FERA	92%	97%	96%

[1] Chi-square used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

[131] The percentages in Table 6.5-12 are significantly lower if "reduce your household energy use" is excluded from the tabulations. For non-CARE/FERA households in the moderate climate region, for example, dropping this option from the tabulation reduces the percentages by 12 percentage points (from 57% to 45%). The main conclusion, that there are no statistically significant differences between treatment and control customers, does not change if "reduce your household energy use" is excluded from the tabulations.

Motivations to Participate

Between 40% and 50% of respondents across all segments reported their primary motivation for participating in the study was to save money on their electricity bills (Table 6.5-14). More respondents in the CARE/FERA groups reported their primary motivation as saving money compared than those in the non-CARE/FERA groups. Earning a bill credit(s) was the second most mentioned motivation reported by respondents across all segments (ranging from 22% to 24%). Since it was not expected that the motivation to participate would be influenced by rate treatment group assignment, responses across control and rate treatment groups are combined for this analysis.

Table 6.5-14: Primary Motivation for TOU Study Participation

Climate Region	Segment	To save money on electricity bill	To earn a bill credit	Environmentally responsible	Other[1]
Moderate	Non-CARE/FERA	44%	22%	11%	23%
	CARE/FERA	50%	23%	9%	18%
Cool	Non-CARE/FERA	40%	23%	13%	24%
	CARE/FERA	46%	24%	12%	18%

[1] 'Other' includes: bill protection makes it risk free, to be one of the first to learn about new rates, to give PG&E my feedback on the plan, and other.

Customer Outreach: Welcome Packet

SDG&E sent Rate group customers a welcome packet that included information about their rate and tips for reducing or shifting their energy usage. Most surveyed customers, between 90% and 97%, reported receiving their TOU welcome packet, and of those between 87% and 94% reported looking through it (Table 6.5-15). The lowest percentages were reported by CARE/FERA customers in the cool climate region but even for this group, 90% reported receiving the welcome packet.

Table 6.5-15: Percentage of Respondents Who Received and Looked Through Their TOU Welcome Packet

Climate Region	Segment	Received welcome packet[1] R1	Received welcome packet[1] R2	Looked through welcome packet[2] R1	Looked through welcome packet[2] R2
Hot	General	-	92%	-	93%
Moderate	Non-CARE/FERA	97%	96%	94%	92%
	CARE/FERA	95%	94%	92%	89%
Cool	Non-CARE/FERA	97%	95%	93%	93%
	CARE/FERA	90%	90%	87%	88%

[1] Asked only of Rate groups; Control group did not receive a welcome packet.

[2] Asked only to respondents who reported receiving the welcome packet.

Customers who received and looked through their welcome packet agreed that most of the information in the packet clearly explained how the price of electricity varied on their rate plan (Table 6.5-16). Customers gave these items the highest average rating on an 11-point scale where 0 means "do not agree at all" and 10 means "completely agree". Customers also mostly agreed that the items in the packet were easy to understand, that they understood how their rate worked after looking at the packet, and that they used many of the tips included in the packet. Customers somewhat agreed that the decals and stickers were helpful. CARE/FERA customers reported slightly higher average agreement ratings, compared to non-CARE/FERA customers, with two aspects about the welcome packet: that they used many of the tips and that the decals and stickers were helpful. CARE/FERA customers reported lower ratings, in general, compared to non-CARE/FERA customers for the other three aspects about the packet.

Table 6.5-16: Average Level of Agreement with Aspects of Their TOU Welcome Packet[1,2]

Climate Region	Segment	Info explained how price of electricity varied		The items were easy to understand		After packet, I understand how the rate works		I used many of the tips		The decals or stickers were helpful	
		R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
Hot	General	-	8.2	-	8.1	-	7.6	-	6.7	-	4.0
Moderate	Non-CARE/FERA	8.2	8.0	8.0	7.9	7.6	7.4	6.8	6.7	4.6	4.4
	CARE/FERA	8.0	8.0	7.7	7.8	7.2	7.3	7.0	7.0	5.8	5.8
Cool	Non-CARE/FERA	8.3	8.1	8.1	7.9	7.7	7.5	6.7	6.4	4.5	4.1
	CARE/FERA	8.0	8.2	7.8	8.1	7.2	7.5	7.1	7.1	5.5	5.9

[1] Agreement ratings are based on an 11-point scale where 0 means 'do not agree at all' and 10 means 'completely agree'.

[2] Asked only to Rate groups who reported looking through the packet; Control group did not receive a welcome packet.

Satisfaction

Satisfaction with SDG&E and Rate Plan

Overall, surveyed customers reported being somewhat to mostly satisfied with SDG&E and their rate plan. Ratings were on an 11-point scale, where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'. As shown in Table 6.5-17, customers were slightly more satisfied with SDG&E (6.5 to 7.9) than with their rate plan (6.0 to 7.5). CARE/FERA control group customers in the moderate region were slightly more satisfied with SDG&E and the rate plan compared to Rate group customers but these small differences were statistically significant given the high statistical power of the survey sample. In addition, CARE/FERA customers reported higher average satisfaction ratings for SDG&E and the rate plan compared to non-CARE/FERA customers, and satisfaction ratings among hot and moderate climate region customers were slightly lower than cool region customers.

Table 6.5-17: Average Level of Satisfaction with SDG&E and Their Rate Plan[1,2]

Climate Region	Segment	Satisfaction with SDG&E			Satisfaction with rate		
		C	R1	R2	C	R1	R2
Hot	General	-	-	6.5	-	-	6.0
Moderate	Non-CARE/FERA	6.8	6.7 ▼	6.7 ▼	6.0	6.1 ▲	6.1 ▲
	CARE/FERA	7.9	7.6 ▼	7.6 ▼	7.3	7.0 ▼	7.0 ▼
Cool	Non-CARE/FERA	7.1	6.9 ▼	7.0 ▼	6.3	6.4 ▲	6.5 ▲
	CARE/FERA	7.9	7.8 ▼	7.8 ▼	7.5	7.3 ▼	7.4 ▼

[1] Satisfaction ratings based on 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Table 6.5-18 and Table 6.5-19 show additional statistics for Control vs. Rate group comparisons of average satisfaction with SDG&E. Table 6.5-20 and Table 6.5-21 show additional statistics for Control vs. Rate group comparisons of average satisfaction with the rate.

Table 6.5-18: Average Level of Satisfaction with SDG&E, Control vs. Rate 1[1,2]

Climate Region	Segment	Control			Rate 1			Statistics				
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value
Moderate	Non-CARE/FERA	6.8	2.3	881	6.7	2.4	861	-0.12	0.11	1,740	-1.09	0.278 ▼
	CARE/FERA	7.9	2.4	661	7.6	2.4	645	-0.28	0.13	1,304	-2.09	0.037 ▼
Cool	Non-CARE/FERA	7.1	2.2	908	6.9	2.3	923	-0.16	0.11	1,829	-1.55	0.121 ▼
	CARE/FERA	7.9	2.2	713	7.8	2.3	698	-0.12	0.12	1,409	-1.00	0.316 ▼

[1] Satisfaction ratings based on 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Table 6.5-19: Average Level of Satisfaction with SDG&E, Control vs. Rate 2[1,2]

Climate Region	Segment	Control			Rate 2			Statistics				
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	General				6.5	2.6	348					
Moderate	Non-CARE/FERA	6.8	2.3	881	6.7	2.4	1,478	-0.12	0.10	2,357	-1.21	0.227 ▼
	CARE/FERA	7.9	2.4	661	7.6	2.5	1,091	-0.28	0.12	1,750	-2.33	0.020 ▼
Cool	Non-CARE/FERA	7.1	2.2	908	7.0	2.2	1,541	-0.05	0.09	2,447	-0.56	0.577 ▼
	CARE/FERA	7.9	2.2	713	7.8	2.3	1,171	-0.07	0.11	1,882	-0.65	0.515 ▼

[1] Satisfaction ratings based on 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Table 6.5-20: Average Level of Satisfaction with Rate, Control vs. Rate 1[1,2]

Climate Region	Segment	Control			Rate 1			Statistics				
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value
Moderate	Non-CARE/FERA	6.0	2.5	908	6.1	2.4	889	0.12	0.11	1,795	1.03	0.304 ▲
	CARE/FERA	7.3	2.6	690	7.0	2.6	669	-0.29	0.14	1,357	-2.04	0.042 ▼
Cool	Non-CARE/FERA	6.3	2.4	937	6.4	2.3	941	0.10	0.11	1,876	0.95	0.342 ▲
	CARE/FERA	7.5	2.4	744	7.3	2.5	724	-0.15	0.13	1,466	-1.22	0.223 ▼

[1] Satisfaction ratings based on 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.
[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Table 6.5-21: Average Level of Satisfaction with Rate, Control vs. Rate 2[1,2]

Climate Region	Segment	Control			Rate 2			Statistics				
		Mean	SD	n	Mean	SD	n	Mean Difference	Pooled SE	DF	t-stat	p-value
Hot	General				6.0	2.5	358					
Moderate	Non-CARE/FERA	6.0	2.5	908	6.1	2.5	1,517	0.06	0.10	2,423	0.61	0.540 ▲
	CARE/FERA	7.3	2.6	690	7.0	2.6	1,151	-0.26	0.13	1,839	-2.07	0.038 ▼
Cool	Non-CARE/FERA	6.3	2.4	937	6.5	2.3	1,578	0.14	0.10	2,513	1.48	0.140 ▲
	CARE/FERA	7.5	2.4	744	7.4	2.5	1,220	-0.11	0.11	1,962	-0.95	0.343 ▼

[1] Satisfaction ratings based on 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.
[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Higher Agreement Scores for TOU Customers on Several Factors

Many customer segments on TOU rates gave higher average agreement ratings compared with control customers on statements concerning ease of understanding of the rate and the rate offering opportunities to save money.

Surveyed customers were asked to rate their level of agreement with eleven aspects about their rate plan, using an 11-point scale, where 0 means 'do not agree at all' and 10 means 'completely agree'. Customers reported the highest average agreement with the statement that the peak and off-peak time periods are easy to remember (7.4 to 8.1), and that their electricity bill helps them understand the time of day they're spending the most on electricity (7.0 to 7.7) (Table 6.5-22). Customers also somewhat to mostly agreed that the rate (6.2 to 7.1) and electricity bill (6.6 to 7.2) are easy to understand, they would recommend the rate plan to friends or family (6.3 to 7.7), the rate provided opportunities to save money (5.8 to 7.4), and they want to stay on the rate plan after the study ends (6.3 to 7.8) (Table 6.5-21 & Table 6.5-23). Customers somewhat agreed that the rate is fair (5.6 to 6.8) or affordable (5.4 to 6.8), the new rate is better than their old rate (5.5 to 6.8), and the rate works with their household schedule (5.3 to 6.8).

Rate group customers in all segments reported significantly lower average agreement compared to the respective Control group customers in regarding the rate working with their household schedule (Table 6.5-23). Conversely, half or more of Rate group segments had significantly higher agreement compared to respective Control groups with several aspects about their rate plan. These include recommending the rate to friends or family, wanting to stay on the rate after the study ends, the rate being easy to understand, the rate providing opportunities to save money, and the rate being fair (Table 6.5-22 & Table 6.5-23). The statistically significant differences, however, are substantively small for most comparisons (one point or less on an 11-point scale). In addition, CARE/FERA customers reported higher average agreement ratings across most of the aspects of their rate plan compared to non-CARE/FERA customers.

Table 6.5-22: Average Level of Agreement with Aspects About Their Rate Plan (Aspects 1-6)[1,2,3]

		The peak and off-peak times are easy to remember[4]		Bill hleps me understand time of day when spending most[4]		Rate is easy to understand			Bill is easy to understand			Recommend to friends or family			Rate gave opp. to save money		
Climate Region	Segment	R1	R2	R1	R2	C	R1	R2	C	R1	R2	C	R1	R2	C	R1	R2
Hot	General	-	8.0	-	7.4	-	-	6.9	-	-	6.6	-	-	6.6	-	-	6.6
Moderate	Non-CARE/FERA	7.4	7.9	7.0	7.2	6.2	6.8	6.8	6.6	6.4	6.6	6.3	6.5	6.7	5.8	6.6	6.6
	CARE/FERA	7.4	7.8	7.2	7.4	6.7	6.6	6.9	7.2	6.8	7.1	7.4	7.1	7.5	7.1	6.9	7.0
Cool	Non-CARE/FERA	7.4	7.9	7.1	7.1	6.5	7.0	6.9	6.7	6.6	6.6	6.4	6.8	6.8	6.0	6.9	6.8
	CARE/FERA	7.6	8.1	7.6	7.7	6.8	7.1	7.1	7.2	6.9	7.2	7.6	7.4	7.7	6.9	7.4	7.3

[1] Agreement ratings are based on an 11-point scale where 0 means 'do not agree at all' and 10 means 'completely agree'.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

[3] The Hot Climate Region included only a Rate 2 group (not a Control or Rate 1 group).

[4] Asked only to Rate groups.

Table 6.5-23: Average Level of Agreement with Aspects About Their Rate Plan (Aspects 7-11)[1,2,3]

		Want to stay on rate after study ends			Rate is fair			Rate is affordable			New rate is better than old rate[4]		Rate works with HH Schedule		
Climate Region	Segment	C	R1	R2	C	R1	R2	C	R1	R2	R1	R2	C	R1	R2
Hot	General	-	-	6.3	-	-	5.6	-	-	5.4	-	5.5	-	-	5.5
Moderate	Non-CARE/FERA	6.4	6.3	6.5	5.6	5.7	5.8	5.5	5.6	5.7	5.6	5.8	5.9	5.3	5.4
	CARE/FERA	7.5	6.9	7.2	6.5	6.2	6.4	6.6	6.2	6.4	6.1	6.4	6.6	6.0	6.1
Cool	Non-CARE/FERA	6.6	6.7	6.5	5.9	6.2	6.1	5.9	6.0	6.0	6.1	6.0	6.0	5.8	5.7
	CARE/FERA	7.8	7.3	7.5	6.5	6.7	6.8	6.6	6.6	6.8	6.5	6.8	6.8	6.3	6.5

[1] Agreement ratings are based on an 11-point scale where 0 means 'do not agree at all' and 10 means 'completely agree'.

[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

[3] The Hot Climate Region included only a Rate 2 group (not a Control or Rate 1 group).

[4] Asked only to Rate groups.

Perception of Bill Amount

Respondents reported how the amount of their electricity bill – since participating in the pilot – has compared to their expectations. Respondents chose from the following options: higher than you expected; about the same as you expected; lower than you expected; or did not have any expectation.

Table 6.5-24 shows the percent of respondents reporting that their bill was higher than expected. Less than one-third of customers in each segment and Rate group reported that their bills had been higher than expected. These percentages are much lower than was seen for PG&E and SCE. Significantly fewer CARE/FERA customers on Rate 2 in the cool climate region reported their bills had been higher than expected compared to the Control group. There were no significant differences between other rate and control groups. Overall, perceptions of higher than expected bills were highest for moderate region segments compared to cool region segments.

Table 6.5-24: Percentage of Respondents Reporting That Their Electricity Bills Have Been Higher Than They Expected Since June 2016[1]

Climate Region	Segment	C	R1	R2
Moderate	Non-CARE/FERA	32%	30% ▼	31% ▼
	CARE-FERA	30%	32% ▲	31% ▲
Cool	Non-CARE/FERA	27%	27% ▼	27% ▼
	CARE-FERA	25%	24% ▼	19% ▼

[1] Z-test for proportions used, grey shading indicates statistically significant difference versus Control group at p≤.05.

Reason for Rate Change

When asked why California utilities are changing rates, respondents overwhelmingly selected "to give customers an incentive to reduce electricity at times when use is high", and "to improve the reliability of the power grid and avoid power outages" (Table 6.5-25 & Table 6.5-26). Respondents chose other reasons less frequently. The least likely reason selected was "to help SDG&E make more money." Generally, more Rate group customers selected "to improve reliability" as a reason than the corresponding Control group. While there are other significant differences between Rate and Control groups for other reasons selected, no meaningful trends emerged.

Table 6.5-25: Reasons for Why CA Utilities are Changing to TOU Rates (Reasons 1-4)[1]

		Help customers save money on electricity bills			Improve reliability of the electricity power grid and avoid power outages			Better align the price customers pay for electricity to the actual cost to produce and deliver it			Help reduce the need to build new power plants		
Climate Region	Segment	C	R1	R2	C	R1	R2	C	R1	R2	C	R1	R2
Hot	Non-CARE/FERA	-	-	52%	-	-	82%	-	-	58%	-	-	46%
Moderate	Non-CARE/FERA	69%	55%	54%	78%	86%	86%	57%	66%	64%	45%	47%	48%
	CARE/FERA	74%	71%	72%	76%	84%	85%	56%	69%	67%	41%	48%	50%
Cool	Non-CARE/FERA	47%	51%	52%	88%	86%	89%	53%	68%	68%	47%	52%	56%
	CARE/FERA	73%	69%	73%	78%	87%	85%	64%	70%	70%	46%	53%	49%

[1] Z-test for proportions used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

Table 6.5-26: Reasons for Why CA Utilities are Changing to TOU Rates (Reasons 5-8)[1]

		Balance the electric grid due to the growing amount of renewable energy			Give customers an incentive to reduce use at times when electricity use is high			Help utility make more money			Help utility keep energy costs down		
Climate Region	Segment	C	R1	R2	C	R1	R2	C	R1	R2	C	R1	R2
Hot	Non-CARE/FERA	-	-	56%	-	-	90%	-	-	35%	-	-	56%
Moderate	Non-CARE/FERA	63%	57%	55%	88%	92%	91%	17%	33%	30%	71%	62%	62%
	CARE/FERA	61%	57%	60%	85%	88%	90%	16%	20%	19%	76%	73%	72%
Cool	Non-CARE/FERA	50%	54%	56%	90%	93%	94%	31%	28%	28%	64%	66%	66%
	CARE/FERA	61%	64%	61%	86%	92%	90%	20%	18%	20%	75%	75%	74%

[1] Z-test for proportions used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

Frequency of Being Uncomfortably Hot in Home

Respondents reported how frequently they had been uncomfortably hot in their home this summer due to trying to save money on electricity bills. Respondents chose from the following options: never, rarely, sometimes, most of the time, or always. Table 6.5-27 shows the percent of customers that responded either most of the time or always (summarized as "most to all of the time").

About one-third or less of each segment on each rate plan reporting being uncomfortably hot most to all of the time. More CARE/FERA customers in the Rate groups reported being uncomfortably hot than the Control group but the differences are not significant. CARE/FERA segments reported higher frequency of being uncomfortably hot compared to non-CARE/FERA customers, with CARE/FERA customers being about twice as likely to report frequent discomfort.

Table 6.5-27: Percentage of Respondents Reporting Being Uncomfortably Hot 'Most to All of the Time' Since June 2016 Due to Trying to Save on Electricity Bills[1]

Climate Region	Segment	C	R1		R2	
Moderate	Non-CARE/FERA	18%	17%	▼	19%	▲
	CARE-FERA	33%	36%	▲	34%	▲
Cool	Non-CARE/FERA	14%	11%	▼	12%	▼
	CARE-FERA	27%	30%	▲	25%	▼

[1] Z-test for proportions used, grey shading indicates statistically significant difference versus Control group at p≤.05.

Understanding How Rates Work

As a test to determine the extent to which respondents understood what influences the price of electricity on their rate, respondents were asked to identify which of five factors influences their electricity price. The correct answers varied among control and rate groups. The list of factors and the groups for whom the factors are correct included:

- Time of day: a correct answer for both Rate groups,
- Day of week (weekends vs. weekdays): a correct answer for Rate 1,
- Seasons: a correct answer for both Rate groups,
- Weather or temperature: an incorrect answer for all groups, and
- Total amount of electricity used: a correct answer for all groups.

Table 6.5-28 reports the percentage of customers that selected over half of the correct answers for their rate plan. Overall, between 28% and 48% of customers understood over half of the factors that influence their electricity rate (Table 6.5-27). Significantly fewer customers in three of the four Rate 1 groups selected over half the correct answers compared to the Control groups. On average, respondents in the CARE/FERA segments were least likely to select over half the correct answer(s) compared to the corresponding non-CARE/FERA segments. In addition, more Rate 2 customers selected over half the correct answers than Rate 1 customers.

Table 6.5-28: Percentage of Respondents Who Selected Over Half of the Correct Factors that Influence the Price of Electricity on their Rate Plan[1,2]

Climate Region	Segment	% Selected Over Half the Correct Answers C	R1	R2
Hot	General	-	-	28%
Moderate	Non-CARE/FERA	47%	42%	48%
	CARE/FERA	43%	31%	40%
Cool	Non-CARE/FERA	44%	42%	48%
	CARE/FERA	44%	34%	43%

[1] Z-test for proportions used, shading indicates statistically significant difference versus Control group at p≤.05.

[2] Factors include: Time of day, day of week, season, weather/temperature, total amount of electricity used

Rate group customers were also asked to select the hours of the day, from 12 am to midnight, when electricity is most expensive on their rate plan to determine the extent they know the peak hours of their rate. For both Rates groups, the correct hours are 4 pm to 9 pm.

Table 6.5-29 shows the percent of customers in each segment who, on average, got none of the hours correct and who got over half of the hours correct. As shown, between 37% and 57% of customers selected over half of the correct hours for their rate plan, which is slightly better than their understanding of the general factors that influence the price of their electricity (Table 6.5-28). A much lower percentage of customers, 6% to 17%, did not select any of the correct hours. On average, respondents in the CARE/FERA segments were most likely to not select any of the correct hours of the day when electricity is most expensive, compared to the corresponding non-CARE/FERA customers.

Table 6.5-29: Percentage of Respondents Who Selected None or Over Half of the Correct Times of the Day When the Price of Electricity is Most Expensive on their Rate Plan[1]

Climate Region	Segment	% Selected No Correct Answers R1	% Selected No Correct Answers R2	% Selected Over Half the Correct Answers R1	% Selected Over Half the Correct Answers R2
Hot	General	-	12%	-	48%
Moderate	Non-CARE/FERA	10%	8%	56%	57%
	CARE/FERA	18%	17%	35%	37%
Cool	Non-CARE/FERA	6%	8%	56%	56%
	CARE/FERA	15%	15%	37%	38%

[1] Asked only to Rate groups since Control group customers' rate does not vary by time of day.

Actions Taken

Customers were asked how frequently they took ten different actions in the afternoons and evenings to reduce or shift their electricity usage. Customers could choose always, usually, sometimes, rarely, never, or not applicable. Table 6.5-30 & Table 6.5-31 report the percentage of respondents who reported taking the actions 'often,' which is a combination of 'always' and 'usually'. Customers who reported 'not applicable' were excluded.

Overall, surveyed customers reported that turning off lights not in use (85%-94%), avoiding doing laundry (49%-77%), and/or avoiding running the dishwasher (51%-78%) were the most common actions they took to reduce electricity usage in the afternoons and evenings. Many customers also reported that they 'often' turned off office equipment (40%-60%), turned off air conditioning (48%-58%), increased their thermostat temperature (28%-53%), and avoided running their pool/spa pump (39%-67%). The least common actions customers reported taking were avoiding cooking (15%-35%), turning off entertainment equipment (26%-47%), and pre-cooling their home (17%-36%).

Nearly all Rate group customers (vs. Control group customers) reported more frequently taking most of the actions. However, trends and significant differences between rates/segments/regions were mostly unique for each action, as follows:

- **Turned off lights not in use:** no significant differences between rate and control groups; most frequently done by hot climate region customers (vs. customers in moderate and cool regions) (Table 6.5-30).
- **Avoided doing laundry:** significantly more customers in all Rate group segments reported taking action vs. Control group customers; more Non-CARE/FERA customers (vs. CARE/FERA customers), and more hot climate region customers, followed by customers in moderate and cool region customers, respectively, reported taking action (Table 6.5-30).
- **Avoided running the dishwasher:** significantly more customers in all Rate group segments reported taking action (vs. Control group customers); more Non-CARE/FERA and senior customers reported taking action (vs. low-income customers) (Table 6.5-30).
- **Turned off office equipment:** no significant differences between rate and control groups except fewer Rate group 1 CARE/FERA customers in the moderate climate region reported taking action (vs. Control group customers); and, more CARE/FERA customers reported taking action (vs. Non-CARE/FERA customers) (Table 6.5-30).

- **Avoided cooking:** significantly fewer Rate group 1 non-CARE/FERA customers in the moderate climate region reported taking action (vs. Control group customers) but there were no other significant differences; more CARE/FERA customers reported taking action (vs. non-CARE/FERA customers) (Table 6.5-30).

Table 6.5-30: Percentage of Respondents Who Reported Taking Actions 'Often' to Reduce or Shift Their Electricity Usage in the Afternoons and Evenings (Actions 1-5)[1,2]

Climate Region	Segment	Turned off lights C	Turned off lights R1	Turned off lights R2	Avoided laundry C	Avoided laundry R1	Avoided laundry R2	Avoided diswasher C	Avoided diswasher R1	Avoided diswasher R2	Turned off office equip C	Turned off office equip R1	Turned off office equip R2	Avoided cooking C	Avoided cooking R1	Avoided cooking R2
Hot	General	-	-	94%	-	-	77%	-	-	77%	-	-	51%	-	-	28%
Moderate	Non-CARE/FERA	88%	91%	87%	54%	73%	72%	59%	76%	78%	47%	46%	46%	20%	24%	24%
	CARE/FERA	88%	87%	87%	58%	67%	67%	63%	69%	72%	64%	59%	61%	33%	32%	33%
Cool	Non-CARE/FERA	86%	85%	86%	49%	69%	70%	51%	71%	74%	41%	38%	40%	15%	18%	18%
	CARE/FERA	88%	87%	89%	58%	65%	66%	56%	71%	70%	55%	60%	60%	32%	35%	31%

[1] Chi-square used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.
[2] Survey responses 'usually' and 'always' combined into 'often'.

- **Turned off entertainment equipment:** no significant differences between rate and control groups except fewer Rate 2 non-CARE/FERA customers in the cool region reported taking action (vs. Control group customers); more CARE/FERA customers reported taking action (vs. non-CARE/FERA customers) (Table 6.5-31).
- **Turned off air-conditioning:** no significant differences between rate and control groups except fewer Rate 2 CARE/FERA customers in the cool region reported taking action (vs. Control group customers); (Table 6.5-31).
- **Increased temperature on the thermostat:** no significant differences between rate and control groups; more non-CARE/FERA customers (vs. non-CARE/FERA customers) and more hot and moderate region customers (vs. cool region customers) reported taking action (Table 6.5-31).
- **Pre-cooled home earlier in the day:** significantly more Rate 2 group customers reported taking action (vs. Control group customers); more CARE/FERA customers reported taking action (vs. non-CARE/FERA customers) (Table 6.5-31).
- **Avoided running pool or spa pump:** significantly more Rate 1 and 2 non-CARE/FERA customers in both climate regions and significantly fewer Rate 1 CARE/FERA customers in the cool region reported taking action (vs. Control group customers; more non-CARE/FERA customers reported taking action (vs. CARE/FERA customers) (Table 6.5-31).

Table 6.5-31: Percentage of Respondents Who Reported Taking Actions 'Often' to Reduce or Shift Their Electricity Usage in the Afternoons and Evenings (Actions 6-10)[1,2]

Climate Region	Segment	Turned off entertainment equip C	Turned off entertainment equip R1	Turned off entertainment equip R2	Turned off AC C	Turned off AC R1	Turned off AC R2	Increased temp on thermostat C	Increased temp on thermostat R1	Increased temp on thermostat R2	Precooled home C	Precooled home R1	Precooled home R2	Avoided pool/spa pump C	Avoided pool/spa pump R1	Avoided pool/spa pump R2
Hot	General	-	-	28%	-	-	49%	-	-	53%	-	-	36%	-	-	63%
Moderate	Non-CARE/FERA	31%	31%	29%	51%	54%	56%	46%	52%	50%	24%	28%	28%	48%	63%	67%
	CARE/FERA	46%	42%	44%	56%	56%	58%	40%	36%	37%	30%	36%	36%	48%	50%	52%
Cool	Non-CARE/FERA	32%	29%	26%	53%	51%	49%	38%	39%	41%	17%	20%	23%	44%	56%	53%
	CARE/FERA	43%	45%	47%	48%	56%	53%	29%	30%	28%	27%	33%	33%	47%	39%	50%

[1] Chi-square used, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.
[2] Survey responses 'usually' and 'always' combined into 'often'.

Respondents had the option to provide a 'Not Applicable' (NA) response to all the actions taken asked in the survey. These NA responses can serve as a rough proxy measure for whether respondents have air conditioning, laundry, or dishwashers in their home. While not a perfect measure of availability in the home, these responses indicate that, when compared to non-CARE/FERA households, more CARE/FERA households indicated NA for avoiding laundry use, avoiding dishwasher use, and turning off office equipment (Table 6.5-32). A similar proportion of CARE/FERA and non-CARE/FERA households indicated

NA to their ability to turn off entertainment equipment, air conditioning actions, and avoiding using spa or pool-pump.

Table 6.5-32: Not Applicable Responses for Key Actions Taken by Segment

Climate Region	Segment	Avoided laundry	Avoided dishwasher	Turned off office equipment	Turned off entertainment equipment	Increased thermostat temp	Turned off air-conditioning	Pre-cooled home	Avoided pool/spa pump
Hot	General	4%	30%	12%	6%	25%	22%	26%	72%
Moderate	Non-CARE/FERA	7%	19%	7%	5%	20%	17%	20%	78%
	CARE/FERA	20%	37%	17%	7%	26%	20%	25%	75%
Cool	Non-CARE/FERA	10%	20%	8%	6%	39%	43%	45%	80%
	CARE/FERA	24%	43%	18%	8%	42%	45%	48%	81%

Overall, customers reported that taking actions to reduce or shift their electricity usage in the afternoons and evenings were somewhat easy (Table 6.5-33). On a scale of 0 to 10, where 0 means 'not at all easy' and 10 means 'extremely easy', customers reported an average rating between 6.0 and 6.8 across the groups and segments. No significant differences were found between rate and control group customers except Rate 2 non-CARE/FERA customers in the cool region reported a slightly but significantly higher average rating compared to the Control group.

Table 6.5-33: Respondents' Average Level of Ease of Taking Energy Saving Actions in the Afternoons and Evenings[1,2]

Climate Region	Segment	Ease of taking action C	R1		R2	
Hot	General	-	-		6.2	
Moderate	Non-CARE/FERA	6.0	6.2	▲	6.2	▲
	CARE/FERA	6.2	6.2	▼	6.3	▲
Cool	Non-CARE/FERA	6.0	6.3	▲	6.4	▲
	CARE/FERA	6.6	6.7	▲	6.8	▲

[1] Level of ease ratings are based on an 11-point scale where 0 means 'not at all easy' and 10 means 'extremely easy'.
[2] T-test used, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Respondents were also asked which of 10 barriers keep them from reducing or shifting their electricity usage in the afternoons and evenings (Table 6.5-34 &Table 6.5-35).[132] Across the climate regions and segments, the most common barriers to reducing or shifting electricity usage during the afternoons and evenings reported by customers include the household already using very little electricity (29%-40%), the respondent being home most of the day (27%-33%), and the home gets uncomfortable (13%-26%) (Table 6.5-34). The least common barriers reported by customers include the presence of elderly household member(s) (5%-13%) and the presence of disabled household member(s) (3%-9%).

There is some variation between rates/segments/regions but trends were mostly unique for each barrier, as follows:

[132] The original list of barriers includes 13 but three were excluded from the report. Two of these are not 'barriers' but provide respondents an answer option: 'nothing prevents customers from reducing/shifting usage' and 'customers can afford to use as much as they want or need'. The third barrier is very similar to one included in the analysis: 'customer doesn't know what actions to take' (very similar to 'customer can't think of anything else to do').

- **Household already uses little electricity:** significantly fewer Rate 1 and 2 non-CARE/FERA customers in the cool region reported the barrier (vs. Control group customers); more CARE/FERA customers reported the barrier, on average (vs. non-CARE/FERA customers) (Table 6.5-34).
- **Respondent at home most of the day:** no significant differences between rate and control groups; slightly more CARE/FERA customers (vs. non-CARE/FERA customers) and cool region customers (vs. hot and moderate regions) reported the barrier, on average (Table 6.5-34).
- **Home gets uncomfortable:** no significant differences between rate and control groups except significantly fewer Rate 2 CARE/FERA customers in the cool region reported the barrier (vs. Control group customers); fewer CARE/FERA customers in the moderate climate region (vs. non-CARE/FERA customers) and cool region customers (vs. hot and moderate climate region customers) reported the barrier, on average (Table 6.5-34).
- **Children in household:** significantly more Rate 1 and 2 CARE/FERA customers in the moderate region and Rate 1 non-CARE/FERA customers in the cool region reported the barrier (vs. Control group customers); more CARE/FERA customers reported the barrier, on average (vs. non-CARE/FERA customers) (Table 6.5-34).
- **Schedule doesn't allow it:** significantly more Rate 1 and 2 customers reported the barrier (vs. Control groups), except Rate 2 CARE/FERA customers; more non-CARE/FERA customers reported the barrier, on average (vs. CARE/FERA customers) (Table 6.5-34).

Table 6.5-34: Percentage of Respondents Who Reported Barriers to Reducing or Shifting Their Electricity Use During Afternoons and Evenings (Barriers 1-5)[1,2]

Climate Region	Segment	My household already uses very little electricity			I am at home most of the day			My home gets uncomfortable if I try to reduce electricity usage			Child(ren) in household make it difficult to change our routines			My schedule doesn't allow me to reduce my usage		
		C	R1	R2	C	R1	R2	C	R1	R2	C	R1	R2	C	R1	R2
Hot	General	-	-	39%	-	-	33%	-	-	24%	-	-	13%	-	-	11%
Moderate	Non-CARE/FERA	33%	29%	29%	28%	30%	29%	23%	26%	24%	16%	16%	15%	13%	17%	17%
	CARE/FERA	38%	34%	34%	31%	33%	30%	21%	22%	20%	18%	23%	23%	9%	14%	11%
Cool	Non-CARE/FERA	39%	34%	34%	27%	27%	27%	17%	16%	16%	10%	14%	12%	14%	17%	17%
	CARE/FERA	39%	40%	40%	32%	29%	29%	18%	16%	13%	16%	16%	18%	9%	15%	11%

[1] Used chi-square, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.

[2] Respondents could select more than one item, and respondents who selected all items or items mutually exclusive are excluded from the results.

- **Old appliances use lots of energy:** no significant differences between rate and control groups except fewer Rate 1 CARE/FERA customers in the cool climate region reported the barrier (vs. Control group customers); more CARE/FERA customers reported the barrier, on average (vs. non-CARE/FERA customers) (Table 6.5-35).
- **Can't think of anything else to do:** significantly fewer Rate 1 and 2 non-CARE/FERA customers in the moderate region reported the barrier (vs. Control group customers), with no other significant differences between groups (Table 6.5-35).
- **Working from home:** significantly more Rate 1 and 2 non-CARE/FERA customers in the cool region reported the barrier (vs. Control group customers), with no other significant differences between groups; more non-CARE/FERA customers (vs. CARE/FERA customers) and more moderate and cool climate region customers (vs. hot region customers) reported the barrier, on average (Table 6.5-35).
- **Presence of elderly household member(s):** significantly fewer Rate 1 and 2 CARE/FERA customers in the cool climate region reported the barrier (vs. Control group customers), with no

other significant differences between groups; more customers in the hot climate region reported the barrier, on average (vs. moderate and cool region customers) (Table 6.5-35).

- **Presence of disabled household member(s):** significantly fewer Rate 1 and 2 CARE/FERA customers in the cool climate region reported the barrier (vs. Control group customers), with no other significant differences between groups; more CARE/FERA customers reported the barrier, on average (vs. non-CARE/FERA customers) (Table 6.5-35).

Table 6.5-35: Percentage of Respondents Who Reported Barriers to Reducing or Shifting Their Electricity Use During Afternoons and Evenings (Barriers 6-10)[1,2]

Climate Region	Segment	I have old appliances that use a lot of energy			I can't think of anything else to do			Working from home makes it difficult to use less electricity			Elderly household member makes it difficult to change our routines			Disabled household member makes it difficult to change our routines		
		C	R1	R2	C	R1	R2	C	R1	R2	C	R1	R2	C	R1	R2
Hot	General	-	-	14%	-	-	13%	-	-	7%	-	-	13%	-	-	4%
Moderate	Non-CARE/FERA	11%	10%	10%	15%	10%	12%	13%	13%	13%	8%	7%	7%	3%	4%	4%
	CARE/FERA	14%	15%	16%	15%	12%	12%	7%	7%	8%	10%	9%	9%	8%	9%	8%
Cool	Non-CARE/FERA	10%	10%	9%	14%	10%	12%	15%	19%	18%	5%	6%	6%	3%	2%	2%
	CARE/FERA	17%	13%	15%	13%	11%	11%	10%	10%	11%	9%	6%	6%	9%	6%	6%

[1] Used chi-square, highlighted percentages indicate statistically significant difference versus Control group at p≤.05.
[2] Respondents could select more than one item, and respondents who selected all items or items mutually exclusive are excluded from the results.

General Attitudes and Awareness Towards EE and DR

Respondents rated their agreement with six statements designed to measure respondents' attitudes towards adopting energy saving behaviors using an 11-point scale with 0 meaning "do not agree at all" and 10 meaning "completely agree" (Table 6.5-36).[133] The statements were designed to capture respondents' intention to conserve, responsibility to conserve, concern about environment, and concern about their electricity bill. All significant differences were small, with differences between Control and treatment group ratings less than a point on the 11-point rating scale.

Respondents provided moderate ratings, 5.9 to 6.7, to the statement "I am very concerned about how my energy use affects the environment" (Table 6.5-36). No significant differences in ratings between Control and Rate groups were found. Overall, responses were consistent across segments.

Respondents provided low to moderate ratings, 1.5 to 4.9, to the statement "it is my responsibility to use as little energy as possible to help the environment" (Table 6.5-36). When comparing responses between Control and Rate treatment groups, the Rate 1 and 2 non-CARE/FERA segment in the moderate climate region rated this statement lower than their Control group. Respondents in the CARE/FARE segments provided higher agreement ratings to the statement compared to those in the non-CARE/FERA segments.

SDG&E respondents provided moderate ratings, 5.3 to 6.7, to the statement "I feel guilty if I use too much energy" (Table 6.5-36). When comparing responses between Control and Rate treatment groups, the Rate 2 non-CARE/FERA segment in the cool climate region rated agreement to this statement

[133] The first statement, "I often worry whether there is enough money to pay my electricity bill," was used in the economic index and is reported in section 6.5.1.

significantly lower than their Control group. Respondents in the CARE/FARE segments provided slightly higher agreement ratings to the statement compared to those in the non-CARE/FERA segments.

Respondents provided moderate to high ratings, 7.1 to 7.8, to the statement "I conserved electricity in my home this summer" (Table 6.5-36). When comparing responses between Control and Rate treatment groups, the Rate 1 and 2 non-CARE/FERA segment in the moderate climate region and the Rate 1 and Rate 2 CARE/FERA and non-CARE/FERA segments in the cool climate region rated agreement to this statement higher than their Control groups. Overall, responses were consistent across segments.

SDG&E respondents provided moderate to high ratings, 7.3 to 8.3, to the statement "if my electricity bill goes up, I feel I must do something to reduce it" (Table 6.5-36). No significant differences in ratings between Control and Rate groups were found. Respondents in the CARE/FARE segments provided slightly higher agreement ratings to the statement compared to those in the non-CARE/FERA segments.

Table 6.5-36: Average Level of Agreement with Attitudinal Statements Related to Adopting Energy Saving Behaviors[1]

Climate Region	Segment	I am very concerned about how my energy use affects the environment			It is my responsibility to use as little energy as possible to help the environment			I feel guilty if I use too much energy			I conserved electricity in my home this summer			If my electricity bill goes up, I feel I must do something to reduce it		
		C	R1	R2	C	R1	R2	C	R1	R2	C	R1	R2	C	R1	R2
Moderate	Non-CARE/FERA	5.9	5.9	5.9	2.6	2.2	2.3	5.6	5.3	5.4	7.2	7.6	7.6	7.6	7.6	7.6
	CARE/FERA	6.3	6.4	6.4	4.8	4.8	4.9	6.3	6.0	6.4	7.3	7.3	7.4	8.3	8.2	8.1
Cool	Non-CARE/FERA	6.4	6.2	6.3	1.7	1.5	1.7	6.0	5.8	5.6	7.1	7.7	7.5	7.5	7.5	7.3
	CARE/FERA	6.7	6.6	6.7	4.4	4.1	4.1	6.7	6.3	6.5	7.4	7.8	7.7	8.2	8.2	8.3

[1] Used t-test, highlighted averages indicate statistically significant difference versus Control group at p≤.05.

Demographic Characteristics

This section summarizes the responses to demographic characteristics questions contained in the survey and trends in differences across segments.[134]

Respondent Age (Table 6.5-37)

- On average, surveyed customers in the cool and moderate climate regions tended to be younger than customers in the hot climate region.
- CARE/FERA segments tended to have slightly lower mean ages than non-CARE/FERA segments.
-

Table 6.5-37: Respondents' Average Age[1]

Climate Region	Segment	Mean	Inter Quartile Range		
			Percentile 25	Median	Percentile 75
Hot	General	61	52	63	71
Moderate	Non-CARE/FERA	54	39	54	67
	CARE/FERA	51	35	49	64
Cool	Non-CARE/FERA	52	37	52	66
	CARE/FERA	51	36	50	65

[1] Results are based on weighted averages across all four RCT groups (Control, Rate 1, and Rate 2)

[134] Trend analyses did not include tests for statistical significance and are based on observation of the differences in values.

Respondent Educational Attainment (Table 6.5-38)

- Some college or less was the most commonly reported levels of education for CARE/FERA customers and some college or more was most common for non-CARE/FERA customers. Non-CARE/FERA customers in the moderate and cool climate regions were the most highly educated group, with around three-fifths to three-quarters reporting that they had a four-year or graduate/professional degree (60% and 72%, respectively).
- CARE/FERA customers were somewhat under-representative of California households with a high school diploma or less (38%) while non-CARE/FERA customers were over-representative of Californians with a graduate degree (11%) (2015 ACS 5-year estimates).

Table 6.5-38: Respondents' Educational Attainment

Climate Region	Segment	Some HS	HS Diploma	Some College	Tech. College	Two-year Degree	Four-year Degree	Grad Degree
Hot	General	1%	15%	24%	11%	10%	21%	19%
Moderate	Non-CARE/FERA	1%	6%	19%	5%	8%	29%	31%
	CARE-FERA	11%	19%	25%	9%	11%	16%	10%
Cool	Non-CARE/FERA	1%	4%	13%	4%	6%	33%	39%
	CARE-FERA	10%	15%	23%	9%	10%	21%	14%

Annual Household Income (Table 6.5-39)

- CARE/FERA customers had lower annual household incomes compared to non-CARE/FERA customers: more than half (55%) reported earning less than $25,000 per year, compared to roughly 5% for non-CARE/FERA customers.
- On average, most non-CARE/FERA customers made more than $50,000/year across all Rate groups. Conversely, nearly all CARE/FERA customers made less than $50,000/year across all Rate groups.

Table 6.5-39: Annual Household Income

Climate Region	Segment	Less than $12k	$12k to < $17k	$17k to < $21k	$21k to < $25k	$25k to < $29k	$29k to < $33k	$33k to < $37k	$37k to < $41k	$41k to < $50k	$50k to < $100k	$100k or more
Hot	General	5%	4%	3%	5%	6%	6%	5%	4%	11%	30%	22%
Moderate	Non-CARE/FERA	1%	1%	1%	3%	3%	3%	4%	4%	11%	37%	33%
	CARE-FERA	17%	16%	11%	11%	9%	8%	5%	6%	8%	9%	1%
Cool	Non-CARE/FERA	1%	1%	1%	2%	2%	3%	3%	4%	10%	35%	40%
	CARE-FERA	16%	15%	11%	13%	9%	8%	6%	5%	6%	10%	1%

Respondent Employment Status (Table 6.5-40)

- In the moderate and cool climate regions, roughly 25% of respondents were retired.
- More than 50% of non-CARE/FERA customers in the moderate and cool climate regions reported being employed full time while only 38% of CARE/FERA customers reported being employed full time.
- CARE/FERA customers were most likely be unable to work due to a disability.

Table 6.5-40: Respondents' Employment Status[1,2]

Climate Region	Segment	Employed full-time	Retired	Employed part-time	Can't work (disability)	Homemaker	Other[2]
Hot	General	34%	48%	12%	7%	8%	7%
Moderate	Non-CARE/FERA	56%	29%	11%	2%	6%	7%
	CARE-FERA	38%	23%	17%	14%	7%	18%
Cool	Non-CARE/FERA	58%	27%	10%	2%	4%	7%
	CARE-FERA	38%	25%	18%	12%	7%	17%

[1] Allows for multiple responses, may not add up to 100%.

[2] Includes respondents who reported being seasonally employed, unemployed but looking for work, unemployed but not looking for work, and students.

Major Life Changes during the Past Summer (Table 6.5-41)

- Most surveyed customers across all Rate groups and segments reported not experiencing any of the eight "life changes" items on the survey.
- On average, the most commonly reported "life change" was having work hours or pay reduced followed by becoming unemployed.
- Almost half of CARE/FERA customers reported having experienced one of the eight "life changes" items on the survey whereas roughly one quarter of non-CARE/FERA customers reported one of the eight life change events.
- Relatively few respondents reported having received a foreclosure or eviction notice, got divorced, had a baby, or had a death of a household member compared to other "life changes" items.

Table 6.5-41: Life Changes during the Past Summer

Climate Region	Segment	Became unemployed	Hours or pay reduced	Cared for elderly or disabled	Became disabled or seriously ill	Divorced or separated	Had a baby	Had a death in household	Got foreclosure or eviction	None of the above
Hot	General	6%	11%	7%	5%	3%	1%	2%	1%	72%
Moderate	Non-CARE/FERA	8%	11%	7%	3%	2%	3%	1%	1%	71%
	CARE-FERA	14%	17%	8%	9%	4%	5%	4%	2%	54%
Cool	Non-CARE/FERA	8%	9%	5%	2%	2%	2%	1%	0%	75%
	CARE-FERA	14%	19%	8%	8%	5%	4%	3%	1%	56%

Households with Members Who are Disabled (Table 6.5-42)

- Relatively few surveyed customers reported a household member who receives disability payments or has a serious medical condition.
- A higher proportion of respondents reported a household member having a serious disability than reported a household member receiving disability payments.
- CARE/FERA customers were more likely to report a household member having a serious disability or who received disability payments than non-CARE/FERA customers.

Table 6.5-42: Household Member(s) with Serious Medical Condition and/or Disability Payments

Climate Region	Segment	Has serious medical condition	Receives disability payments
Hot	General	17%	10%
Moderate	Non-CARE/FERA	14%	7%
	CARE/FERA	24%	19%
Cool	Non-CARE/FERA	11%	5%
	CARE/FERA	22%	16%

Household Disability Requirements (Table 6.5-43)

- The most commonly reported disability requirement was the need for someone in the household to stay home for most of the day, followed by the need to cool the home in the summer; very few (3%-7%) of respondents reported that they needed to use more energy for medical equipment.
- CARE/FERA customers were most likely to report having disability requirements across both climate regions.
- CARE/FERA customers in the moderate climate region were most likely to state they need their home to be cooled in the summer, but also reported they use electricity for medical equipment and have a member of the household who needs to stay home for most the day.

Table 6.5-43: Requirements for Households with Disabled Residents

Climate Region	Segment	Need home cooled in the summer	Need more energy for medical equip	Need to be home most of the day
Hot	General	12%	4%	18%
Moderate	Non-CARE/FERA	10%	3%	17%
	CARE/FERA	21%	7%	30%
Cool	Non-CARE/FERA	7%	3%	14%
	CARE/FERA	16%	5%	25%

Household Size (Table 6.5-44)

- On average, most surveyed customers reported a household size of around four people or less across all segments and climate regions.
- CARE/FERA customers in the moderate region reported the largest household size of 3.5 and an inter-quartile range from 2 to 5.
- CARE/FERA customers had slightly more people in their households when compared to non-CARE/FERA customers.

Table 6.5-44: Average Household Size[1]

Climate Region	Segment	Mean	Inter Quartile Range Percentile 25	Median	Percentile 75
Hot	General	2.9	2	3	4
Moderate	Non-CARE/FERA	3.1	2	3	4
	CARE/FERA	3.5	2	3	5
Cool	Non-CARE/FERA	2.8	2	3	3
	CARE/FERA	3.2	2	3	4

[1] Results are based on weighted averages across all four RCT groups (Control, Rate 1, and Rate 2).

Respondent Race & Ethnicity (Table 6.5-45)

- Surveyed customers were most to least likely to report being White, Hispanic, Asian, Other, and African American.
- CARE/FERA customers were more likely to report being non-White.
- There were fewer Asian respondents in the hot climate region compared to moderate and cool climate region.

Table 6.5-45: Respondents' Race and Ethnicity[1]

Climate Region	Segment	Asian	African American	Hispanic	White	Other[1]
Hot	General	3%	2%	10%	86%	9%
Moderate	Non-CARE/FERA	15%	5%	14%	69%	6%
	CARE/FERA	14%	14%	24%	45%	14%
Cool	Non-CARE/FERA	15%	2%	10%	75%	7%
	CARE/FERA	12%	9%	33%	50%	8%

[1] Allows for multiple responses, may not add up to 100%.

[2] Includes American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, Middle Eastern or North African, and Other.

Household Characteristics

This section summarizes the responses to household characteristics questions contained in the survey and trends in differences between segments.[135]

Times Home is Occupied on Weekends & Weekdays (Table 6.5-46)

- Nearly all respondents reported that there was someone home during the evening and night throughout the week.
- Fewer respondents reported their home being occupied in the mornings and afternoons on both the weekends and weekdays compared to evening and nights.
- Morning and afternoon occupancy is higher on weekends than on weekdays.
- Customers in the cool and moderate climate regions reported the lowest level of occupancy throughout the morning and afternoons compared to hot region customers.

Table 6.5-46: Times of the Day When Home is Occupied on Weekdays and Weekends During the Summer Months

Climate Region	Segment	Weekday				Weekend			
		Morning	Afternoon	Evening	Night	Morning	Afternoon	Evening	Night
Hot	General	85%	80%	94%	95%	94%	91%	94%	96%
Moderate	Non-CARE/FERA	80%	75%	97%	99%	96%	92%	95%	98%
	CARE/FERA	84%	83%	95%	98%	94%	90%	94%	97%
Cool	Non-CARE/FERA	81%	72%	96%	99%	96%	90%	94%	98%
	CARE/FERA	84%	79%	95%	98%	95%	87%	92%	97%

Own or Rent Home (Table 6.5-47)

- Most non-CARE/FERA surveyed customers reported owning their home.
- CARE/FERA customers were more likely to report renting their home and receiving subsidized housing assistance, such as Section 8, compared to non-CARE/FERA customers. Less than a third of CARE/FERA households reported owning their home.
- On average, customers in the hot climate region were more likely to report owning their home compared to moderate or cool climate region customers.

Table 6.5-47: Home Ownership Status

Climate Region	Segment	Own	Rent without subsidies	Rent with subsidies
Hot	General	88%	12%	1%
Moderate	Non-CARE/FERA	75%	25%	1%
	CARE/FERA	32%	53%	15%
Cool	Non-CARE/FERA	67%	33%	0%
	CARE/FERA	29%	56%	15%

[135] Trend analyses did not include tests for statistical significance and are based on observation of the differences in values.

Type of Housing (Table 6.5-48)

- Most surveyed customers reported living in a single-family detached home, followed by apartments or condos.
- CARE/FERA customers in the moderate and cool regions were most likely to report living in an apartment or condo than non-CARE/FERA customers.
- Customers in the hot region were more likely to report living in a manufactured or mobile home compared to the corresponding customers in the moderate or cool climate regions.

Table 6.5-48: Housing Type

Climate Region	Segment	Single-Family Detached	2 to 4 plex	Apt or condo	Townhome	Man. or mobile home, or mobile unit
Hot	General	85%	1%	4%	0%	10%
Moderate	Non-CARE/FERA	63%	4%	25%	7%	2%
	CARE/FERA	32%	6%	53%	6%	3%
Cool	Non-CARE/FERA	52%	6%	34%	8%	1%
	CARE/FERA	29%	11%	54%	6%	1%

Number of Bedrooms in Home (Table 6.5-49)

- On average, most surveyed customers reported having two to three bedrooms in their homes.
- Very few respondents reported having five or more bedrooms or living in a studio.
- CARE/FERA and low-income customers reported having fewer bedrooms in their home compared to non-CARE/FERA customers.

Table 6.5-49: Number of Bedrooms in Home

Climate Region	Segment	Studio	One	Two	Three	Four	Five +
Hot	General	1%	6%	28%	46%	17%	2%
Moderate	Non-CARE/FERA	0%	8%	26%	37%	23%	6%
	CARE/FERA	1%	21%	42%	25%	10%	1%
Cool	Non-CARE/FERA	2%	14%	31%	31%	18%	4%
	CARE/FERA	4%	27%	40%	23%	7%	1%

Cooling Equipment in Home (Table 6.5-50)

- A large majority of surveyed customers reported having and using ceiling or portable fans in their home.
- Non-CARE/FERA customers in hot and moderate regions were more likely to report having central air-conditioning or a room air-conditioning unit in their home, and report using it more frequently compared to cool climate region customers.
- More CARE/FERA customers reported having a room air conditioning unit and fewer reported central air conditioning, heat pumps, or fans compared to non-CARE/FERA customers.
- Very few respondents reported having a heat pump or evaporative/swamp cooler in their home, and of those who did, around three-quarters reported never using them.

Table 6.5-50: Cooling Equipment in Home and Frequency of Use[1]

		Hot	Moderate		Cool	
Item	Install & Use	General	Non-CARE/FERA	CARE/FERA	Non-CARE/FERA	CARE/FERA
Central air-conditioning	Have in home	62%	72%	45%	41%	25%
	Daily	24%	19%	19%	16%	12%
	Several days a week	23%	26%	25%	19%	18%
	Several days a month	33%	38%	27%	38%	23%
	Never	20%	17%	30%	27%	47%
Room air conditioning unit	Have in home	25%	21%	37%	21%	28%
	Daily	17%	12%	19%	11%	15%
	Several days a week	17%	20%	25%	21%	21%
	Several days a month	33%	27%	26%	31%	27%
	Never	33%	42%	31%	38%	38%
Evaporative or swamp cooler	Have in home	14%	2%	3%	2%	3%
	Daily	20%	3%	7%	6%	5%
	Several days a week	25%	7%	5%	6%	6%
	Several days a month	8%	6%	7%	6%	9%
	Never	48%	85%	82%	85%	81%
Heat pump	Have in home	16%	6%	6%	5%	4%
	Daily	12%	6%	5%	6%	4%
	Several days a week	15%	7%	5%	5%	5%
	Several days a month	12%	12%	7%	12%	9%
	Never	61%	77%	84%	78%	84%
Ceiling or portable fans	Have in home	94%	88%	80%	86%	80%
	Daily	66%	63%	59%	54%	53%
	Several days a week	18%	23%	22%	26%	26%
	Several days a month	12%	12%	13%	16%	15%
	Never	3%	3%	7%	4%	7%

[1] Allows for multiple responses, columns may not add to 100%.

Thermostat for Heating and/or Cooling (Table 6.5-51)

- Surveyed customers in the hot and moderate climate regions were more likely to report having a thermostat for both heating *and* cooling compared to cool climate region customers.
- CARE/FERA customers were more likely to report having a thermostat for heating only or not having a thermostat in their home compared to non-CARE/FERA customers.
- Very few respondents reported having a thermostat for cooling only.

Table 6.5-51: Thermostat in Home for Heating and/or Cooling

Climate Region	Segment	Thermostat for heating only	Thermostat for cooling only	Thermostat for both heating & cooling	No thermostat
Hot	General	17%	2%	63%	19%
Moderate	Non-CARE/FERA	17%	2%	71%	10%
	CARE/FERA	25%	4%	40%	32%
Cool	Non-CARE/FERA	42%	1%	41%	16%
	CARE/FERA	39%	2%	23%	37%

Thermostat Type (Table 6.5-52)

- CARE/FERA customers were more likely to report having a standard thermostat in their home compared to non-CARE/FERA customers.
- Non-CARE/FERA customers were both more likely to report having a programmable or smart thermostat compared to CARE/FERA customers.

Table 6.5-52: Thermostat Type in Home

Climate Region	Segment	A standard thermostat	A programmable thermostat	A smart thermostat
Moderate	Non-CARE/FERA	44%	46%	9%
	CARE/FERA	67%	29%	4%
Cool	Non-CARE/FERA	50%	43%	8%
	CARE/FERA	73%	24%	3%

Thermostat Temperature Settings (Table 6.5-53)

- Surveyed customers in the cool climate region were more likely to report turning their thermostat to a low setting or completely off in the late afternoon and evenings during the summer compared to hot or moderate region customers.
- CARE/FERA customers were more likely to report setting their thermostat to "off" or setting it to a lower temperature compared to non-CARE/FERA customers.
- There was very little variation between customers' reported thermostat settings on weekdays versus weekends.

Table 6.5-53: Thermostat Settings in Late Afternoons and Evenings on Weekdays and Weekends During Summer Months

Weekday / Weekend	Temperature	Hot	Moderate		Cool	
		General	Non-CARE/FERA	CARE/FERA	Non-CARE/FERA	CARE/FERA
Weekday	Off	18%	17%	20%	23%	32%
	Below 68 F	0%	1%	5%	2%	4%
	69 F to 71 F	3%	5%	11%	5%	9%
	72 F to 74 F	9%	15%	18%	18%	18%
	75 F to 77 F	17%	23%	22%	25%	19%
	78 F to 80 F	36%	32%	21%	23%	16%
	81 F or higher	17%	8%	6%	4%	2%
Weekend	Off	19%	15%	19%	23%	32%
	Below 68 F	1%	1%	5%	2%	5%
	69 F to 71 F	3%	5%	10%	5%	10%
	72 F to 74 F	10%	16%	19%	19%	19%
	75 F to 77 F	17%	24%	23%	26%	19%
	78 F to 80 F	37%	32%	20%	22%	14%
	81 F or higher	14%	7%	5%	4%	2%

Smart Thermostats

In the web version of the survey, customers who reported having a smart thermostat installed in their home were asked about their overall satisfaction and their level of agreement with four statements regarding their smart thermostat. Due to small sample sizes, in this section only findings for non-CARE/FERA SDG&E customers in the moderate climate region for the Control and Rate 2 treatment group are presented.[136]

Few surveyed customers reported having a smart thermostat installed in their home (10% for the Control and 9% for the Rate 2 treatment group; not shown in table). Customers in the Control and Rate 2 treatment group who reported having a smart thermostat provided high satisfaction ratings with their smart thermostat (both groups providing an average rating 8.5 on an 11-point scale, with 0 meaning “not satisfied at all” and 10 meaning “extremely satisfied”). Customers rated their level of agreement with four statements regarding aspects of their smart thermostat using a 11-point scale, with 0 meaning “do not agree at all” and 10 meaning “completely agree.” On average, SDG&E customers provided highest agreement ratings to the statement “[my thermoset] is easy to use” and the lowest agreement ratings to the statement “[my thermostat] helps me lower my electricity bill” (Table 6.5-54). Agreement ratings did not differ significantly between the Control and Rate 2 treatment group.

[136] For this analysis, any segments or rate treatment groups where sample sizes were too small to draw inferences (40 or fewer respondents) were excluded.

Table 6.5-54: Respondents' Average Level of Agreement with Aspects of Their Smart Thermostat [1]

Statement	Control (n=48)	Rate 1 (n=85)
Easy to use	7.8	7.7
Helps keep home at a comfortable temperature	7.5	6.8
Helps lower electricity bill	6.4	6.2
Helped manage electricity use during study	6.2	5.5

[1] Agreement ratings are based on an 11-point scale where 0 means 'do not agree at all' and 10 means 'completely agree'.
[2] Asked to web survey respondents in the Control and Rate 1 groups who reported having a smart thermostat; Rate 2 and 3 groups not asked.

Newsletters and Websites

Nearly all web survey respondents (between 90% and 96%) reported receiving the TOU study welcome packet (Table 6.5-55). Slightly fewer respondents reported receiving the summer newsletter (between 70% and 78%) and between one-third and two-fifths (33% to 44%) reported receiving the fall newsletter.

Table 6.5-55: Percentage of Respondents Who Received TOU Study Information[1]

Climate Region	Segment	Welcome packet R1	Welcome packet R2	Summer newsletter R1	Summer newsletter R2	Fall newsletter R1	Fall newsletter R2
Moderate	Non-CARE/FERA	97%	95%	73%	70%	32%	30%
	CARE/FERA	91%	92%	70%	71%	39%	39%
Cool	Non-CARE/FERA	97%	96%	70%	71%	33%	34%
	CARE/FERA	96%	95%	78%	77%	43%	44%

[1] Asked to web survey respondents in the Rate groups; Control group not asked.

Respondents who reported receiving the TOU study welcome packet or the summer/fall newsletters indicated that the informational materials were moderately useful (using a 11-point scale with 0 meaning "not useful at all" and 10 meaning "extremely useful";" Table 6.5-56). Respondents in the non-CARE/FARE segments found informational materials slightly less useful compared to those in the CARE/FERA segments. Usefulness ratings did not vary substantially between informational material type or Rate treatment group.

Table 6.5-56: Average Usefulness Rating for TOU Study Information,[2]

Climate Region	Segment	Welcome packet R1	Welcome packet R2	Summer newsletter R1	Summer newsletter R2	Fall newsletter R1	Fall newsletter R2
Moderate	Non-CARE/FERA	6.6	6.2	6.1	6.2	6.4	6.2
	CARE/FERA	7.3	6.8	7.1	7.1	7.3	7.2
Cool	Non-CARE/FERA	6.6	6.2	6.2	6.1	6.1	5.9
	CARE/FERA	7.3	7.0	7.2	7.2	7.2	7.2

[1] Usefulness ratings are based on an 11-point scale where 0 means 'not at all useful' and 10 means 'extremely useful'.
[2] Asked to web survey respondents in the Rate groups who reported receiving each item; Control group not asked.

About two-thirds of SDG&E respondents (between 58% and 68%) reported visiting the SDG&E My Account website since summer of 2016 (Table 6.5-57). Substantially fewer SDG&E respondents reported visiting the rate plan study website since summer 2016 (between 23% and 31%). Overall, responses did not differ substantially between respondent segment or Rate treatment group.

Table 6.5-57: Percentage of Respondents Who Visited IOU and TOU Study Websites[1]

Climate Region	Segment	SDG&E My Account website R1	SDG&E My Account website R2	Rate plan study website R1	Rate plan study website R2
Moderate	Non-CARE/FERA	59%	60%	23%	26%
	CARE/FERA	64%	66%	26%	31%
Cool	Non-CARE/FERA	58%	63%	24%	25%
	CARE/FERA	68%	66%	23%	30%

[1] Asked to web survey respondents in the Rate groups; Control group not asked.

Respondents who reported visiting the SDG&E My Account website or the TOU rate plan study website found the websites to be moderately useful (using a 11-point scale with 0 meaning “not useful at all” and 10 meaning “extremely useful”;” Table 6.5-58). Respondents in the non-CARE/FARE segments found the websites slightly less useful compared to those in the CARE/FERA segments. Usefulness ratings did not vary substantially between website type, or rate treatment group.

Table 6.5-58: Average Usefulness Rating for IOU and TOU Study Websites[1,2]

Climate Region	Segment	SDG&E My Account website R1	SDG&E My Account website R2	Rate plan study website R1	Rate plan study website R2
Moderate	Non-CARE/FERA	7.2	7.3	6.5	7.0
	CARE/FERA	7.6	7.8	7.7	7.5
Cool	Non-CARE/FERA	6.9	7.2	6.9	6.9
	CARE/FERA	7.9	7.9	7.5	7.6

[1] Usefulness ratings are based on an 11-point scale where 0 means ‘not at all useful and 10 means ‘extremely useful’.
[2] Asked to web survey respondents in the Rate groups who reported visiting each website; Control group not asked.

Respondents who received TOU study information in both English and in their native language were asked the importance of receiving information in both languages (using a 11-point scale with 0 meaning “not important at all” and 10 meaning “extremely important”). On average, SDG&E respondents found having materials available in their native language to be of high importance (Table 6.5-59). Respondents in the non-CARE/FERA segments provided slightly lower ratings compared to those in the CARE/FERA segments. Due to small sample sizes, however, results should be interpreted carefully.

Table 6.5-59: Average Importance Rating for Receiving Information in Respondents’ Native Language [1,2,3]

Climate Region	Segment	Rate 1 n	Rate 1 Average	Rate 2 n	Rate 2 Average
Moderate	Non-CARE/FERA	9	7.6	25	7.2
	CARE/FERA	53	7.8	66	8.3
Cool	Non-CARE/FERA	10	5.3	20	5.6
	CARE/FERA	61	8.1	139	8.9

[1] Importance ratings are based on an 11-point scale where 0 means ‘not at all important and 10 means ‘extremely important’.
[2] Blank cells in figure indicate sample size for that segment/Rate treatment group was fewer than five.
[3] Asked only to web survey respondents who are non-English speakers in the Rate groups and who reported receiving information from SDG&E.

Overall, SDG&E respondents provided moderate to high satisfaction ratings with TOU study outreach (using a 11-point scale with 0 meaning "not satisfied at all" and 10 meaning "extremely satisfied;" Table 6.5-60). Respondents in the non-CARE/FARE segments reported being slightly less satisfied with TOU study outreach compared to those in the CARE/FERA segments.

Table 6.5-60: Average Satisfaction Rating for All TOU Study Outreach[1,2]

Climate Region	Segment	R1	R2
Moderate	Non-CARE/FERA	7.6	7.6
	CARE/FERA	8.0	8.2
Cool	Non-CARE/FERA	7.7	7.7
	CARE/FERA	8.2	8.3

[1] Satisfaction ratings are based on an 11-point scale where 0 means 'not at all satisfied' and 10 means 'extremely satisfied'.
[2] Asked to web survey respondents in the Rate groups who reported receiving any outreach items; Control group not asked.

6.6 Synthesis for SDG&E Pilot

This section compares input from the load impact analysis, the bill impact analysis, and the survey analysis. The objective of these comparisons, at least in part, is to determine if the information and conclusions observed for individual metrics are supported by findings from other metrics or, alternatively, findings for one metric contradict those for another metric. We also look for clues from the survey findings that might help explain why load or bill impacts for one rate differ from those for other rates. As in the other synthesis sections, readers are reminded once again that, given the large samples underlying the survey analysis, statistically significant differences may not reflect meaningful differences from a policy perspective.

6.6.1 Synthesis

Tables 6.6-1 and 6.6-2 summarize some of the relevant findings from the load impact, bill impact and survey analysis. Readers are directed to Section 4.6.1 for an explanation of the variables and symbols contained in the tables. As a reminder, SDG&E had two pilot rates, one with two pricing periods during the summer and the other with three. The peak periods were the same for both rates and start at 4 PM and end at 9 PM. Each rate has the same number of periods on weekdays and weekends, but the shoulder period on weekends is much shorter for the three period rate (Rate 1). The weekday shoulder period for the three period rate is long, beginning at 6 AM, whereas on weekends, the shoulder period begins at 2 PM.

Looking across the various metrics for each customer segment and rate, the load impact and bill impact findings typically align quite well. However, we observed a few internal inconsistencies related to the survey responses. Satisfaction with the rate and with SDG&E in general showed a statistically significant, though small, difference between treatment and control customers for the CARE/FERA segment in the moderate climate region on both rates. These customers were able to successfully shift load and only saw negligible structural bill increases. Rate 1 customers had no statistically significant total bill impacts, and Rate 2 customers in the moderate climate region actually had a statistically significantly lower bill by around $3 per month after factoring in the slight structural increase, which was more than offset by the behavioral impact.

Table 6.6-1: Load Impacts, Bill Impacts, and Selected Survey Findings for SDG&E Rate 1

Climate	Segment	Load Impacts		Bill Impacts			Survey							
		Peak Period Load Reduction	Net Decrease in Daily Usage	Summer Monthly Average Structural Bill Impact	Average Behavioral Bill Impact	Total Bill Impact	Respondents Reporting Being Uncomfortably Hot	Health Index	Bill Higher than Expected	Difficulty Paying Bills	Economic Index (Range 0-10)	Understanding TOU Pricing (None-Correct)	Satisfaction w/ Rate (11 pt. Scale)	Satisfaction w/ Utility (11 pt. Scale)
Hot	General Population	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Moderate	Non-CARE/FERA	6.3% ▼	3.5% ▼	$7.44	-$5.25 ▼	$2.19 -	17% -	I/S	30% -	28% ▼	2.39 ▼	10%	6.1 -	6.7 -
	CARE/FERA	5.2% ▼	2.9% ▼	$0.51	-$1.16 -	-$0.65 -	36% -	I/S	32% -	70% -	4.17 -	18%	7.0 ▼	7.6 ▼
Cool	Non-CARE/FERA	5.2% ▼	1.7% ▼	$3.44	-$2.75 -	$0.69 -	11% -	I/S	27% -	22% ▼	1.99 ▼	6%	6.4 -	6.9 -
	CARE/FERA	1.7% ▼	1.0% ▼	-$0.59	-$0.55 -	-$1.14 -	30% -	I/S	24% -	65% ▼	3.90 -	15%	7.3 -	7.8 -

Table 6.6-2: Load Impacts, Bill Impacts, and Selected Survey Findings for SDG&E Rate 2

Climate	Segment	Load Impacts		Bill Impacts			Survey							
		Peak Period Load Reduction	Net Decrease in Daily Usage	Summer Monthly Average Structural Bill Impact	Average Behavioral Bill Impact	Total Bill Impact	Respondents Reporting Being Uncomfortably Hot	Health Index	Bill Higher than Expected	Difficulty Paying Bills	Economic Index (Range 0-10)	Understanding TOU Pricing (None-Correct)	Satisfaction w/ Rate (11 pt. Scale)	Satisfaction w/ Utility (11 pt. Scale)
Hot	General Population	6.8% ▼	3.4% ▼	$7.52	-$5.13 -	$2.39 -	N/A	I/S	N/A	N/A	N/A	12%	6.0 N/A	6.5 N/A
Moderate	Non-CARE/FERA	5.1% ▼	2.3% ▼	$6.86	-$4.30 ▼	$2.56 -	19% -	I/S	31% -	31% -	2.46 ▼	8%	6.1 -	6.7 -
	CARE/FERA	5.3% ▼	3.7% ▼	$0.29	-$3.12 ▼	-$2.83 ▼	34% -	I/S	31% -	69% -	4.14 -	17%	7.0 ▼	7.6 ▼
Cool	Non-CARE/FERA	4.3% ▼	2.5% ▼	$3.40	-$5.21 ▼	-$1.81 -	12% -	I/S	27% -	25% -	2.12 -	8%	6.5 -	7 -
	CARE/FERA	2.6% ▼	2.4% ▼	-$0.54	-$1.03 -	-$1.58 ▼	25% -	I/S	19% ▼	65% -	3.83 -	15%	7.4 -	7.8 -

Non-CARE/FERA Customers

Non-CARE/FERA customers had larger load reductions than CARE/FERA customers for both Rates 1 and 2 in both absolute and percentage terms for the cool/moderate climate regions combined and also in the cool climate region. In the moderate climate region, the non-CARE/FERA absolute load reductions were also greater for Rate 1 but were not statistically different for Rate 2. In percentage terms, the differences were not statistically significant in the moderate climate region for either rate. The average peak-period load reduction for non-CARE/FERA customers in the cool/moderate regions combined equaled 5.7% and 0.05 kW for Rate 1 and 4.7% and 0.04 kW for Rate 2. The difference in load impacts across the two rates was not statistically significant. Absolute impacts were larger in the moderate region for both Rates 1 and 2 compared with the cool climate region and the differences were statistically significant. Percentage impacts were also larger in the moderate region compared to the cool region for Rate 1 but the difference in percentage impacts for Rate 2 was not statistically significant.

Non-CARE/FERA customers in the moderate climate region on Rates 1 and 2 experienced the largest structural bill impacts, which were almost as large as the structural impacts of the general population in the hot climate region on Rate 2. Non-CARE/FERA customers on Rate 1 in the cool climate region did not produce statistically significant bill impacts, and this may be partially attributable to that segment producing the lowest daily impacts. Ultimately, the average behavioral bill impact was able to offset the structural bill impact so that there was no statistically significant total bill impact on the TOU rates for non-CARE/FERA customers.

The lack of any statistically significant total bill impact is reflected in the survey responses where customers on the TOU rate expressed less difficulty in paying their bills than customers in the control group on the OAT. While none of the non-CARE/FERA segments showed statistically significant total bill impacts that resulted in overall reductions to their bills, their behaviors were successful in offsetting structural losses so that they were no worse off on the TOU rate. These findings were further corroborated by a statistically significant decrease in the hardship metric that directly aligned with the segments who stated they had less difficulty in paying their bills.

When excluding the hot climate region, non-CARE/FERA customers had the highest percent reduction in peak period energy use, the highest percent reduction in daily usage, and the highest bill reduction due to behavior change in three out of the four segments. In general, only approximately 30% of non-CARE/FERA respondents or less indicated that their bills were higher than expected and this percent was statistically significantly lower than the percent for control customers in the cool region on Rate 2. Non-CARE/FERA customers understood the rates better than the CARE/FERA customers (as indicated by the very low percent that got couldn’t identify at least some hours that fell into the peak period), and had similar satisfaction ratings for the rate plan and for SDG&E compared to the control group. All of these metrics paint an internally consistent picture of a customer segment that understood the rate features relatively well, and worked to reduce usage which resulted in bills similar to what they would have experienced on the OAT. As a result of all of the above, this segment didn’t report significant changes in their level of satisfaction compared to the control group on the OAT.

CARE/FERA Customers

As discussed above, CARE/FERA customers tended to have load reductions that were smaller than non-CARE/FERA customers overall and in the cool climate region on both rates. In the moderate climate region, the difference in load impacts between the two segments was not statistically significant. Consistent with this finding, CARE/FERA customers on average also produced behavioral bill reductions comparable to those of non-CARE/FERA customers in the moderate climate region, and significantly smaller in the cool climate region on both rates.

There were no statistically significant increases in the percent of CARE/FERA customers reporting that they were uncomfortably hot due to trying to reduce bills. However, the level of customers reporting that they were uncomfortably hot was roughly double that of non-CARE/FERA customers.

One potentially important finding related to the rates that could affect performance of CARE/FERA customers is the lower understanding of the timing of the peak period, as evidenced by the much higher percent of customers who could not identify any hours that fell during the high priced period. Taking a simple average across the climate regions and rates for this metric, only about 8% of non-CARE/FERA customers were unable to correctly identify any peak-period hours, whereas twice as many (16%) CARE/FERA customers fell into this category. In the moderate region, the load impacts were not statistically different between the non-CARE/FERA customers and CARE/FERA customers. Perhaps with better understanding of the rates, the CARE/FERA customers could shift even more load, and save more money. In the cool climate region, the CARE/FERA customers didn’t perform nearly as well with load impacts as the non-CARE/FERA customers; yet showed similar levels of misunderstanding of peak period hours compared to customers in the moderate climate region. However, CARE/FERA customers on both rates in the cool climate regions were structural benefiters on average, so there wasn’t much of an economic incentive for them to shift usage, as they were already saving money by being on the TOU rate.

Turning to other metrics of interest, in stark contrast to the bill impacts at PG&E and SCE, the average structural bill increase for CARE/FERA customers at SDG&E was less than $1 per month in the moderate climate region, and customers in the cool climate region actually saw a bill reduction of over $0.50 per month, on average. All CARE/FERA customers produced behavioral bill reductions, although only behavioral bill reductions from the moderate climate region segment on Rate 2 were statistically significant. This resulted in all CARE/FERA segments either experiencing total bill impacts that weren’t statistically significant—on Rate 1— or were in the range of $1 to $3 savings per month on Rate 2. CARE/FERA customers in the cool regions on both rates ultimately reported less difficulty in paying bills compared to the control group. Furthermore, there were no statistically significant changes in the economic index for CARE/FERA customers.

As noted above, in spite of CARE/FERA customers in the moderate climate region on both rates successfully offsetting the very small—less than $1 per month—average structural bill impacts, both segments reported statistically significant reductions in satisfaction with both the rate and with SDG&E. However, the differences were small. For satisfaction with the rate, the control group had an average satisfaction rating of 7.3 while the treatment group had a rating of 7.0. For satisfaction with SDG&E, the relevant values were 7.9 versus 7.6. This is another example where the “over powered” statistical tests due to large sample sizes identified statistically significant differences that were not material.

Percentage load impacts for this group were comparable with those for non-CARE/FERA customers, and none of the other metrics appear to be outliers for these segments. The two metrics where there is a slight difference are the percent of respondents reporting being uncomfortably hot, and the percent of customers unable to correctly identify any peak period hours. While these metrics were higher across the board for CARE/FERA customers, they were both slightly higher for the CARE/FERA customers in the moderate climate region compared to the cool climate region.

Hot Climate Region General Population

General population households in the hot climate region on Rate 2 had load reductions in the peak period equal to 6.8%, which was larger than any of the other customer segment/climate region groups. The next closest comparable impact was from non-CARE/FERA customers on Rate 1 in the moderate climate region with 6.3% peak period reductions. Daily reductions for the general population customers in the hot climate region, at 3.4%, were comparable to CARE/FERA customers in the moderate region on Rate 2 (3.7%) and non-CARE/FERA customers in the moderate region on Rate 1 (3.5%).

Structural bill impacts for the hot region were slightly higher than those for non-CARE/FERA customers in the moderate region, and the highest across all segments. However, customers were able to produce behavioral bill impacts large enough to offset these structural increases so that overall bill impacts were not statistically significant.

Customer surveys were not administered to the control group in the hot region due to implementation decisions made by SDG&E, so several of the survey related metrics that make comparisons between the treatment and control group, such as being uncomfortably hot, higher bill than expected, difficulty of paying bills, and the economic index, could not be calculated. 12% of treatment households in the hot region could not correctly identify any of the peak period hours. 12% also happens to be the average between the non-CARE/FERA customers at 8% and the CARE/FERA customers at 16% in the moderate and cool climate regions. Finally, the satisfaction scores for the Rate 2 customers in the hot climate region are the lowest across all other segments, at 6.0 and 6.5 for satisfaction with the rate and the utility, respectively. This is reasonable given these customers also have the highest structural bill impacts, and the highest overall bills. These scores are only marginally lower than the scores from the non-CARE/FERA customers on both rates in the moderate climate region, which were 6.1 and 6.7 for the rate and utility satisfaction, respectively.

6.6.2 Key Findings

Key findings pertaining to load impacts from the SDG&E pilots include:

1. Customers can and will respond to TOU rates with peak periods that extend well into the evening hours – peak period load reductions averaged roughly 5.4% for Rate 1 and 4.6% for Rate 2 across the service territory as a whole.
2. For Rate 2, which has the same prices in effect on weekends as on weekdays, the pattern of load impacts across rate periods on weekends was very similar to weekdays for all climate regions combined.

3. There was a small but statistically significant reduction in daily electricity use for both rates – for Rate 1, the average reduction was 2.5% for the moderate/cool regions combined while for Rate 2, it was 2.6% for all three climate regions combined.[137]
4. For Rate 2, load impacts, in both absolute and percentage terms, were largest in the hot climate region, second largest in the moderate region, and lowest in the cool region.
5. CARE/FERA customers generally had lower peak period load reductions compared with non-CARE/FERA customers—although not all differences were statistically significant.
6. Load impacts are not available for senior households or households with incomes below 100% of FPG because the sample sizes (and population) in SDG&E's hot region are too small.
7. Differences in load impacts for customers on TOU rates who do and do not receive Weekly Alert Emails were not statistically significant.

Key findings pertaining to bill impacts include:

1. In stark contrast to the findings for PG&E and SCE, bill impacts for SDG&E's pilot rates were quite small, both before and after behavioral adjustments. For some customer segments and climate regions, customers could fully offset the structural increases in summer bills by shifting usage so that the total bills were slightly lower than they would have been on the OAT.
2. Average monthly structural bill differences ranged from a bill decrease of $0.59 for CARE/FERA customers in the cool climate region on Rate 1 to a bill increase of $7.52 for general population customers on Rate 2 in the hot climate region. These bill impacts represent the four summer months from July through October.
3. Over the course of a year, many customers would expect to see a very modest increase or decrease in bills – in the moderate and cool regions, between 60% and 85% of customers would see a structural change in their average monthly bill between ±$3 -- in the hot region, between 35% and 40% of customers would expect to see a bill change of ±$3.

Key findings from the survey research include the following:

1. **Hardship:** SDG&E customers in the moderate and cool regions showed no increase in economic index scores. Non-CARE/FERA customers for Rate 1 and non-CARE/FERA customers in the moderate region for Rate 2 showed a decrease in economic index scores due to TOU rates. Corroborating this finding, non-CARE/FERA customers in the moderate region also reported less difficulty paying their bills than control customers. Sample sizes to assess health outcomes were too small to reliably detect increases in the proportion of customers who sought medical attention due to excessive heat.
2. **Satisfaction:** Except for CARE/FERA customers in the moderate climate region, customer satisfaction ratings for both a customer's rate and SDG&E did not differ between the TOU rate and control groups. The differences in ratings for both the rate and SDG&E for CARE/FERA moderate region customers, while statistically significant are very small, 0.3 differences between control and treatment groups on an 11-point scale.

[137] Note that the hot region in SDG&E's service territory has a very low population weight and does not materially impact this average.

3. **ME&O and understanding of rates:**
   - Though understandability ratings of welcome packet items were high (generally between 7.7 to 8.1), customer's understanding of their rates indicate a disconnect between customer's rating of understandability and actual understanding (with 6% to 18% of customers unable to identify peak hours). Non-CARE/FERA customers were more likely to answer correctly than CARE/FERA customers.
   - When asked if customers agreed that peak and off peak times were easy to remember, Rate 2 customers provided higher agreement ratings than Rate customers. However, a similar proportion of Rate 1 and 2 customers provided "over half correct"[138] answers to the rate understanding questions.
   - Customers on TOU rates were more likely to take time-specific actions than customers in the control condition. For example, while a similar proportion of customers from control and rate groups indicated they turned off their lights to conserve energy, a larger proportion of treatment customers indicated they shifted doing laundry and running the dishwasher during peak hours. This trend suggests that while fewer rate customers understood the nuances of their rates, they did know and act on actions that helped them shift use.

[138] These survey items were coded much like a test with partial credit; customers would get 50% right if they could identify half of the peak hours for their test rate.

7 Overall Summary

This section begins with a comparison of load impacts and bill impacts across utility service territories. Although the experiment was not designed to make cross-utility comparisons, such comparisons are likely to be made nonetheless, and it's important that any observed differences be put into the proper perspective so that they are not misinterpreted. Following that discussion is a brief summary of the key conclusions that can be drawn from looking across all treatments statewide.

7.1 Cross Utility Comparisons of Load and Bill Impacts

When comparing rate impacts or bill impacts across utility service territories, it is very important to keep in mind that any observed differences across service territories could easily be due to differences in the populations or climate regions across the service territories rather than due to differences in the tariffs themselves. Another possible explanation for any observed differences is variation in the months included in the analysis – recall that average impacts for PG&E cover the months of July through September for all three rates; for SCE the same months apply to Rates 1 and 2 but Rate 3 impact estimates do not include July because of billing issues; and for SDG&E, the analysis includes the month of October. Finally, as discussed in each utility section, when comparing peak period load impacts across rates, even within a service territory, differences could be due to variation in the timing and length of the peak periods rather than to differences in price ratios, for example.

Some of the above factors can be controlled for by limiting the cross-utility comparisons to only the hours that all utility tariffs have in common and only the months that are common across all rates and service territories. As such, in the discussion below, peak period load impacts are presented only for the hours from 6 to 8 PM and peak period and daily load impacts and bill impacts are presented only for the months of August and September.[139] For all of the figures below, the following legend applies:

PG&E, Rate 1	SCE, Rate 1	SDG&E, Rate 1
PG&E, Rate 2	SCE, Rate 2	SDG&E, Rate 2
PG&E, Rate 3	SCE, Rate 3	

[139] Because the impacts presented her cover only the hours from 6 to 8 PM and are only for the months of August and September, they will differ from the load reductions reported in prior sections of the report, which represent the average across the full peak period and for at least one more month for each tariff.

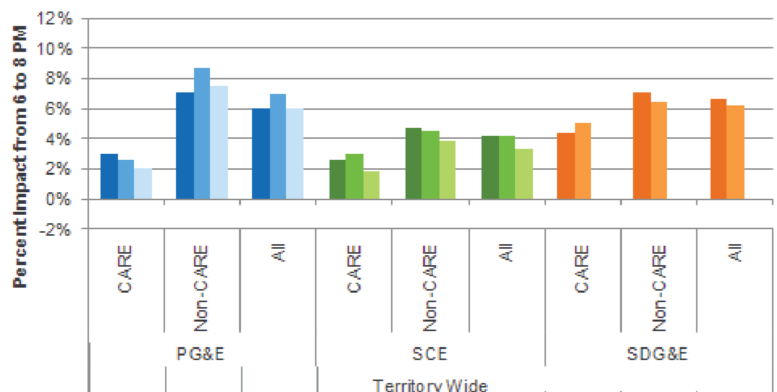
7.1.1 Load Impacts

Figure 7.1-1 shows the load reduction from 6 to 8 PM on the average weekday in August and September for each service territory as a whole and for each climate region for the eight different tariffs tested across the three utilities. The load impacts are also shown for CARE/FERA and non-CARE/FERA customers within each region. The bar graphs show the percent reduction across these hours while absolute reductions are shown below the graph. Table 7.1-1 shows the marginal price for the hours from 6 to 8 PM for each tariff and also for the OAT. The TOU prices represent the price for usage above the baseline allocation.

All rates in all service territories showed meaningful reductions for these early evening hours, ranging from a low of 3.4% for SCE's Rate 3 to a high of 6.6% for SDG&E's Rate 1. The average percent load reduction across all three rates for PG&E was 6.3%, while SCE's average was 3.9%. SDG&E's average reduction across its two rates was nearly identical to PG&E's average.

For non-CARE/FERA customers, the largest load reduction, 8.7%, occurred for PG&E's Rate 2 and the smallest, 3.9%, was for SCE's Rate 3.[140] The average reduction across the multiple rate treatments in each service territory for non-CARE/FERA customers was 7.8% for PG&E, 4.3% for SCE and 6.8% for SDG&E. For CARE/FERA customers, the average reductions were 2.6%, 2.5%, and 4.8% for PG&E, SCE, and SDG&E, respectively. On average, CARE/FERA customers had lower percent reductions in peak period usage than non-CARE/FERA customers. This difference could explain, in part, why SCE's average reduction for all customers in its service territory is lower than either PG&E or SDG&E as SCE has the highest percent of CARE/FERA customers among the pilot eligible population (31%) compared with PG&E (27%) and SDG&E (19%).

Figure 7.1-1: Load Reductions Between 6 and 8 PM by Rate and Service Territory[141]



		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
Rate 1	% Impact	3.1%	7.1%	6.0%	2.6%	4.7%	4.2%	4.5%	7.1%	6.6%
	kW Impact	0.03	0.07	0.06	0.03	0.06	0.05	0.03	0.06	0.05
Rate 2	% Impact	2.6%	8.7%	7.0%	3.1%	4.5%	4.2%	5.1%	6.4%	6.3%
	kW Impact	0.03	0.09	0.07	0.03	0.06	0.05	0.04	0.05	0.05
Rate 3	% Impact	2.0%	7.5%	6.0%	1.9%	3.9%	3.4%			
	kW Impact	0.02	0.07	0.06	0.02	0.05	0.04			

[140] The comparisons are primarily described in percentage terms due to the level differences in average customer energy usage across utilities. The percentage results help to normalize the level differences and show the proportion of load being curtailed. The average kW impacts are provided; however, caution should be used when making any sort of direct comparison.

[141] Impacts in this section represent August and September 2016 only, as these months are common to all rates and utilities

Table 7.1-1 shows the peak period prices for each pilot rate as well as the Tier 2 and 3 prices for the otherwise applicable tariff faced by the control group. As indicated in the title to the table, the treatment group prices represent the marginal price excluding the baseline discount. The most comparable OAT price is the price that applies between 100% and 200% of the baseline quantity. As seen in the table, there is significant variation in the marginal price that applies to the peak period hours across rates within a service territory as well as across service territories.

Table 7.1-1: Peak Period Price Above Baseline Quantity (¢/kWh)

Utility	Customer Segment	Rate 1	Rate 2	Rate 3	Control Group Tariff (OAT)	
					101 – 200% of Baseline	>200% of Baseline
PG&E	Non-CARE	42.0	44.5	57.2	24.1	40.0
	CARE	24.3	24.9	31.9	14.7	21.6
	Total	37.2	39.2	50.4	21.6	35.0
SCE	Non-CARE	34.5	53.3	37.0[142]	22.9	29.2
	CARE	25.0	38.5	26.8	15.7	21.8
	Total	31.6	48.8	33.9	20.7	26.9
SDG&E	Non-CARE	56.6	56.6	n/a	39.5	n/a
	CARE	34.1	34.1	n/a	23.6	n/a
	Total	52.2	52.2	n/a	36.5	n/a

A useful way of comparing the change in usage caused by a change in price is what economists call price elasticity. The price elasticity is simply the percentage change in quantity demanded given a percentage change in price. While price elasticities are best estimated as coefficients on the price variable in a demand model, they can also be calculated by hand for a given set of prices and quantities. These are known as arc price elasticities. When there are tiered rates as there are here, where prices vary with quantity, a question arises as to what is the relevant price term to use in a demand model or when calculating price elasticities. Is it the price you pay for the next unit of electricity, which is known as the marginal price, or is it the average price? With tiered rates, both marginal and average prices vary with consumption, which means that the prices paid differ across customers, across months within seasons, and across seasons. For simplicity, we ignore all of these complexities and, in Table 7.1-2, show the arc price elasticities for each rate using prices above the baseline quantity for the TOU rates and prices between 100% and 200% of baseline for the OAT. Readers are reminded, once again, that the usage values pertain only to the two hours from 6 to 8 PM and only for the months of August and September.

As seen in the table, SDG&E's customers are the most price responsive of the three utilities, and SCE's are the least price responsive, both overall as well as within each of the two key customer segments. All of the arc price elasticities have values in the range that economists refer to as highly inelastic demand, which means that it takes a large percentage change in price to produce a significant change in demand

[142] There is no baseline allowance for SCE's Rate 3

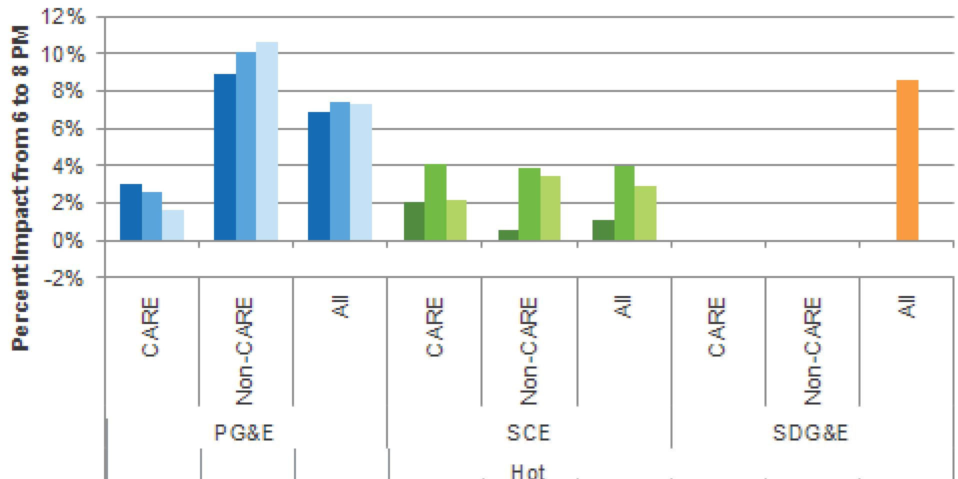
compared with products and services that are much more elastic. A price elasticity of 0.10 means that a 100% increase in price would produce a 10% reduction in demand for a good or service. If the price elasticity equaled 0.50, a 100% increase in price would produce a decrease in demand of 50%.

Table 7.1-2: Arc Price Elasticities Using Marginal Prices Above Baseline Quantities

Utility	Customer Segment	Rate 1	Rate 2	Rate 3
PG&E	Non-CARE	0.10	0.10	0.05
	CARE	0.05	0.04	0.02
	Total	0.08	0.09	0.04
SCE	Non-CARE	0.09	0.02	0.06
	CARE	0.04	0.02	0.03
	Total	0.08	0.02	0.05
SDG&E	Non-CARE	0.17	0.15	n/a
	CARE	0.10	0.12	n/a
	Total	0.15	0.15	n/a

Figure 7.1-2 shows the average load reduction for each rate for the hours from 6 to 8 PM in the hot climate region for the population as a whole as well as for CARE/FERA and non-CARE/FERA segments. There is no meaningful difference in the percent load reduction across the three rates for CARE/FERA customers in PG&E and SCE’s hot region, with average reductions of 2.4% for PG&E and 2.8% for SCE. There is a very substantial difference in the average reduction for non-CARE/FERA customers, however, with PG&E’s average reduction equaling 9.9% and SCE’s equaling only 2.6%. As discussed previously, SCE’s hot region has more very hot days compared with PG&E’s hot region and SCE’s tariffs have much longer shoulder periods than PG&E’s tariffs, making it harder to maintain reasonable comfort throughout the day by increasing temperature settings to reduce electricity bills. It may be that non-CARE/FERA customers in SCE’s service territory are more willing to accept higher bills for maintaining reasonable comfort levels whereas the comfort/cost tradeoff in PG&E’s hot climate region is more palatable given the fewer number of very hot days. In contrast, the similarity in average reductions for CARE/FERA customers in the two service territories is consistent with a hypothesis that even in very hot climate regions, CARE/FERA customers must make tradeoffs between comfort and bills. Survey data shows that roughly 23% of all CARE/FERA respondents in the hot climate regions at PG&E and SCE reported being uncomfortably hot “most to all of the time” since June 2016.

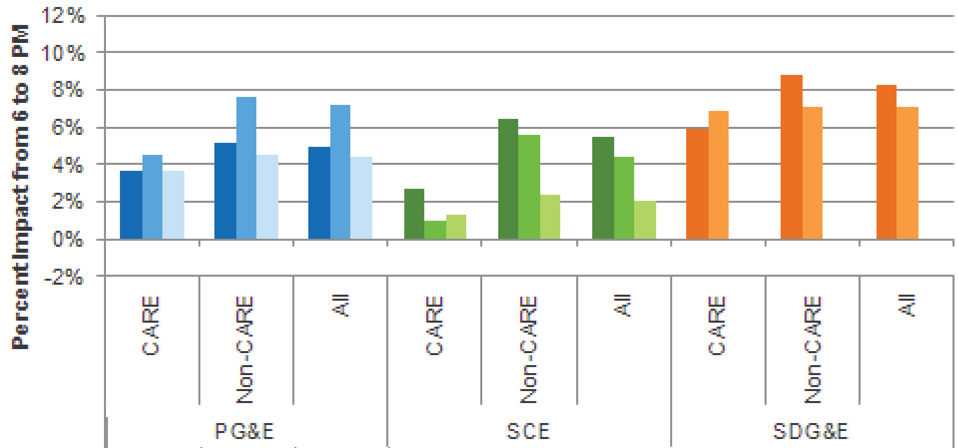
Figure 7.1-2: Load Reductions from 6 to 8 PM for Hot Climate Regions by Customer Segment, Average August and September Weekday



		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
Rate 1	% Impact	3.1%	9.0%	6.8%	2.1%	0.6%	1.1%			
	kW Impact	0.04	0.14	0.10	0.03	0.01	0.02			
Rate 2	% Impact	2.6%	10.1%	7.4%	4.1%	3.9%	3.9%			8.6%
	kW Impact	0.03	0.16	0.11	0.06	0.07	0.07			0.11
Rate 3	% Impact	1.6%	10.6%	7.4%	2.1%	3.4%	3.0%			
	kW Impact	0.02	0.16	0.11	0.03	0.06	0.05			

Figure 7.1-3 shows the average load reductions from 6 to 8 PM for CARE/FERA and non-CARE/FERA customers and for the population as a whole in the moderate climate regions in each service territory. SDG&E's Rate 1 for non-CARE/FERA customers shows the highest percent reduction (8.8%) across all 8 tariffs in the moderate region and SCE's Rate 2 for CARE/FERA customers shows the lowest reduction (1.0%). For the population as a whole, the average reduction across all three rates for PG&E is 5.5%, the average for SCE is 4.0%, and the average for SDG&E is 7.7%. For CARE/FERA customers, the average load reduction across all three rates for PG&E and SCE and the two rates for SDG&E is 3.9%, 1.7% and 6.4%, respectively. The average reduction for non-CARE/FERA customers is 5.8%, 4.9% and 8.0%, respectively. However, SCE's moderate climate region is much hotter on average compared with PG&E and SDG&E's moderate regions, and SCE's reference loads are much higher than at either of the other utilities (as can be seen in prior tables in Sections 4.1, 5.1, and 6.1). As such, the average absolute load reduction for non-CARE/FERA customers is actually the same for SCE and SDG&E (0.08 kW) and is higher than for PG&E (0.05 kW). For CARE/FERA customers, SCE's low percent reduction translates into the lowest absolute reduction of the three utilities in spite of the fact that reference loads for SCE's CARE/FERA customers is significantly higher than the reference loads at PG&E and SDG&E.

Figure 7.1-3: Load Reductions from 6 to 8 PM for Moderate Climate Regions by Customer Segment, Average August and September Weekday

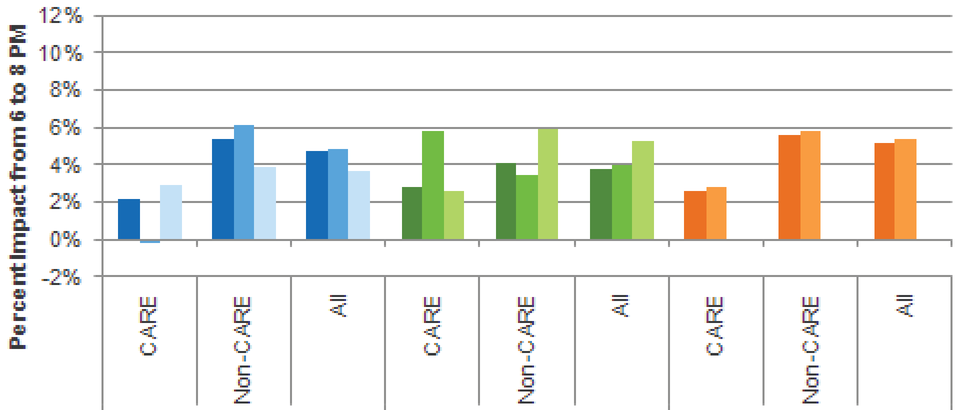


Moderate

		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
Rate 1	% Impact	3.7%	5.2%	5.0%	2.7%	6.4%	5.5%	5.9%	8.8%	8.3%
	kW Impact	0.03	0.04	0.04	0.03	0.11	0.08	0.05	0.09	0.08
Rate 2	% Impact	4.5%	7.7%	7.2%	1.0%	5.6%	4.4%	6.9%	7.1%	7.1%
	kW Impact	0.03	0.07	0.06	0.01	0.09	0.07	0.06	0.07	0.07
Rate 3	% Impact	3.6%	4.5%	4.4%	1.4%	2.4%	2.1%			
	kW Impact	0.03	0.04	0.04	0.02	0.04	0.03			

Figure 7.1-4 shows the load reductions from 6 to 8 PM for CARE/FERA and non-CARE/FERA customers and for the population as a whole in the cool climate region for each service territory. The average reduction across all three rates at PG&E is 4.4%, which is nearly identical to the average in SCE''s cool climate region, which is 4.3%. The average reduction for SDG&E's cool region is 5.3%. For CARE/FERA customers, the average load reduction across the three tariffs in PG&E's cool region is only 1.6%. The average across SCE's three tariffs is 3.7% and the average for SDG&E's two CARE/FERA tariffs is 2.7%. The much lower percent reduction at PG&E, once again, is almost certainly due more to differences in population characteristics and climate than due to differences in the tariffs themselves. For example, customers in PG&E's cool region have much lower reference loads and a saturation of central air conditioning of only 8%, compared with the reference load and air conditioning saturation in SCE and SDG&E's cool region, where the air conditioning saturation equals 31% and 25% respectively. The variation in air conditioning saturations between PG&E and SCE/SDG&E is even greater for non-CARE/FERA customers. In PG&E's cool region, central air conditioning saturation for non-CARE/FERA households is only 6% whereas it equals 47% at SCE and 41% at SDG&E. These larger differences in saturations for non-CARE/FERA customers do not translate into large differences in average load reductions as they do with CARE/FERA customers, however, as the average percent reduction at PG&E is 5.1% compared with 4.5% at SCE and 5.7% at SDG&E.

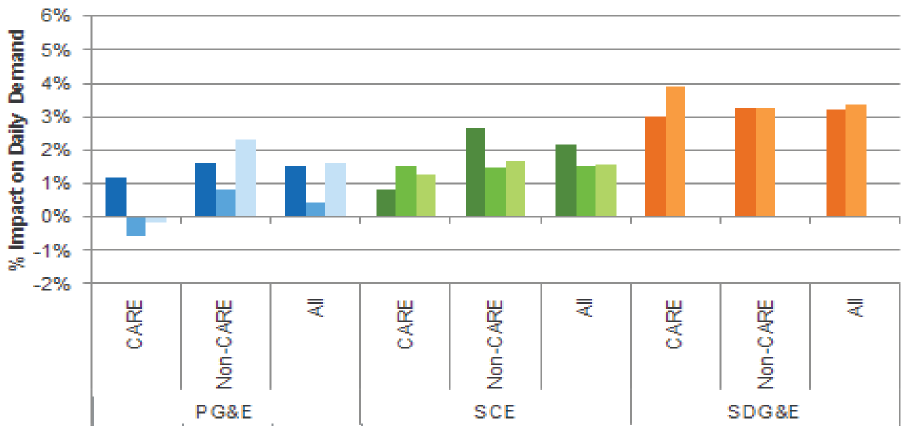
Figure 7.1-4: Load Reductions from 6 to 8 PM for Cool Climate Regions by Customer Segment, Average August and September Weekday



		PG&E			SCE Cool			SDG&E		
		CARE	Non-CARE	All	CARE	Non-CARE	All	CARE	Non-CARE	All
Rate 1	% Impact	2.2%	5.4%	4.7%	2.8%	4.1%	3.8%	2.6%	5.6%	5.1%
	kW Impact	0.01	0.03	0.03	0.02	0.04	0.04	0.02	0.04	0.04
Rate 2	% Impact	-0.2%	6.1%	4.9%	5.8%	3.4%	3.9%	2.8%	5.8%	5.4%
	kW Impact	0.00	0.03	0.03	0.04	0.03	0.04	0.02	0.04	0.04
Rate 3	% Impact	2.9%	3.9%	3.7%	2.6%	6.0%	5.2%			
	kW Impact	0.01	0.02	0.02	0.02	0.06	0.05			

Figure 7.1-5 shows the average reduction in daily electricity use for each of the 8 rate treatments tested across the three utilities. These values are very similar to those shown previously in Sections 4.3.4, 5.3.4 and 6.3.4, except that they represent just the months of August and September whereas the values shown in prior sections represent July through September for PG&E and SCE and July through October for SDG&E. At the service territory level, although the percent and absolute reductions are small, they are all statistically significant (based on the results discussed previously for the greater number of months). The average across the three tariffs is lowest for PG&E (1.2%) and highest for SDG&E (3.3%) with SCE's average equaling 1.7%. A key conclusion is that all of the tariffs show a modest conservation effect overall. There is no difference in the average reduction in daily electricity use between CARE/FERA and non-CARE/FERA customers in SDG&E's service territory and only a small difference in SCE's service territory. In PG&E's service territory, there was essentially no change in daily electricity use for CARE/FERA customers whereas non-CARE/FERA customers had a conservation effect of roughly 1.6%.

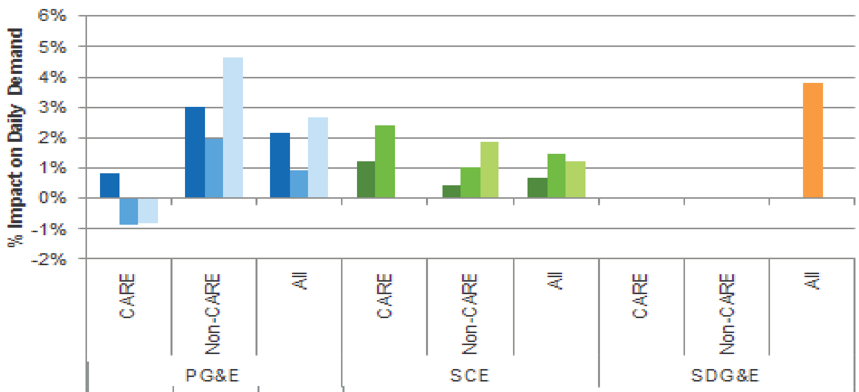
Figure 7.1.5: Daily Load Impacts by Rate Type, Customer Segment and Service Territory



		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
Rate 1	% Impact	1.2%	1.6%	1.5%	0.8%	2.7%	2.2%	3.0%	3.3%	3.2%
	kW Impact	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
Rate 2	% Impact	-0.5%	0.8%	0.4%	1.5%	1.5%	1.5%	3.9%	3.3%	3.4%
	kW Impact	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.02	0.02
Rate 3	% Impact	-0.2%	2.3%	1.6%	1.3%	1.6%	1.5%			
	kW Impact	0.00	0.01	0.01	0.01	0.01	0.01			

Figure 7.1-6 shows the variation in daily load impacts across tariffs, segments, and service territories for selected customer segments in the hot climate region. Recall that the sample sizes in SDG&E's hot region are not large enough to support segmentation for reasons discussed previously. There is significant variation in impacts within segments between PG&E and SCE and across rates within each service territory. The average load reduction across all three rates in the hot climate region for PG&E is 1.9% and for SCE it is 1.1%. However, PG&E's CARE/FERA customers, on average, actually increased use during the hours from 6 to 8 PM, while SCE's CARE/FERA customers decreased use on average by a little over 1%. PG&E's non-CARE/FERA customers had average reductions in daily electricity use equal to more than 3%, which is similar to the average at SDG&E, while SCE's non-CARE/FERA participants reduced use by 1.1% across the three tariffs.

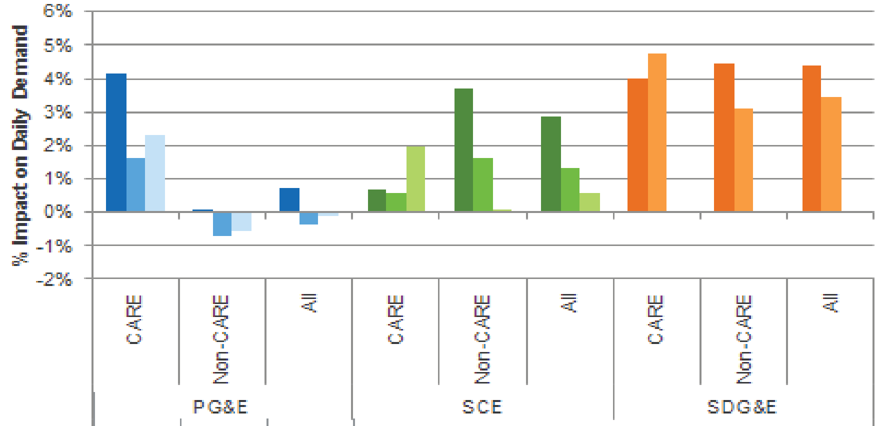
Figure 7.1-6: Daily Load Reductions in Hot Climate Regions by Customer Segment, Average August and September Weekday



		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
Rate 1	% Impact	0.8%	3.0%	2.2%	1.2%	0.4%	0.7%			
	kW Impact	0.01	0.03	0.02	0.01	0.01	0.01			
Rate 2	% Impact	-0.8%	2.0%	0.9%	2.4%	1.0%	1.5%			3.8%
	kW Impact	-0.01	0.02	0.01	0.02	0.01	0.02			0.03
Rate 3	% Impact	-0.8%	4.6%	2.6%	0.0%	1.9%	1.2%			
	kW Impact	-0.01	0.04	0.02	0.00	0.02	0.01			

As seen in Figure 7.1-7, the average reduction in daily electricity use in the moderate climate regions has a very different pattern than in the hot region. For the population as a whole, SDG&E's participants reduced daily electricity use on average by a very robust 4.0% whereas there was essentially no decrease in electricity use on average in PG&E's moderate climate region. At SCE, the average reduction of 1.6% was roughly in the middle of the other two utilities. The difference in the reduction between CARE/FERA and non-CARE/FERA customers in PG&E's moderate region was exactly the opposite of what was observed in the hot region, with CARE/FERA customers producing an average reduction of 2.7% while non-CARE/FERA customers had a slightly negative load reduction on average. The average load reductions between the two segments were much more similar in SCE and SDG&E's service territory.

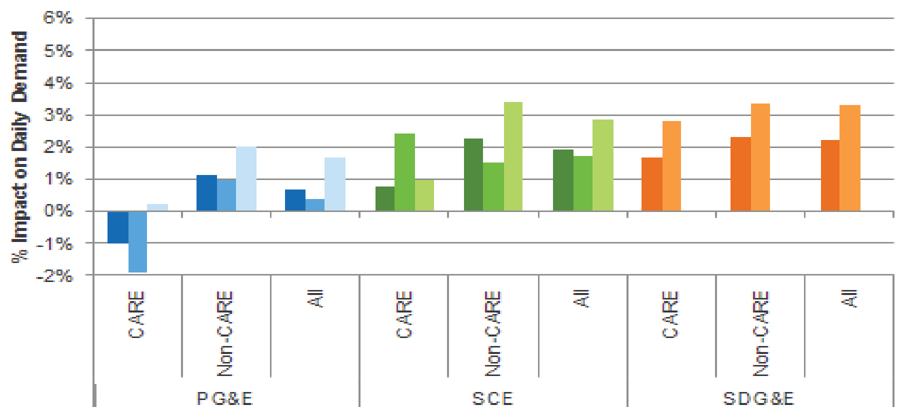
Figure 7.1-7: Daily Load Reductions in Moderate Climate Regions by Customer Segment, Average August and September Weekday



		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
Rate 1	% Impact	4.2%	0.1%	0.7%	0.7%	3.7%	2.9%	4.0%	4.5%	4.4%
	kW Impact	0.02	0.00	0.00	0.01	0.04	0.03	0.02	0.03	0.03
Rate 2	% Impact	1.6%	-0.7%	-0.4%	0.6%	1.6%	1.3%	4.7%	3.1%	3.5%
	kW Impact	0.01	0.00	0.00	0.00	0.02	0.01	0.03	0.02	0.02
Rate 3	% Impact	2.3%	-0.5%	-0.1%	2.0%	0.1%	0.6%			
	kW Impact	0.01	0.00	0.00	0.02	0.00	0.01			

Finally, Figure 7.1-8 shows the average reduction in daily electricity use in the cool climate regions for each rate, segment, and service territory. The average reduction across the three rates for the population as a whole equaled 0.9% for PG&E, 2.2% for SCE and 2.8% for SDG&E. PG&E's CARE/FERA customers had an average increase in daily electricity use while CARE/FERA customers had average load reductions in daily usage at SCE and SDG&E. Non-CARE/FERA customers had average load reductions in all three service territories.

Figure 7.1-8: Daily Load Reductions in Cool Climate Regions by Customer Segment, Average August and September Weekday

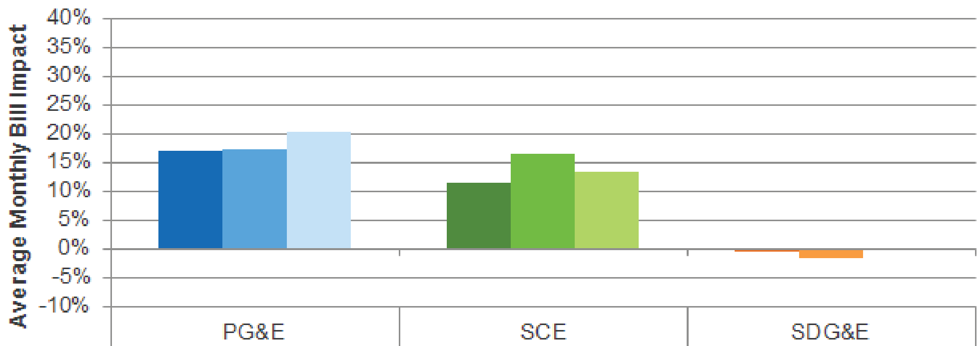


		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
Rate 1	% Impact	-1.0%	1.1%	0.7%	0.8%	2.2%	1.9%	1.7%	2.3%	2.2%
	kW Impact	0.00	0.00	0.00	0.00	0.02	0.01	0.01	0.01	0.01
Rate 2	% Impact	-1.9%	1.0%	0.4%	2.4%	1.5%	1.7%	2.8%	3.4%	3.3%
	kW Impact	-0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02
Rate 3	% Impact	0.2%	2.0%	1.7%	1.0%	3.4%	2.9%			
	kW Impact	0.00	0.01	0.01	0.01	0.02	0.02			

7.1.2 Bill Impacts

Figure 7.1-9 shows the average percentage bill impacts by rate and utility for the service territory as a whole. Keep in mind once again that the values below pertain only to the common months of August and September. As discussed previously, it is not surprising that bills on TOU rates are higher during the summer period, although that is not the case at SDG&E. The average increase over the OAT at PG&E is roughly 18% or almost $18 per month. At SCE, the average percent increase is roughly 14% or $15. In contrast, the average bill impact at SDG&E is a very small and negative, meaning the average customer saw a bill reduction.

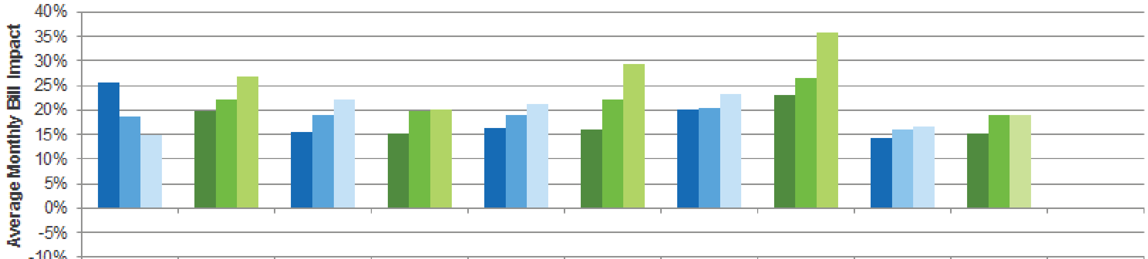
Figure 7.1-9: Average Summer Bill Impacts by Rate for Each Utility Service Territory (August and September)



		PG&E	SCE	SDG&E
Rate 1	% Impact	17.1%	11.5%	-0.5%
	$ Impact	16.48	12.63	-0.46
Rate 2	% Impact	17.2%	16.5%	-1.6%
	$ Impact	17.27	18.05	-1.66
Rate 3	% Impact	20.2%	13.3%	
	$ Impact	19.03	15.33	

Figure 7.1-10 shows the average monthly bill impacts for selected customer segments in the hot climate regions for each utility for the months of August and September. For nearly all customer segments, the largest impacts occur for SCE's Rate 3, which is the only tariff that does not have a baseline credit. The largest increase in average bills is observed for SCE's CARE/FERA customers on Rate 3, who saw an increase of more than 35%, or more than $33 per month. Senior households on SCE's Rate 3 had a lower percentage increase, equaling roughly 30%, but a higher absolute bill increase of more than $39. The lowest percentage bill increase across all segments and tariffs for PG&E and SCE was 14.2% for Rate 1, non-CARE/FERA customers in PG&E's service territory while the lowest absolute bill increase was for CARE/FERA customers on PG&E's Rate 1. There was essentially no change in bills for customers in SDG&E's hot climate region.

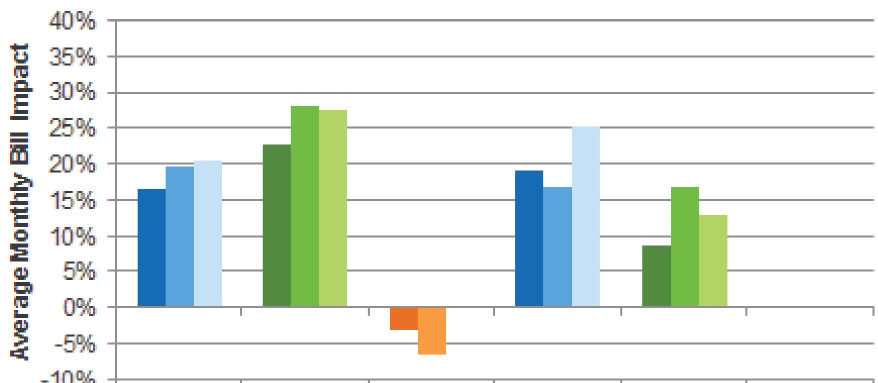
Figure 7.1-10: Average Summer Bill Impacts by Customer Segment for Hot Climate Regions (August & September)



		Below 100% FPG		100% - 200% FPG		Senior		CARE		Non-CARE		
		PG&E	SCE	PG&E	SCE	PG&E	SCE	PG&E	SCE	PG&E	SCE	SDG&E
Rate 1	% Impact	25.6%	19.7%	15.5%	15.1%	16.2%	15.9%	20.1%	22.9%	14.2%	15.1%	
	$ Impact	23.80	20.19	16.44	19.39	19.28	23.36	16.43	20.94	23.33	25.63	
Rate 2	% Impact	18.6%	22.1%	19.0%	19.8%	19.0%	22.1%	20.4%	26.5%	16.0%	18.9%	-0.2%
	$ Impact	19.33	23.57	20.71	24.02	22.59	30.82	17.98	24.22	25.61	31.81	-0.26
Rate 3	% Impact	14.9%	26.8%	22.2%	20.1%	21.2%	29.5%	23.3%	35.6%	16.6%	19.0%	
	$ Impact	15.97	27.70	25.16	26.02	24.90	39.37	20.21	32.67	27.02	32.33	

Figure 7.1-11 shows the bill impacts in the moderate climate regions for each utility service territory. Once again, bill impacts in SDG&E's service territory are either negative or non-existent, whereas the impacts in the other service territories range from a low of roughly 13% for SCE's Rate 3, non-CARE/FERA customers to a high of roughly 28% for SCE's Rate 2, CARE/FERA customers. Absolute bill increases at PG&E and SCE range from a low of roughly $8 for PG&E's CARE/FERA customers on Rate 1 to a high of roughly $21 for SCE's CARE/FERA customers on Rate 2.

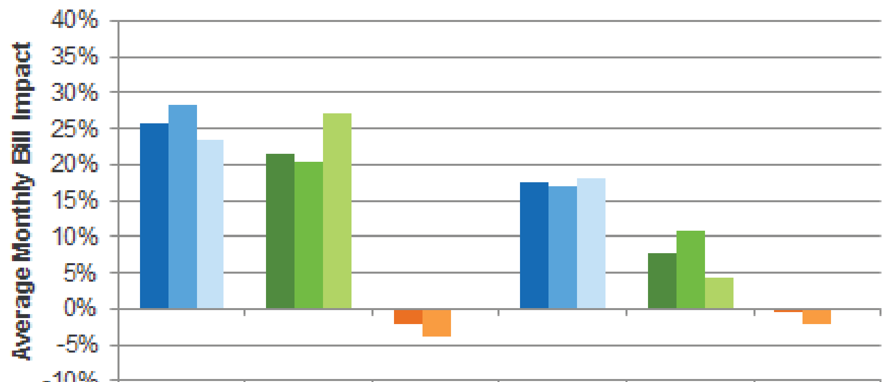
Figure 7.1-11: Moderate Climate Zones, Average Summer Bill Impacts (August & September)



		CARE			Non-CARE		
		PG&E	SCE	SDG&E	PG&E	SCE	SDG&E
Rate 1	% Impact	16.4%	22.7%	-3.3%	19.2%	8.6%	0.3%
	$ Impact	8.06	16.02	-2.39	17.00	13.71	0.41
Rate 2	% Impact	19.7%	28.1%	-6.5%	16.7%	16.7%	0.2%
	$ Impact	9.31	21.01	-4.87	16.99	23.86	0.26
Rate 3	% Impact	20.4%	27.4%		25.2%	12.7%	
	$ Impact	9.38	20.37		20.63	20.10	

Figure 7.1-12 shows the bill impacts in the cool climate region, which are significantly less than the bill impacts in the moderate and hot regions. At PG&E and SCE, bill impacts ranged from a low of 4.4% for SCE's Rate 3, non-CARE/FERA customers to a high of more than 28% for PG&E's Rate 2, CARE/FERA customers. The lowest dollar impact in the cool climate region at SCE and PG&E was $5 and occurred for non-CARE/FERA customers on Rate 3 in SCE's service territory and the highest bill increase, roughly $13, occurred for PG&E's CARE/FERA customers on Rate 3.Once again, on average, SD&E's customers showed an average reduction in bills even during this summer period.

Figure 7.1-12: Cool Climate Zones, Average Summer Bill Impacts (August & September)



		CARE			Non-CARE		
		PG&E	SCE	SDG&E	PG&E	SCE	SDG&E
Rate 1	% Impact	25.8%	21.5%	-2.1%	17.5%	7.7%	-0.5%
	$ Impact	9.22	10.21	-1.05	12.06	7.77	-0.52
Rate 2	% Impact	28.3%	20.3%	-3.9%	16.9%	11.0%	-2.2%
	$ Impact	9.42	9.97	-2.01	11.71	11.94	-2.20
Rate 3	% Impact	23.6%	27.3%		18.2%	4.4%	
	$ Impact	8.29	13.11		11.96	5.05	

7.2 Overall Key Findings

The initial few months of the TOU pilots summarized above has produced a large amount of preliminary information that will be useful in guiding California's pricing strategy over the coming years. However, it must be kept in mind that these findings are preliminary and are based on only a few summer months. Both load impacts and bill impacts are going to differ significantly during winter months and the actions and perceptions of TOU pilot participants may be quite different over the course of a full year and even over the course of summer 2017 when customers will have had the experience of summer 2016 to rely on for input to their behavioral decisions. Also, as mentioned numerous times above, when interpreting results to date, policymakers must keep in mind that statistically significant differences do not necessarily translate into material differences, especially for survey findings, since the large number of customers participating in the pilots (which was driven largely by the desire to estimate load impacts with reasonable precision) combined with the decision to survey all participants means that even very small differences in survey metrics can be found to be statistically significant. With these cautions in mind, the remainder of this section provides a high level summary of key findings.

7.2.1 Load Impacts

Key findings for load impacts include the following:

- While many pricing pilots and programs have been evaluated in the electricity industry nationwide and in California, few if any have tested tariffs that have peak pricing periods that extend well into the evening hours when air conditioning loads are lower and when many residential households have occupants arriving home from work and engaging in evening activities. All eight tariffs tested in these pilots had a substantial portion of the peak period covering key evening hours. Indeed, the common hours across all eight tariffs are from 6 to 8 PM. Some tariffs had peak periods extending until 9 PM and some had shoulder periods extending until midnight. As such, a key finding from the pilots is that statistically significant load reductions were found for all rates tested for the service territory as a whole and for all climate regions. Table 7.2-1 summarizes the percentage and absolute peak period load reductions for each rate and service territory. As seen, the lowest load impact occurred for SCE's Rate 3, showing an average reduction of 2.7% and 0.03 kW, and the highest occurred for PG&E's Rate 2, which had an average percentage reduction of 6.1% and 0.06 kW.

Table 7.2-1: Peak Period Load Reductions

Utility	Metric	Rate 1	Rate 2	Rate 3
PG&E	Peak Period Hours	4-9 PM	6-9 PM	4-9 PM
	% Impact	5.8%	6.1%	5.5%
	Absolute Impact (kW)	0.06 kW	0.06 kW	0.06 kW
SCE	Peak Period Hours	2-8 PM	5-8 PM	4-9 PM
	% Impact	4.4%	4.2%	2.7%
	Absolute Impact (kW)	0.06 kW	0.06 kW	0.03 kW
SDG&E	Peak Period Hours	4-9 PM	4-9 PM	N/A
	% Impact	5.4%	4.6%	N/A
	Absolute Impact (kW)	0.04 kW	0.04 kW	N/A

- Another important policy question given shifting load patterns at some utilities is the magnitude of peak period load reductions on weekends. Peak period load reductions on weekends and the pattern of load reductions across rate periods on weekends were generally similar to weekday impacts.
- Also often of interest when examining TOU rates is whether peak period reductions consist primarily of load shifting, in which case daily usage would remain roughly the same, load reductions that are not completely offset by increases in other rate periods, which would reduce usage overall, or whether customers actually take advantage of lower off-peak prices by consuming more in lower priced periods than is reduced during high priced periods in which case overall usage would increase. For the majority of rates, climate regions and customer segments, there was a small but statistically significant overall reduction in electricity use. The reduction in daily usage ranged from very small negative values (e.g., an increase) to as high as 4%.
- For PG&E, absolute reductions in peak period energy use were largest in the hot climate region, second largest in the moderate region and smallest in the cool region and differences across regions were statistically significant for all three rates. Percentage reductions also followed this

pattern at PG&E but the differences were not always statistically significant. This pattern was also found at SDG&E. However, at SCE, the pattern of load reductions was not the same. In general, the differences across regions were smaller and in some cases, the largest load reductions were found in the cool climate region and the smallest in the hot region. It is noteworthy that SCE's hot region has many more hot days than PG&E's hot region and SCE's moderate region is much hotter than PG&E or SDG&E's hot region. This, combined with the fact that some of SCE's rates had long shoulder periods during which prices were higher than during the off-peak period may have made it difficult for customers in hot regions to reduce energy use and still stay reasonably comfortable.

- For the service territory as a whole for all three utilities, CARE/FERA customers had lower average percent and absolute peak period load reductions than non-CARE/FERA customers for all rates. This pattern was typically (although not universally) true at PG&E and SDG&E for all rates and climate regions. Once again, SCE had a different result for some rates and climate regions. In selected cases, CARE/FERA customers even had larger load reductions than non-CARE/FERA customers in SCE's service territory.
- Senior households in both PG&E's and SCE's hot climate region had load reductions very similar to those for the general population in the hot climate region. This was true for senior households overall as well as for senior households that were and were not in the CARE/FERA program.
- Households with incomes below 100% of the Federal Poverty Guidelines (FPG) in hot climate regions did not reduce peak period loads in PG&E's service territory but had load reductions similar to the general population in SCE's hot climate region.
- SCE recruited customers who already owned smart thermostats into the study and randomly assigned these customers to rate and treatment groups to estimate the magnitude of load impacts for customers with smart thermostats. Load impacts for these customers were similar to those for the general population even though these customers had larger usage overall and, therefore, might be expected to have larger load reductions. SCE plans to work with the smart thermostat provider in the lead-up to summer 2017 to see if the offer to optimize usage in light of being on TOU rates might produce larger load reductions.
- SDG&E tested whether delivery of weekly summaries of usage and bills to TOU customers would produce greater load reductions compared with households on TOU rates that did not receive this information. Differences in load impacts between customers who did and did not receive Weekly Alert Emails were not statistically significant.
- PG&E offered a smart phone app that would provide a variety of information to those who downloaded it that might help them to manage their energy use. The number of customers who successfully downloaded the app was quite low and there were not enough users to determine whether the app had an impact.

7.2.2 Bill Impacts

Key findings concerning bill impacts include the following:

- At both PG&E and SCE, average monthly bills were higher for all TOU rates than they would have been on the OAT for all customer segments and all climate regions. Average monthly bill increases over three summer months ranged from a low of roughly $5 to as much as $40. Most segments on average were only able to offset a small proportion of the structural bill increase by reducing or shifting usage. It is important to keep in mind that these bill increasers are likely to be the worst that will occur over any stretch during the pilot. It should also be noted that some of the increases would be largely or completely offset by enrollment bill credits that were distributed during the summer (and to also not that these credits were not factored into the bill comparison calculations presented here).

- Absolute bill impacts were typically largest in the hot climate region, second largest in the moderate region and smallest in the cool region.
- Bill impacts at SDG&E were quite different from those at PG&E and SCE, with very small structural impacts and with some customer segments being able to more than offset small structural bill increases with load shifting or conservation behavior and, thus, had slightly lower bills even during the summer period than they would have had on the OAT.

The stark contrast between the relatively large bill increases for TOU customers during the summer months at PG&E and SCE relative to SDG&E is noteworthy and should be examined carefully as the IOUs develop pricing strategies for default enrollment starting in 2019. This significant difference did not stem from SDG&E having significantly more modest peak-to-off-peak price differentials or smaller differentials between peak prices and the OAT price relative to the other two utilities. Indeed, SDG&E's price differentials were larger than for several of the pilot rates at PG&E and SCE. Rather, the much more modest bill impacts at SDG&E had to do with the fact that both SDG&E's OAT and TOU rates are seasonally price differentiated, with higher prices in the summer than in the winter. SCE and PG&E's OATs are not seasonally differentiated, but their TOU rates are. As a result, the summer bill differentials between their TOU and OAT rates were much greater than SDG&E's.

Another point to keep in mind is that bill volatility across seasons can be managed through tools designed specifically to address bill volatility, such as balanced payment plans, which allow customers to pay the same bill each month based on historical usage and current rates (with periodic true-ups). The extent to which this option might mute TOU price signals is subject to debate but will be examined in the default pilots that the IOUs will implement in 2018.

A final point to keep in mind as default tariff options are designed is that all customers who will be defaulted onto TOU rates in 2019 will receive bill protection for the first full year on the new tariff. As such, while summer bills may be higher than under the OAT, customers who stay for a full year will not pay a higher bill than they would under the OAT.

In summary, while bill volatility is a legitimate concern in light of the relatively large bill increases experienced by many pilot participants over the few summer months covered by this initial evaluation period, it is not at all clear that a good solution to this problem is to mute the TOU price signal. Seasonal bill volatility exists even under the OAT in California due to tiered pricing and variation in usage over seasons. Importantly, SDG&E's pilot tariffs had TOU price signals higher than some of the PG&E and SCE pilot rates that were associated with much higher bill volatility. Designing TOU tariffs that account for the seasonal differentiation in the OAT (or lack thereof), and offering balanced payment programs, combined with first year bill protection, may be better solutions that will protect customers while improving economic efficiency through TOU prices that more accurately reflect cost causation.

7.2.3 Customer Attrition

Customer attrition is driven by three very different factors. One is customers who move, referred to as customer churn. Another is customers who become ineligible as a result of factors such as installing solar, going onto medical baseline, or switching to service from a Community Choice Aggregator (CCA). The final factor is customers who consciously opt out of the rate because they are unhappy being on a TOU rate. Key findings concerning customer attrition include the following:

- Cumulative opt-out rates between enrollment and the end of December have been quite low for nearly all rates and customer segments. For PG&E, the cumulative percent of treatment customers who dropped off the rate was between 1% and 2% and at SCE it was between 1.5% and 3%.
- There is no material difference in the cumulative percent of opt outs across tariffs at PG&E or SDG&E. At SCE, the cumulative percent of opt outs for Rate 3 was 3% for the service territory as a whole and was roughly 10% for CARE/FERA customers in the hot climate region.
- The number of customers dropping off the TOU rates was highest in the hot region, second in the moderate and lowest in the cool climate region for all tariffs (but still very low in all cases except for SCE's Rate 3 in the hot climate region).
- Opt out rates were slightly lower for CARE/FERA customers in PG&E's service territory compared with non-CARE/FERA customers and the opposite was true in SCE's service territory but the differences were small in all cases except for Rate 3 at SCE.
- Overall attrition ranged from as low as 4% to as high as 18% with the highest being for CARE/FERA customers in SCE's hot climate region on Rate 3. Given that the pilot planning assumption was that total attrition would be roughly 25% over the course of the two summer periods, this segment may be at risk of having sample sizes that are lower than ideal by summer 2017.
- Attrition has also been high in PG&E's moderate and cool climate regions for some segments due primarily to customers switching to CCAs, which are quite active in PG&E's service territory. With CCA growth expected to continue, some sample sizes at PG&E may also be at risk of being smaller than required to meet target levels of statistical precision by summer 2017. However, there is some cushion in these sample size estimates and unless the pace of CCA recruitment increases dramatically over current projections, this problem should be manageable.

7.2.4 Survey Findings

Key findings from the surveys that were administered include the following:

- An important policy question is whether TOU rates might increase economic hardship for selected customer segments in the hot climate region for PG&E and SCE and the moderate climate region for SDG&E. The surveys included questions pertaining to economic hardship and responses to several questions were combined to produce an economic index. The value of this index was compared between treatment and control customers to determine whether the TOU rates increase the value of the index. There were no statistically significant differences in the index values for segments of interest at PG&E or SDG&E. At SCE, Rate 3 CARE/FERA customers and Rate 2 customers with incomes between 100% and 200% of FPG had higher economic index scores when compared with control group customers. The difference in values is equivalent to a customer noting difficulty paying one additional bill over the summer or using one additional non-income based method to pay their bills.

- The surveys also asked customers whether they had sought medical attention due to excessive heat and these responses were compared between treatment and control customers. These comparisons were made only for customers who reported requiring air conditioning due to a medical condition. No difference in this health index between treatment and control customers was found at PG&E or SDG&E. At SCE, about 10% more Rate 1 and Rate 3 CARE/FERA customers reported seeking medical attention due to excessive heat when compared with control customers.
- At PG&E and SCE, satisfaction ratings with the TOU rate and with the utility were typically slightly lower for TOU rate customers than for control customers and these differences were sometimes statistically significant but they were always less than 1 point on an 11 point scale. Put another way, none of these differences are likely to be judged as material. At SDG&E, customers on the TOU rates sometimes had higher satisfaction ratings than control customers.
- The surveys revealed that a very large percent of customers on TOU rates received summer bills that were higher than expected. This is also true of control customers since summer bills are typically higher for many customers in California. However, the percentage difference on this metric between treatment and control customers was statistically significant for the majority of rates, customer segments, and climate regions at PG&E and SCE. For some segments, rates and climate regions, more than 50% of customers said their bills were higher than expected. This is an important finding that should influence not only the timing of enrollment for customers on TOU rates but also the content of ME&O materials which could do a better job of preparing customers for higher than expected bills in the summer period (while reminding them about lower bills at other times of the year).
- The surveys also showed a significant disparity in understanding of the timing of the peak period between CARE/FERA and non-CARE/FERA customers. For some rates and climate regions, between 30% and 40% of CARE/FERA customers could not identify a single hour that fell in the peak period rate window, while the percent of non-CARE/FERA customers that had the same level of misunderstanding was often significantly lower or even in the single digits. This disparity could partly be due to the fact that more CARE/FERA customers have English as a second language, but there may be other explanations. Nexant recommends that this issue be carefully addressed and studied further in the upcoming default pilots where there is a much greater emphasis on and opportunity to test ME&O options and content for all segments.
- For all three utilities, customers on TOU rates were more likely to take time-specific actions than customers in the control condition. For example, while a similar proportion of customers from control and rate groups indicated they turned off their lights to conserve energy, a larger proportion of treatment customers indicated they shifted doing laundry and running the dishwasher during peak hours. This trend suggests that while fewer rate customers understood the nuances of their rates, they did know and act on actions that helped them shift use.

Appendix A Listing of Electronic Tables

The following Microsoft Excel files have been filed as electronic tables in conjunction with the primary report. Given the large volume of different rates and customer segments across utilities, electronic tables are the most efficient medium to present this data. Within these tables, users are able to select options such as the rate or customer segment of interest. The numbering of the tables corresponds to the section of the report containing the corresponding static figures and tables. In cases where more than one table corresponds to a section, each electronic table is labeled as X.X-1 and X.X-2. The file names for the electronic tables do not directly tie to any particular figure or table numbers, even though the naming convention is similar. These electronic tables allow the reader to access the underlying data that created the figures, and to determine actual values for data points within figures.

E-Table 4.3-1 - PG&E Load Impacts by Hour

E-Table 4.3-2 - PG&E Load Impact Tables & Figures

E-Table 4.4 - PG&E Bill Impacts

E-Table 4.5-1 - PG&E Survey Results Tables and Statistical Details

E-Table 4.5-2 - PG&E Survey Responses by Segment

E-Table 5.3-1 - SCE Load Impacts by Hour

E-Table 5.3-2 - SCE Load Impact Tables & Figures

E-Table 5.4 - SCE Bill Impacts

E-Table 5.5-1 - SCE Survey Results Tables and Statistical Details

E-Table 5.5-2 - SCE Survey Responses by Segment

E-Table 6.3-1 - SDG&E Load Impacts by Hour

E-Table 6.3-2 - SDG&E Load Impact Tables & Figures

E-Table 6.4 - SDG&E Bill Impacts

E-Table 6.5-1 - SDG&E Survey Results Tables and Statistical Details

E-Table 6.5-2 - SDG&E Survey Responses by Segment

E-Table 7.1 - Cross Utility Comparison

ATTACHMENT B

CALIFORNIA STATEWIDE OPT-IN TOU PRICING PILOT -SECOND INTERIM EVALUATION NOVEMBER 1ST 2017

Nexant
Reimagine tomorrow.

California Statewide Opt-in Time-of-Use Pricing Pilot

Second Interim Evaluation

November 1, 2017

Prepared for
The TOU Working Group,
under contract to:
Southern California Edison Company

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1 Executive Summary

This document constitutes the second interim evaluation report and covers findings from the first full year of California's statewide, residential opt-in time-of-use (TOU) pricing pilots implemented by Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE) and San Diego Gas and Electric Company (SDG&E). These pilots were implemented in response to California Public Utilities Commission (CPUC) Decision 15-07-001. A key objective of the pilots is to develop insights that will guide the IOUs applications to be filed in January 2018 proposing the implementation of default TOU pricing for all residential electricity customers and the CPUC's policy decisions regarding default pricing. Findings from the first summer—June through October 2016—are documented in the "Statewide Opt-in TOU Evaluation First Interim Report"[1] dated April 11, 2017. The First Interim Report contains detailed background information on the pilot, a detailed methodology section, describes the pilot design and evaluation methodology used for analysis, discusses each IOUs pilot implementation and treatments, and presents load impacts, bill impacts, and survey findings covering the first summer period.

Collectively, the pilots implemented across the three IOUs are testing nine different TOU rate options. For eight of the nine options, more than 50,000 households were enrolled and assigned to one of the TOU rates or retained in the study on the standard tiered rate to act as a control group for those who were placed on the new tariffs. The ninth rate option is a complex, dynamic rate that SDG&E is testing on a very small group of customers. Recruitment for this rate led to enrollment of roughly 65 customers.

1.1 Pilot Evaluation

Evaluation of the opt-in pilots focused on a number of important research objectives, including:

- Determining the change in electricity use in different time periods for different customer segments and climate regions from each rate treatment and in response to the technology and information treatments that were also included in the pilot as described in the First Interim Report;
- Estimating the distribution of bill impacts associated with each rate option both before and after enrolling on the TOU rates;
- Assessing the extent to which the TOU rates cause unreasonable hardship among selected customer segments such as seniors and economically vulnerable customers in hot climate areas;
- Determining satisfaction with and perceptions about, understanding of and reported changes in behavior associated with different treatment options.

Load and bill impacts are estimated for CARE/FERA[2] and non-CARE/FERA customer segments in each of three climate regions (hot, moderate, and cool) in each IOU service territory. In the hot climate region in PG&E and SCE's service territories, senior households (e.g., households with at least one resident who is

[1] The First Interim Report can be found here: http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442453144

Additional related documents on the CPUC website can be found here: http://www.cpuc.ca.gov/General.aspx?id=12154

[2] California Alternate Rates for Energy (CARE) and Family Electric Rate Assistance (FERA) customers receive significant electricity price subsidies. Participation in these programs is tied to income and household size.

65 years or older) and households with incomes below 100% of Federal Poverty Guidelines (FPG) were oversampled for one rate option in the hot climate region in order to assess whether TOU rates might cause undue hardship for these segments.

Load impacts for each rate and technology treatment were estimated by comparing loads for customers randomly assigned to each TOU tariff (e.g., treatment customers) with loads for customers randomly assigned to the OAT (e.g., control customers). The difference in loads between treatment and control customers in each rate period before customers are placed on the TOU rate (e.g., the pretreatment period) is subtracted from the difference after customers are placed on the rate (e.g., the treatment period) to ensure that there is no bias in the estimated impact due to random chance. This is referred to as a “difference-in-differences” (DiD) analysis. When applied to data collected through an RCT design, DiD analysis produces the most accurate load impact estimates possible through experimental research.

Bill impacts were estimated in a similar manner to load impacts in that a DiD analysis was conducted in order to control for exogenous factors that might impact bills between the pre- and post-treatment periods. Bill impacts were estimated as the difference between bills using pre- or post-treatment loads based on the TOU tariff compared with the OAT. Average bill impacts are reported as well as changes in the percent of customers who experience bill impacts above a certain threshold.

Assessing the extent to which TOU rates cause unreasonable hardship among selected customer segments such as seniors and economically vulnerable customers in hot climate areas is done primarily through survey questions designed to measure hardship. Two surveys were conducted, one following the first summer period and the second at the end of the first year on the pilot rates. Both surveys were sent to the entire treatment and control population using a mixed mode, email, mail and phone (EMP) methodology. Responses between treatment and control customers are compared to determine if TOU rates significantly increase the percent of customers that report hardship conditions. Satisfaction with, perceptions about, understanding of, and reported changes in behavior associated with different rate and other treatment options are also determined through surveys. Response rates varied across customer segments and treatment cells but were substantial to guard against bias.

1.2 Overall Findings

The first year of the TOU pilots produced a large amount of information that will be useful in guiding California’s pricing strategy over the coming years. The first year has provided insights regarding changes in customers’ energy use in response to TOU rates during the summer, winter, spring, and for the full year, a variety of bill impact metrics on an equivalent seasonal and annual basis, and insights into the customer’s experience on the pilot through two surveys. One of the final research objectives for the pilot, to evaluate impact persistence, will follow in the final report after data from the second summer is available for analysis. When interpreting results to date, policymakers must keep in mind that statistically significant differences do not necessarily translate into material differences, especially for survey findings, since the large number of customers participating in the pilots (which was driven largely by the desire to estimate load impacts with reasonable precision) combined with the decision to survey all participants means that even very small differences in survey metrics can be found to be statistically significant. With this caution in mind, the remainder of this section provides a high level summary of key findings.

1.2.1 Load Impacts

Key findings for load impacts include the following:

- While many pricing pilots and programs have been evaluated in the electricity industry nationwide and in California, few if any have tested tariffs that have peak pricing periods that extend well into the evening hours when many residential households have occupants arriving home from work and engaging in evening activities. **This second interim report now evaluates how customers responded to the time-of-use rates during the winter and spring seasons.** All eight tariffs tested in these pilots had a substantial portion of the peak period covering key evening hours, which include more hours after the sun has set, compared to the summer season. Indeed, **the common hours across all eight tariffs are from 6 to 8 PM**. Some tariffs had peak periods extending until 9 PM and some had shoulder periods extending until midnight. **A key finding from the pilots in the winter season is that statistically significant load reductions were found for all rates tested for the service territory as a whole and for nearly all climate regions.** Table 1.2-1 summarizes the percentage and absolute peak period load reductions for each rate and service territory. As seen, the lowest load impact occurred for SCE's Rate 1, showing an average reduction of 1.4% and 0.01 kW, and the highest occurred for PG&E's Rate 1 and Rate 2, which had average percentage reductions of 3.6% and 0.03 kW.

Table 1.2-1: Winter Weekday Peak Period Load Reductions*

Utility	Metric	Rate 1	Rate 2	Rate 3
PG&E	Peak Period Hours	4-9 PM	6-9 PM	4-9 PM
	% Impact	3.6%	3.6%	3.5%
	Absolute Impact (kW)	0.03 kW	0.03 kW	0.03 kW
SCE	Peak Period Hours	2-8 PM	5-8 PM	4-9 PM
	% Impact	1.4%	2.0%	3.2%
	Absolute Impact (kW)	0.01 kW	0.02 kW	0.03 kW
SDG&E	Peak Period Hours	4-9 PM	4-9 PM	N/A
	% Impact	2.3%	1.7%	N/A
	Absolute Impact (kW)	0.02 kW	0.01 kW	N/A

* All impacts presented here are statistically significant

- Another important policy question given shifting load patterns at some utilities is the magnitude of peak period load reductions on weekends. Peak period load reductions on weekends and the pattern of load reductions across rate periods on weekends were generally similar to weekday impacts. **That is, customers can and will respond to TOU price signals on weekends.**
- Also often of interest when examining TOU rates is whether peak period reductions consist primarily of load shifting, in which case daily usage would remain roughly the same, load reductions that are not completely offset by increases in other rate periods, which would reduce usage overall, or whether customers actually take advantage of lower off-peak prices by consuming more in lower priced periods than is reduced during high priced periods in which case overall usage would increase. For the majority of rates, climate regions and customer segments, there was a small but statistically significant overall reduction in electricity use. **The**

reduction in total annual usage ranged from very small negative values (e.g., an increase) to as high as 3.1%.

- **For PG&E, winter load impacts in both absolute and percentage terms, were largest in the hot climate region, second largest in the moderate region, and lowest in the cool region for Rates 1 and 3** (although the differences were not always statistically significant). PG&E load impacts were slightly larger in the moderate climate region than the hot region for Rate 2, though the difference is not statistically significant. **At SDG&E, load impacts for Rate 2 in both absolute and percentage terms, were largest in the hot climate region, and there was not a statistically significant difference between the moderate and cool climate regions.** However, at SCE, the pattern of load reductions was not the same. **In general, the differences across regions at SCE were smaller and in some cases, the largest load reductions were found in the moderate or cool climate region and the smallest in the hot region.** It is noteworthy that SCE's hot region experiences some of the most extreme temperature swings both seasonally and daily. In fact, SCE's hot region is generally SCE's coldest region in the winter. Similar temperature patterns were also observed in PG&E's territory in regions such as Bakersfield.
- **Load impacts in the winter are slightly smaller than in the summer even though, according to survey results, customers mostly persisted in taking several actions to shift or reduce their usage during the summer and the winter. This is likely due to customers having fewer opportunities to take actions in the winter that have a large impact on their electricity load, such as reducing or turning off their air-conditioning.** Customers did report reducing or turning off their heat during the winter, for example, but most customers use natural gas for heating their homes, which would have little to no impact on electricity usage.
- **For the service territory as a whole for all three utilities, CARE/FERA customers had lower average percent and absolute peak period load reductions than non-CARE/FERA customers for all rates.** This pattern was typically (although not universally) true at PG&E, SCE, and SDG&E for all rates and climate regions.
- **Senior households in both PG&E's and SCE's hot climate region had load reductions generally similar to those for the general population in the hot climate region**. However, SCE Senior households had slightly lower impacts than the general population in the hot climate region, and PG&E Senior households had slightly larger impacts than the general population in the hot climate region.
- **Households with incomes below 100% of the Federal Poverty Guidelines (FPG) in hot climate regions did not reduce peak period loads in PG&E's service territory but had load reductions slightly larger compared to the general population in SCE's hot climate region.**
- **Households who had previously purchased smart thermostats reduced winter peak period usage by approximately 4.9% in the SCE service territory,** which was significantly higher compared to non-CARE/FERA population weighted load reductions of 1.8%. Nest offered its "Time of Savings" support service for the second summer, which could affect second summer impacts in the final report.
- **SDG&E customers who received Weekly Alert Emails in the moderate climate region had small but statistically significant increases in load reductions equal to approximately 0.01 kW**, whereas customers in the cool climate region had impacts decline by approximately 0.01 kW. In both cases, the difference was negligible due to the small impacts in general.
- **SDG&E offered rebates for smart thermostats to customers through the Whenergy program.** 2,214 customers were reached out to via direct mail and 4,889 customers were contacted via email for the $100 rebate offer. A similar number of customers were offered the $200 rebate

(2,201 direct mail and 4,920 email).[3] 349 applications were received, and of those, 246 were deemed eligible and ultimately accepted. **Of the 246 applications accepted, 95 were for the $100 rebate offer, and 151 were for the $200 rebate offer.**

- PG&E continued to offer a smart phone app that would provide a variety of information to those who downloaded it that might help them to manage their energy use. **The number of customers who successfully downloaded the app was quite low and there were not enough users to determine whether the app had an impact.**

1.2.2 Bill Impacts

Key findings concerning bill impacts include the following:

- **Total annual bill impacts were very small at all three utilities, with impacts between essentially 0% and 2% reductions for the average customer.** The 12-month bill impacts varied significantly by climate region and CARE/FERA status. At SCE, CARE/FERA customers faced greater bill increases than non-CARE/FERA customers in most cases (on a percentage basis).
- **At both PG&E and SCE, average monthly winter bills were lower for all TOU rates than they would have been on the OAT for nearly all customer segments and all climate regions.** The exception was CARE/FERA customers on Rate 3 in SCE's cool climate region. Average monthly bill reductions over the winter months ranged from a low of roughly $1 to as much as $12. Most segments on average were only able to save a small amount more in addition to the structural bill reduction by reducing or shifting usage. It is important to keep in mind that customers generally faced bill increases during the summer months of the pilot.
- **Bill impacts at SDG&E were quite different from those at PG&E and SCE, with very small structural impacts in the winter months.** Customers faced winter bill impacts that were generally less than 1% in either direction, at the territory level and at the CARE/FERA and non-CARE/FERA level.
- **Average annual total bill impacts varied significantly by utility, rate, and climate region.** The average customer at PG&E across all three rates either had no change in the total annual cost of energy or a slight reduction of up to $6. The largest decrease was $36 for CARE/FERA customers in the moderate climate region on Rate 1, and the largest annual bill increase was $40 for non-CARE/FERA customers on Rate 2 in the hot climate region. At SCE, the average customer across all three rates either had no change in the total annual cost of energy or a slight reduction of up to $10. The largest decrease was $47 for SCE non-CARE/FERA customers in the cool climate region on Rate 3, and the largest annual bill increase was $64 for non-CARE/FERA customers on Rate 1 in the hot climate region. At SDG&E, the average customer across both rates had a slight reduction of up to $10 in the total annual cost of energy. The largest decrease was $28 for SDG&E non-CARE/FERA customers in the cool climate region on Rate 2, and the largest annual bill increase was $20 for general population on Rate 2 in the hot climate region.

[3] It isn't known if there was overlap in marketing to customers between the email and direct mail channels. This will be clarified and additional details regarding acceptance rates by incentive level and treatment versus control group will be included in the final report. Load impacts were not estimated for the customers who received the rebates due the sample size being too small to yield statistically significant impacts.

Overall, the average customer across all utilities experienced a slight decrease in the annual cost of electricity. The findings varied significantly by utility, rate, climate region, and customer segment ranging from an increase of $64 to a decrease of $47 per year. While this is the net difference in total bills for the year, it's important to keep in mind that lower winter prices generally offset the higher summer prices. Many customers experienced summertime bill increases of $20 to $35 per month on average. While bill volatility is a legitimate concern in light of the relatively large bill increases experienced by many pilot participants over the few summer months covered in the initial evaluation period, this is not an indication that a good solution to this problem is to mute the TOU price signal.

Seasonal bill volatility exists even under the OAT in California due to tiered pricing and variation in usage over seasons. Importantly, SDG&E's pilot tariffs had TOU price signals higher than some of the PG&E and SCE pilot rates that were associated with much higher bill volatility. Designing TOU tariffs that account for the seasonal differentiation in the OAT (or lack thereof), and offering balanced payment programs, which allow customers to pay the same bill each month based on historical usage and current rates (with periodic true-ups), combined with first year bill protection, may be better solutions that will protect customers while improving economic efficiency through TOU prices that more accurately reflect cost causation. The extent to which this option might mute TOU price signals is subject to debate but will be examined in the default pilots that the IOUs will implement in 2018.

A final point to keep in mind as default tariff options are designed is that all customers who will be defaulted onto TOU rates in 2019 will receive bill protection for the first full year on the new tariff. As such, while summer bills may be higher than under the OAT, customers who stay for a full year will not pay a higher bill than they would under the OAT.

1.2.3 Customer Attrition

Customer attrition is driven by three very different factors. One is customers who move, referred to as customer churn. Another is customers who become ineligible as a result of factors such as installing solar, going onto medical baseline, or switching to service from a Community Choice Aggregator (CCA). The final factor is customers who consciously opt out of the rate because they are unhappy being on a TOU rate. Key findings concerning customer attrition include the following:

- **Cumulative opt-out rates between enrollment and the end of June 2017 have been quite low for nearly all rates and customer segments.** For PG&E, the cumulative percent of treatment customers who dropped off the rate was between 1% and 7% and at SCE it was between 0.5% and 12%. For SDG&E, opt-out rates were between 1% and 3.5%. For example, PG&E experienced 7% attrition from Non-CARE customers in the hot climate region on Rate 3.
- At PG&E and SCE, there are small differences in the cumulative percent of opt outs between tariffs at each utility. Cumulative opt-out rates are greatest for PG&E and SCE's Rate 3 (about 4.5%). At SDG&E, the greatest cumulative opt-out rates, about 3.5%, are among customers in the hot climate region on Rate 2.
- **The number of customers dropping off the TOU rates was highest in the hot region,** second in the moderate and lowest in the cool climate region for all tariffs.

- **Opt-out rates were slightly lower for CARE/FERA customers in PG&E and SDGE's service territory compared with non-CARE/FERA customers. In SCE's territory, the differences between CARE/FERA and non-CARE/FERA were small. Opt-out rates leveled off over the course of the winter.**
- **Overall attrition ranged from as low as 10% to as high as 33% with the highest being for CARE/FERA customers in SCE's hot climate region on Rate 3.** Given that the pilot planning assumption was that total attrition would be roughly 25% over the course of the two summer periods, this segment may be at risk of having sample sizes that are lower than ideal by summer 2017.
- **Attrition has also been high in PG&E's moderate and cool climate regions for some segments due primarily to customers switching to CCAs,** which are quite active in PG&E's service territory.

1.2.4 Survey Findings

Key findings from the surveys that were administered include the following:

- **There were no statistically significant increases in the economic index values of treatment customers, compared to control customers, for segments of interest at SCE. PG&E Rate 3 CARE/FERA customers in the hot region** (and SDG&E Rate 1 CARE/FERA customers in the moderate region) **had higher economic index scores, or greater economic hardship, when compared with control group customers.** For context, the size of the difference in the economic index score is equivalent to the difference in the value of the index from using one additional non-income based method to pay bills or from having difficulty paying one additional bill since December 2016. An important policy question is whether TOU rates might increase economic hardship for selected customer segments in the hot climate region for PG&E and SCE. The surveys included questions pertaining to economic hardship and responses to several questions were combined to produce an economic index. The value of this index was compared between treatment and control customers to determine whether the TOU rates increase the value of the index.
- **There were no statistically significant increases in the health index values of treatment customers, compared to control customers, for segments of interest at PG&E and SCE.** SDG&E Rate 2 CARE/FERA customers in the moderate climate region had a higher health index score, or greater health hardship, when compared with control group customers. For context, the size of the difference in the health index score is equivalent to the difference in the value of the index from having a slightly higher frequency of experiencing poor health or having poor health limit usual activities (e.g. from rarely to sometimes, sometimes to often, etc.) since December 2016. Another important policy question is whether TOU rates might increase health hardship for selected customer segments in the hot climate region for PG&E and SCE. The surveys included questions pertaining to health hardship and responses to two questions were combined to produce a health index. The value of this index was compared between treatment and control customers to determine whether the TOU rates increase the value of the index.
- **No significant increases in the health metrics for treatment customers, compared to control customers, were found at PG&E. About 6% more SCE Rate 1 CARE/FERA customers and Rate 1 and 2 customers on or eligible for CARE/FERA, who have electric heat, reported seeking**

medical attention due to excessive cold when compared with control customers; there were no significant increases regarding excessive heat. About 5% more SDG&E Rate 1 and Rate 2 CARE/FERA customers in the moderate climate region with air conditioning sought medical attention due to excessive heat when compared to their control customers; there were no significant increases regarding excessive cold. The surveys also asked customers whether they had sought medical attention due to excessive heat or cold in their home (health metrics), and these responses were compared between treatment and control customers. The comparisons regarding excessive heat were made only for customers who reported having air conditioning, and for those who require air conditioning due to a medical condition. The comparisons regarding excessive cold were made only for customers who reported having electric heat, and for those who require heating due to a medical condition.

- **At PG&E and SCE, satisfaction ratings with the TOU rate and with the utility were typically slightly higher for TOU rate customers than for control customers, which is a reversal of trends from the first survey, and these differences were sometimes statistically significant but they were always less than 1 point on an 11-point scale.** Put another way, none of these differences are likely to be judged as material.
- S**atisfaction ratings for both the IOU and the rate were slightly higher for PG&E's and SCE's Rate segments, and SDG&E's Rate 2 segments, compared to 2016 survey results, indicating an improvement in satisfaction.** Average ratings were slightly lower, however, for all Control group segments and SDG&E's Rate 1 segments compared to 2016 survey results.
- The surveys revealed that **a much smaller percent of customers on TOU rates received bills during the previous six months that were higher than expected compared to the results from the first survey, which asked about bills during the summer months. The percentage difference on this metric between treatment and control customers was significantly lower for the majority of rates and customer segments in the hot and moderate climate regions at PG&E, and for one SCE and two SDG&E segments.** This is an important finding that should influence not only the timing of enrollment for customers on TOU rates (e.g., enrolling customers during winter or spring, not in summer or early-fall) but also the content of ME&O materials, which should be designed to prepare customers for higher than expected bills in the summer period (while reminding them about lower bills at other times of the year).
- The surveys showed that **about half to two-thirds of customers reported knowing when bill protection ends, but that customers' understanding of bill protection may depend on how the question is asked.** SCE and SDG&E customers were provided a brief explanation of bill protection and asked if they understand what it means using a yes/no answer scale. Over 86% reported they did understand. PG&E customers, however, were provided the same brief explanation but were asked to choose what bill protection means among four possible choices. Between 28% and 59% selected the correct meaning while 25% to 51% reported they did not know. Net of each IOU's outreach to customers about bill protection, customers may overwhelmingly understand bill protection generally, but many do not understand the specifics when presented with other possible meanings (e.g. several customers think they will receive a bill credit each month during the first year instead of receiving one credit after the first year).
- **The surveys also showed a significant disparity in understanding of the timing of the peak period between CARE/FERA and non-CARE/FERA customers.** For some rates and climate regions, between 14% and 44% of CARE/FERA customers could not identify a single hour that fell in the peak period rate window, while the percent of non-CARE/FERA customers that had the same level of misunderstanding was often significantly lower or even in the single digits. While many customers' understanding of rates improved compared to results from the first

survey, particularly for PG&E, the level of understanding for SCE's Rate 1 and 2 and SDG&E's Rate 2 customers worsened. This issue should be carefully addressed and studied further in the upcoming default pilots, where there is a much greater emphasis on and opportunity to test ME&O alternatives for all segments.

- **For all three utilities, customers on TOU rates were more likely to 'often' take time-specific actions than customers on the OAT.** For example, while a similar proportion of customers from control and treatment groups indicated they often turned off their lights to conserve energy, a larger proportion of treatment customers indicated they often shifted doing laundry and running the dishwasher during peak hours. In addition, substantial percentages of customer reported taking several of actions often to shift or reduce usage. Trends in the actions taken results suggest that many treatment customers did know about and take several actions that helped them shift usage even though fewer of them understood the nuances of their rates.
- Overall, the opt-in TOU pilot customer survey answered the research questions it was designed to address, including TOU rates' effects on customers' economic and health statuses, satisfaction, bill expectations, understanding of rates, actions taken to shift and/or reduce usage, and attitudes toward smart technologies, demand response and energy efficiency, and TOU outreach materials. However, the results also revealed some questions to begin or to continue exploring, such as how to improve customers' understanding of TOU rates (particularly the on-peak hours) and bill protection, their satisfaction with different aspects of the rates, and their persistence in taking actions to shift and/or reduce usage.

2 Introduction

In Decision 15-07-001, the California Public Utilities Commission (CPUC or the Commission) ordered California's three investor owned utilities (IOUs) to conduct certain "pilot" programs and studies of residential Time-of-Use (TOU) electric rate designs (TOU Pilots and Studies) beginning the summer of 2016, and to file applications no later than January 1, 2018 proposing default TOU rates for residential electric customers. The IOUs were also directed to form a working group (TOU Working Group) to address issues regarding the TOU pilots and to hire one or more qualified independent consultants to assist with the design and implementation of the TOU Pilots and Studies. Nexant, Inc. was engaged as the independent consultant.

Collectively, the pilots implemented across the three IOUs are testing nine different TOU rate options. For eight of the nine options, more than 50,000 households were enrolled and assigned to one of the TOU rates or retained in the study on the standard tiered rate to act as a control group for those who were placed on the new tariffs. The ninth rate option is a complex, dynamic rate that SDG&E is testing on a very small group of customers. Recruitment for this rate led to enrollment of roughly 65 customers.

Findings from the first summer—June through October 2016—are documented in the "Statewide Opt-in TOU Evaluation First Interim Report"[4] dated April 11, 2017. The First Interim Report contains detailed background information on the pilot, a detailed methodology section, describes the pilot design and evaluation methodology used for analysis, discusses each IOUs pilot implementation and treatments, and presents load impacts, bill impacts, and survey findings covering the first summer period. This document constitutes the second interim report and covers the findings from the first full year of the pilot. During pilot implementation, customers were enrolled onto the pilot rates throughout the month of June 2016 according to their regular billing cycle date. Consequently, the results presented in this report cover from July 2016 through June 2017 in order to reflect a complete year of enrollment for all customers on the pilot.

2.1 Pilot Evaluation

Evaluation of the opt-in pilots focused on a number of important research objectives, including:

- Determining the change in electricity use in different time periods for different customer segments and climate regions from each rate treatment and in response to the technology and information treatments that were also included in the pilot as described in the First Interim Report;
- Estimating the distribution of bill impacts associated with each rate option both before and after enrolling on the TOU rates;
- Assessing the extent to which the TOU rates cause unreasonable hardship among selected customer segments such as seniors and economically vulnerable customers in hot climate areas;
- Determining satisfaction with and perceptions about, understanding of and reported changes in behavior associated with different treatment options.

[4] The First Interim Report can be found here: http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442453144

Additional related document on the CPUC website can be found here: http://www.cpuc.ca.gov/General.aspx?id=12154

Load and bill impacts are estimated for CARE/FERA[5] and non-CARE/FERA customer segments in each of three climate regions (hot, moderate, and cool) in each IOU service territory. In the hot climate region in PG&E and SCE's service territories, senior households (e.g., households with at least one resident who is 65 years or older) and households with incomes below 100% of Federal Poverty Guidelines (FPG) were oversampled for one rate option in the hot climate region in order to assess whether TOU rates might cause undue hardship for these segments.

Load impacts for each rate and technology treatment were estimated by comparing loads for customers randomly assigned to each TOU tariff (e.g., treatment customers) with loads for customers randomly assigned to the OAT (e.g., control customers). The difference in loads between treatment and control customers in each rate period before customers are placed on the TOU rate (e.g., the pretreatment period) is subtracted from the difference after customers are placed on the rate (e.g., the treatment period) to ensure that there is no bias in the estimated impact due to random chance. This is referred to as a "difference-in-differences" (DiD) analysis. When applied to data collected through an RCT design, DiD analysis produces the most accurate load impact estimates possible through experimental research.

Bill impacts were estimated in a similar manner to load impacts in that a DiD analysis was conducted in order to control for exogenous factors that might impact bills between the pre- and post-treatment periods. Bill impacts were estimated as the difference between bills using pre- or post-treatment loads based on the TOU tariff compared with the OAT. Average bill impacts are reported as well as changes in the percent of customers who experience bill impacts above a certain threshold.

Assessing the extent to which TOU rates cause unreasonable hardship among selected customer segments such as seniors and economically vulnerable customers in hot climate areas is done primarily through survey questions designed to measure hardship. Two surveys were conducted, one following the first summer period and the second at the end of the first year on the pilot rates. Both surveys were sent to the entire treatment and control population using a mixed mode, email, mail and phone (EMP) methodology. Responses between treatment and control customers are compared to determine if TOU rates significantly increase the percent of customers that report hardship conditions. Satisfaction with, perceptions about, understanding of, and reported changes in behavior associated with different rate and other treatment options are also determined through surveys. Response rates varied across customer segments and treatment cells but were excellent in all cases. The lowest response rate was around 66% and the highest exceeded 92%. The survey was designed, managed, and analyzed by Research Into Action (RIA).

2.2 Report Organization

The remainder of this report is organized as follows. Sections 3, 4 and 5 summarize the load impact and bill impact results along with a synthesis section for PG&E, SCE, and SDG&E, respectively. Each section starts with an update on customer attrition. Following the attrition section, load impacts by rate period are presented for each rate option and relevant customer segment for the winter and spring season, along with annual energy savings. The next subsection discusses bill impacts for the winter, spring, and

[5] California Alternate Rates for Energy (CARE) and Family Electric Rate Assistance (FERA) customers receive significant electricity price subsidies. Participation in these programs is tied to income and household size.

on an annual basis. Findings from the second survey are available in a separate document discussed below. The final subsections of Sections 3 through 5 provide a high level summary and synthesis of the impact and survey results for each IOU.

Section 6 provides a comparison of results across the utilities as well as overall conclusions that can (or cannot) be drawn from the entire body of research. While the pilots were designed jointly and are meant to be complementary, they were not designed specifically to allow cross-utility comparisons in most instances. For example, it is not appropriate to compare Rate 1 from SCE's pilot to Rate 2 from PG&E's pilot and conclude that one rate produced greater load impacts than the other due to differences in rate structure because differences in other factors, such as climate, customer demographics, customer satisfaction, perceptions about the utility, economic conditions and perhaps others may partially or fully explain any observed differences in the load impacts between the two rate options. Nevertheless, cross-utility comparisons are likely to be made by reviewers and some comparisons are more valid than others. As such, we provide a brief comparison of some key findings across utilities in this final section.

Appendix A to this report contains a list of Microsoft Excel files that have been filed as electronic tables in conjunction with the primary report. These electronic tables allow readers to access the underlying data that created the figures and tables in the report, and to determine actual values for data points within the figures.

Detailed findings from the second survey are available in the second volume of this report "California Statewide Opt-In Time-Of-Use Pricing Pilot: 2017 Customer Survey Results", written by RIA. The survey discussion focuses on key research issues such as hardship and the customers' experiences on the pilot. A detailed summary of the responses to each survey question is contained in this volume.

The First Interim Report contained detailed background information on the pilot, a detailed methodology section, and detailed descriptions of each IOUs pilot implementation and treatments. Readers interested in this background information are encouraged to review the first report[4], as this information has not been carried forward into this report in an effort to manage the report length. Interested readers may also wish to review the TOU Pilot Design Report,[6] which contains a detailed discussion of research issues and explanations for the design decisions that were made by the TOU Working Group. The IOU advice letters[7] and the CPUC resolutions may also contain information of interest.[8]

[6] George, S., Sullivan, M., Potter, J., & Savage, A. (2015). Time-of-Use Pricing Opt-in Pilot Plan. *Nexant, Inc.*

[7] SCE: Advice Letter 3335-E; PG&E: Advice Letter 4764-E; and SDG&E: Advice Letter 2835-E.

[8] SCE: Resolution E-4761; PG&E: Resolution E-4762; and SDG&E: Resolution E-4769.

3 PG&E Evaluation

This report section summarizes the attrition, load impacts, and bill impacts for the first year of PG&E's pilot, with specific attention to the winter months and annual results. Load and bill impacts from the first summer season can be found in the First Interim Report.

3.1 Summary of Pilot Treatments

Figure 3.1-1 through Figure 3.1-3 summarize the three tariffs that are being tested in the PG&E service territory. All three tariffs have peak periods that include the prime evening hours from 6 to 9 PM. The rates have changed since the launch of the pilot, and the figures represent the tariffs that were in effect in March 2017 and do not reflect the baseline credit of 8.8 ¢/kWh. Appendix B shows the prices that were in effect in each rate period for each tariff, including the OAT. Two sets of prices are shown in the appendix, one covering the period from pilot start through February 2017, and the other beginning on March 1, 2017. While several minor rate changes occurred over the course of the pilot, the rate adjustment that occurred on March 1, 2017 was more significant and, as such, it was factored into the estimation of bill impacts summarized in Section 3.4 below.

Rate 1 is a simple, two-period rate with weekday peak period from 4 to 9 PM all year long and off-peak prices in effect on all other weekday hours and for all hours on weekends. The tier-2, peak-to-off-peak price ratio[9] in the summer is roughly 1.3 to 1 and is very modest in the winter (non-summer months).

Rate 2 is slightly more complex than Rate 1 as it adds a summer "Partial-Peak" period covering the two hours immediately preceding and the one hour immediately following the three-hour Peak period that runs from 6:00 to 9:00 PM on weekdays and weekends. In order to offset the additional complexity incurred with a third TOU period, PG&E kept the same prices in effect on both weekdays and weekends.

Rate 3 is more complex than Rates 1 and 2. It includes TOU pricing in the spring (from March until May) that differs from pricing in the winter in order to allow for lower prices during low-cost hours from 10:00 am until 4:00 PM to be charged in a "Super-Off-Peak" period. The "Super-Off-Peak" period coincides with the period CAISO identifies as being at high risk for excess supply in the future. Rate 3 has the same design as Rate 1 for the summer and winter seasons, with peak times from 4:00 to 9:00 PM and all other hours being off-peak. In the spring, the peak hours are also the same as Rate 1, but the remaining hours are divided into off-peak and super-off-peak periods.

[9] The peak-to-off-peak price ratio is equal to the peak price divided by the off-peak price.

Figure 3.1-1: PG&E Pilot Rate 1 (March 2017)[10]

Tariff	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Off-Peak (30.7¢)																Peak (41.0¢)							
	Winter	Off-Peak (26.1¢)																Peak (28.0¢)							
	Spring	Off-Peak (26.1¢)																Peak (28.0¢)							
Weekend	Summer	Off-Peak (30.7¢)																							
	Winter	Off-Peak (26.1¢)																							
	Spring	Off-Peak (26.1¢)																							

Figure 3.1-2: PG&E Pilot Rate 2 (March 2017)

Tariff	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Off Peak (28.6¢)																Partial Peak (38.3¢)		Peak (43.5¢)					
	Winter	Off Peak (26.0¢)																		Peak (28.6¢)					
	Spring	Off Peak (26.0¢)																		Peak (28.6¢)					
Weekend	Summer	Off Peak (28.6¢)																Partial Peak (38.3¢)		Peak (43.5¢)					
	Winter	Off Peak (26.0¢)																		Peak (28.6¢)					
	Spring	Off Peak (26.0¢)																		Peak (28.6¢)					

Figure 3.1-3: PG&E Pilot Rate 3 (March 2017)

Tariff	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Off-Peak (27.8¢)																Peak (55.6¢)							
	Winter	Off-Peak (26.1¢)																Peak (28.0¢)							
	Spring	Off Peak (25.8¢)										Super Off-Peak (17.4¢)						Peak (34.7¢)							
Weekend	Summer	Off-Peak (27.8¢)																							
	Winter	Off-Peak (26.1¢)																							
	Spring	Off Peak (25.8¢)										Super Off-Peak (17.4¢)													

Figure 3.1-4 presents the seasons for each rate. For all three rates, the summer season covers the months of June through September. The winter season is October through May for Rates 1 and 2, and October through February for Rate 3. The spring period for Rate 3 is March through May.

Figure 3.1-4 Seasons by Rate

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rate 1	Winter					Summer				Winter		
Rate 2	Winter					Summer				Winter		
Rate 3	Winter		Spring			Summer				Winter		

The next section, Section 3.2, is a discussion of customer attrition over the first year of the pilot. Section 3.3 presents the load impact estimates for the winter period for each rate and Section 3.4 summarizes the bill impacts for the winter months and on an annual basis.

[10] See Appendix B for comparison of tariffs.

3.2 Customer Attrition

Figure 3.2-1 through Figure 3.2-3 show the cumulative opt-out rates over time for each test cell and climate region. As discussed in the First Interim Report, there is an important distinction between opt-out rates and overall attrition. Opt out refers to customers actively deciding to transfer off a pilot rate whereas attrition refers to customers that leave the study for any reason, including becoming ineligible due to closing their account (customer churn), taking service from a Community Choice Aggregator (CCA), becoming a net metered solar customer, and others. As seen, opt-out rates are much lower than attrition rates. It should also be noted that pilot customers had a financial incentive tied to staying on the pilot rates through completion of the second survey near the end of the first year of enrollment. As such, the overall opt-out rate may be biased downward compared to a situation where no incentive was offered. Since all rates had the same financial incentive to stay enrolled for a year, the relative opt-out rates across tariffs should not be biased.

Overall, opt-out rates are low and steady over the course of the 12 month period and the differences between customer segments are small. The cumulative number of opt-outs is highest in the hot region, second highest in the moderate region and lowest in the cool region. The number of control customers dropping out is very low in all climate regions. The cumulative opt-out rate in the moderate and cool regions is below 6% for all customer segments and rates. In the hot region, the opt-out rate exceeds 5% for three customer-segment/rate combinations, each of them involving non-CARE/FERA customers. Over 7% of non-CARE/FERA customers on Rate 3 in the hot climate region have dropped out of the study. Overall, opt-out rates were slightly higher for non-CARE/FERA customers than for CARE/FERA customers. While there is evidence of an upturn in the opt-out rates starting in late July, after the first bills were sent out, there is also evidence of a slight leveling off near the beginning of October that continues until June 2017.

Figure 3.2-1: Cumulative PG&E Opt Outs by Month – Hot Climate Region

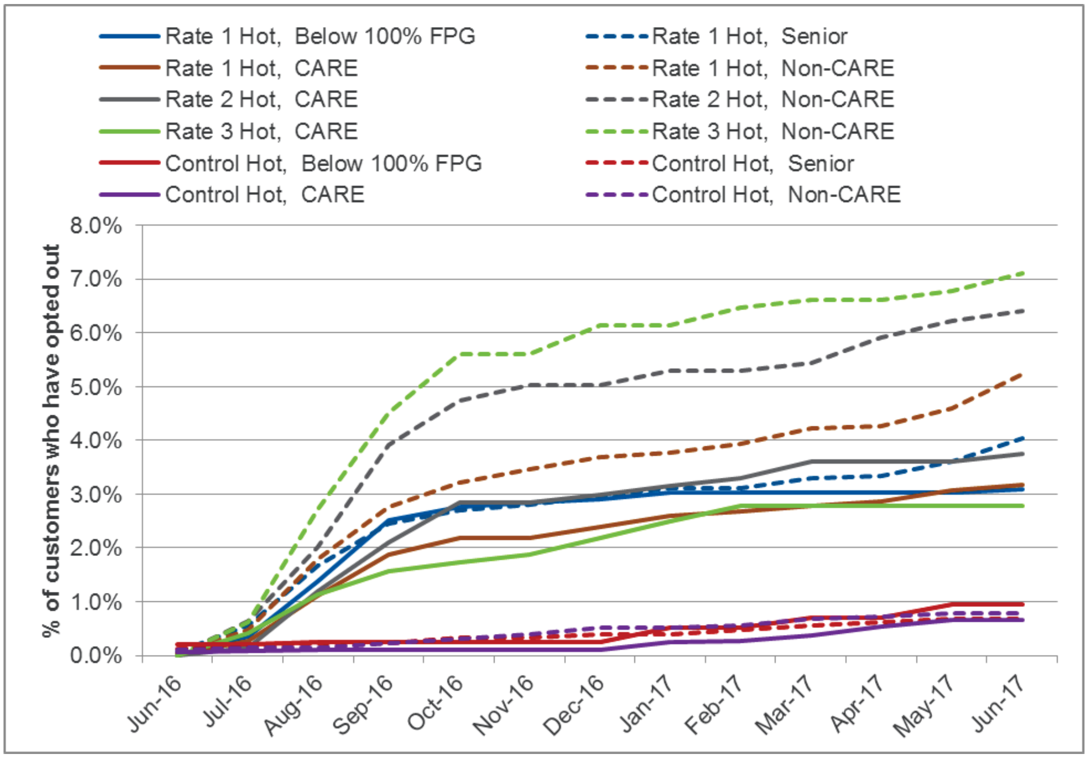


Figure 3.2-2: Cumulative PG&E Opt Outs by Month – Moderate Climate Region

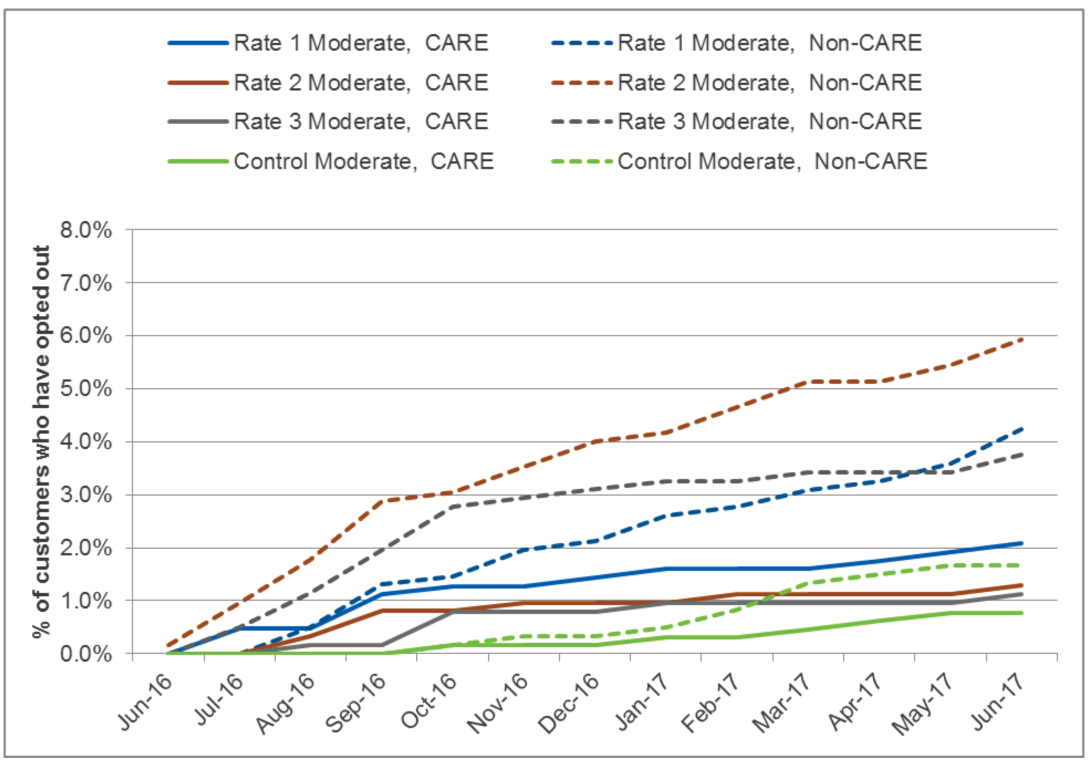


Figure 3.2-3: Cumulative PG&E Opt Outs by Month – Cool Climate Region

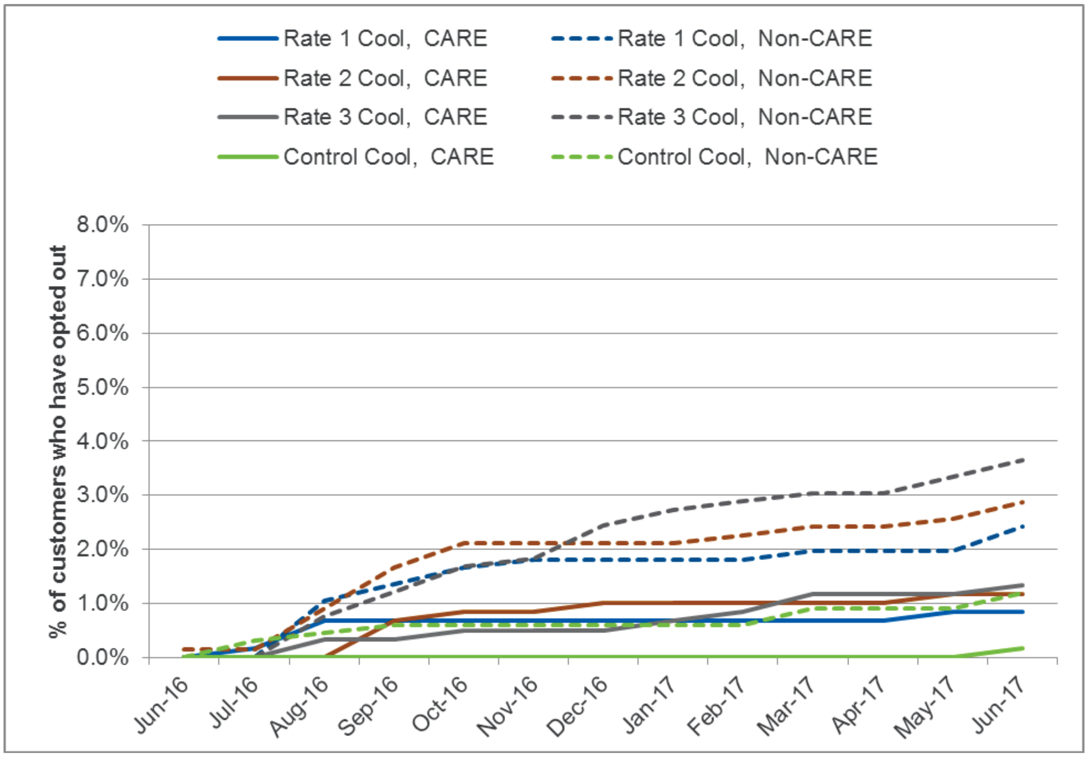


Figure 3.2-4 shows the cumulative percent of customers that opted out of each tariff for the CARE/FERA and non-CARE/FERA segments and for the total population across PG&E's service territory as a whole. As seen, the cumulative percent of customers opting out was quite low for all rates and segments. The lowest cumulative percent opt out was for CARE/FERA customers on Rate 3 and the highest was for non-CARE/FERA customers on Rate 2. For the service territory as a whole, Rate 2 saw the most opt outs, but there is no meaningful difference in the cumulative percent of opt outs between Rate 2 and Rate 3. Customers on Rate 1 had the lowest opt-out rate.

Figure 3.2-4: Cumulative Opt Outs by Rate and Customer Segment for the PG&E Service Territory

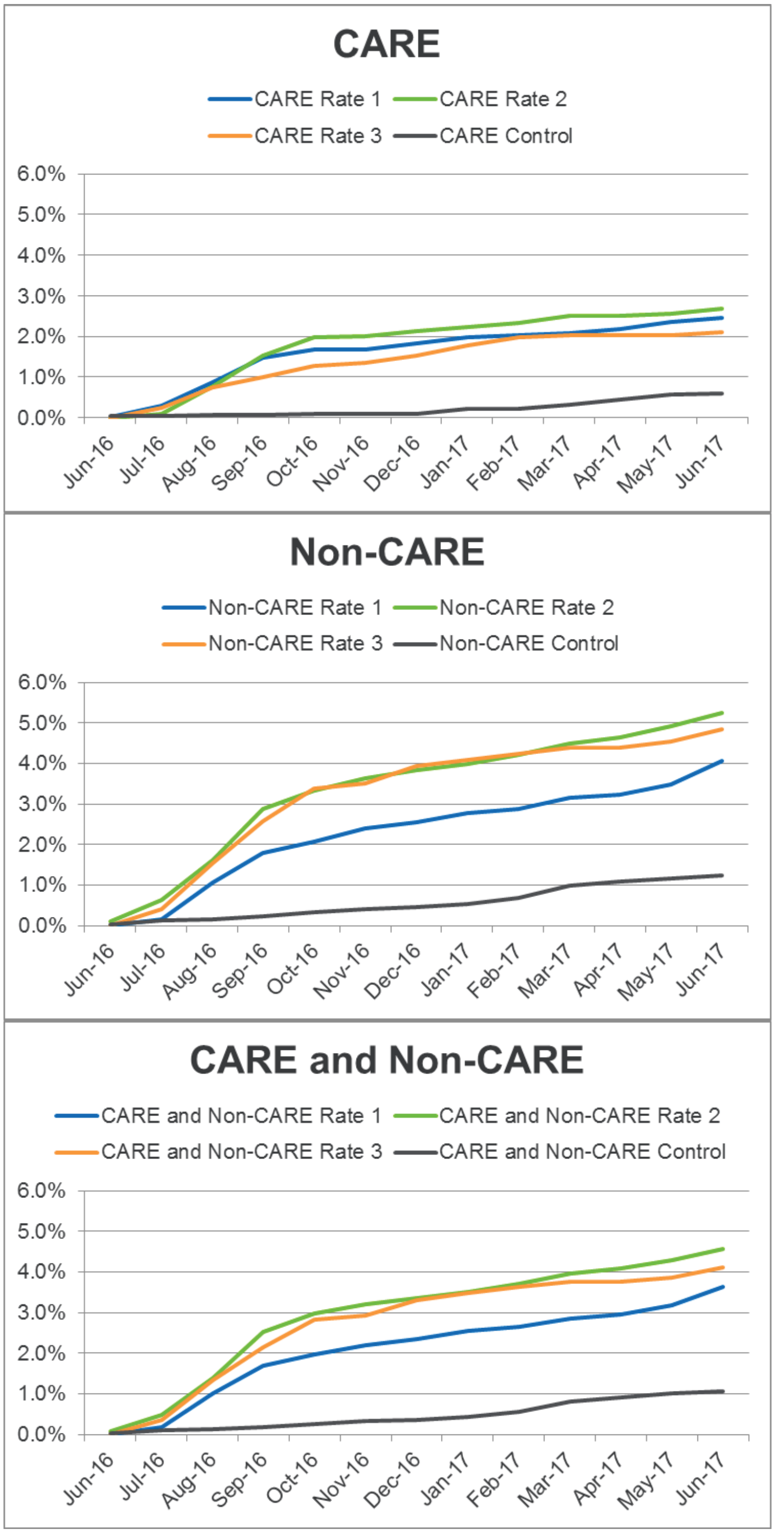


Figure 3.2-5 through Figure 3.2-7 show the overall attrition rate over time for each climate region, customer segment, and TOU rate. As seen in Figure 3.2-5, the attrition rate is quite constant over time in the hot region, with the final attrition rate ranging from a low of roughly 10% for the non-CARE/FERA control group and a high of over 20% for households with incomes below 100% of FPG in the hot climate region. The attrition graphs in the moderate and cool climate regions have a very different shape over time, with a significant increase in attrition starting in August in the moderate region and in September in the cool region. These higher rates coincide with more active transitions of customers to CCAs during those periods, especially among non-CARE/FERA customers in the cool climate region.

Figure 3.2-5: Cumulative PG&E Attrition by Month – Hot Climate Region

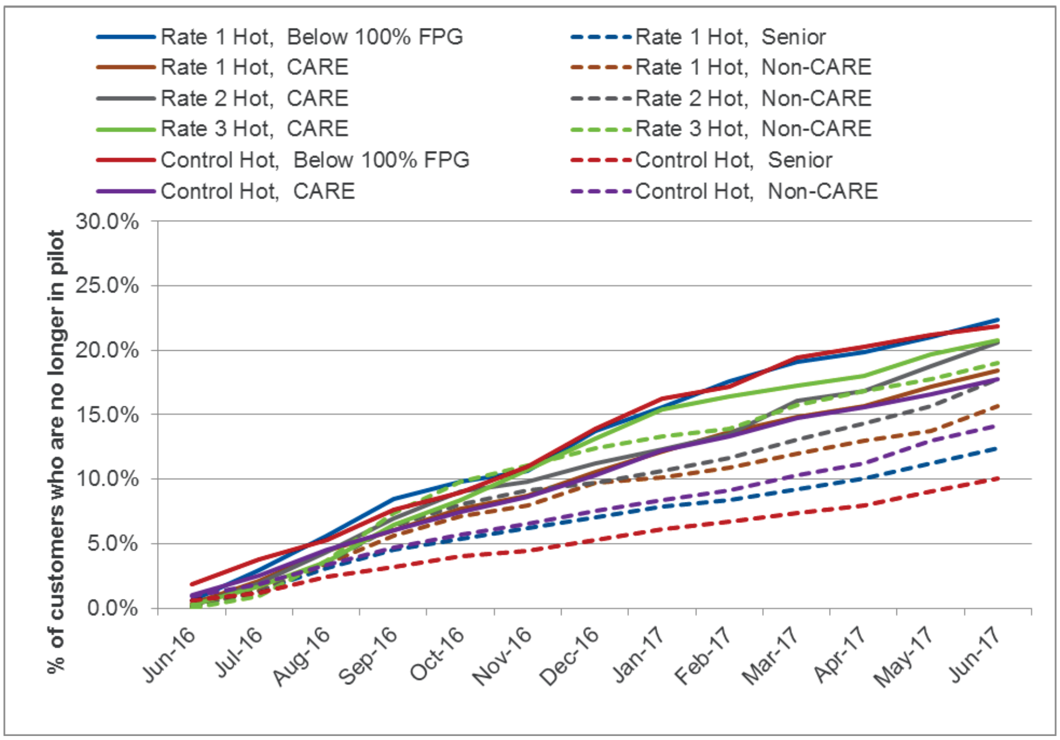
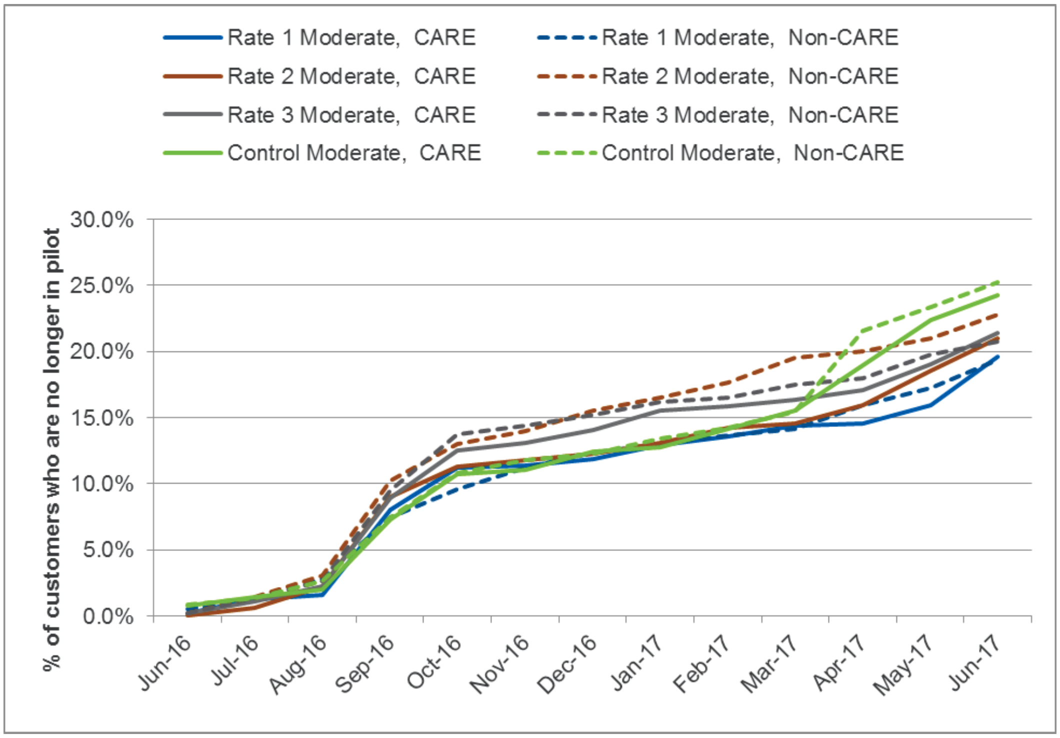
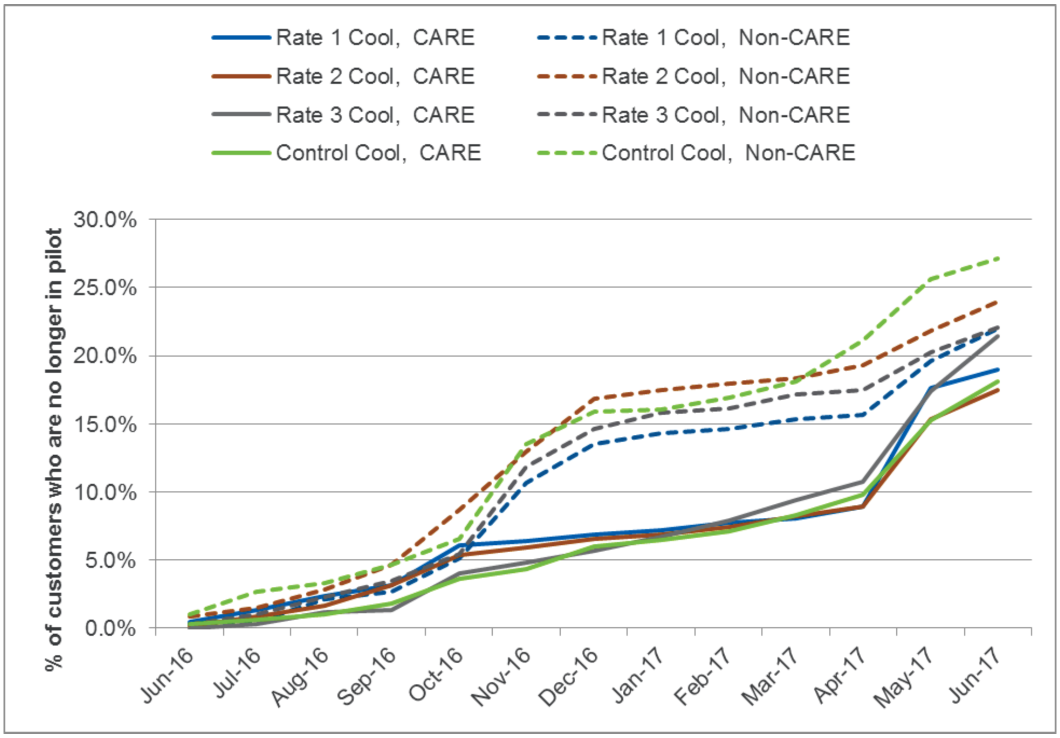


Figure 3.2-6: Cumulative PG&E Attrition by Month – Moderate Climate Region[11]



[11] There is a slight spike in ineligibilities in the Moderate climate region due to customers' transition to the Peninsula Clean Energy CCA, but the spike is not presented here. PG&E and PCE worked to accommodate participation of the Opt-in Pilot customers in the pilot during this scheduled transition by delaying the transition of Opt-in Pilot participants to PCE until the end of the pilot. However, over the course of PCE's final transition, a small number of pilot participants living in PCE territory and assigned to the Opt-in Pilot's control group were defaulted early to the PCE CCA. Because the transition of these customers from a full service PG&E customer to a PCE CCA customer did not lead to any changes in their underlying rate structure, Nexant retained these customers in the load and bill impacts analysis

Figure 3.2-7: Cumulative PG&E Attrition by Month – Cool Climate Region



3.3 Load Impacts

This section summarizes the load impact estimates for the three rate treatments tested by PG&E. The CPUC resolution approving PG&E's pilot requires that load impacts be estimated for the peak and off-peak periods and for daily energy use for the following rates, customer segments, and climate regions:

- Seniors, CARE/FERA customers, non-CARE/FERA customers and households with incomes below 100% of FPG in PG&E's hot climate region for Rate 1;
- For all three rates for all customers in PG&E's service territory as a whole and for all customers in PG&E's hot and moderate climate regions; and
- For CARE/FERA and non-CARE/FERA customers on each rate across PG&E's service territory as a whole.

In addition to these required segments, Nexant estimated load impacts for CARE/FERA and non-CARE/FERA customers for each rate for each climate region. Load impacts are reported for each rate period for the average weekday, average weekend and for the average monthly peak day for the winter months of October through May for Rate 1 and Rate 2 and October through February for Rate 3 and for the spring months of March through May for Rate 3. Impacts are reported for each rate, climate zone and customer segment summarized above. Underlying the values presented in the report are electronic tables that contain estimates for each hour of the day for each day type, segment and climate zone and for each month separately. These values are contained in Excel spreadsheets that are available upon request through the CPUC.

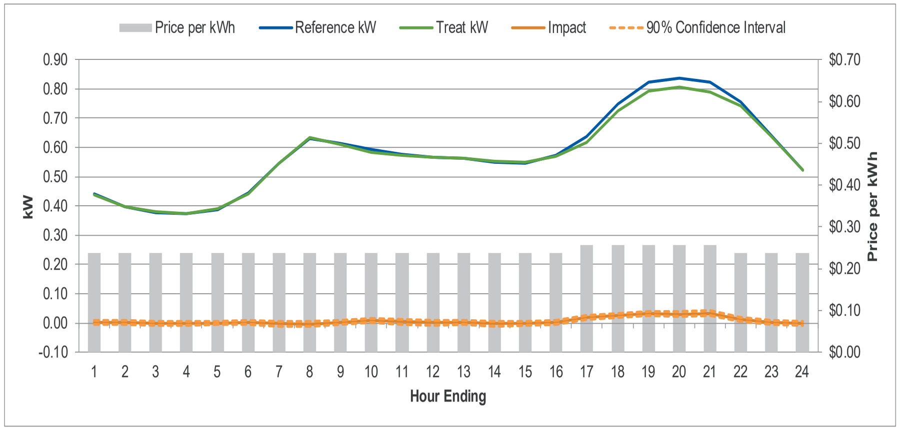
Figure 3.3-1 shows an example of the content of these tables for PG&E Rate 1 for all eligible customers in the service territory. Pull down menus in the upper left hand corner allow users to select different customer segments, climate regions, day types (e.g., weekdays, weekends, monthly peak day) and time period (individual months or the average of each season).

The remainder of this section is organized by rate treatment – that is, load impacts are presented for each relevant customer segment and climate region for each of the three rates. Following the summary for each rate, load impacts are compared across rates. This comparison is made only for the hours within each peak period that are common across all three rates (6 to 9 PM). Because the rates differ with respect to the length and timing of peak and off-peak periods, differences in load impacts across rates for any particular rate period may be due not only to differences in prices within the rate period but also due to differences in the length or timing of the rate periods

Figure 3.3-1: Example of Content of Electronic Tables Underlying Load Impacts Summarized in this Report (PG&E Rate 1, Average Winter Weekday, All Customers)

Segment	All
Rate	Rate 1
Month	Winter 2016 2017 - Rate 1 or 2
Day Type	Average Weekday
Treated Customers	6,096

Period	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval	
Peak	0.77	0.75	0.03	3.6%	0.02	0.03
Partial Peak	N/A	N/A	N/A	N/A	N/A	N/A
Off Peak	0.53	0.53	0.00	0.3%	0.00	0.00
Super Off Peak	N/A	N/A	N/A	N/A	N/A	N/A
Daily kWh	13.96	13.79	0.17	1.2%	0.13	0.20



Hour Ending	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval		Price	Period
1	0.44	0.44	0.00	0.3%	-0.01	0.01	$0.24	Off Peak
2	0.40	0.40	0.00	0.3%	-0.01	0.01	$0.24	Off Peak
3	0.38	0.38	0.00	-0.3%	-0.01	0.01	$0.24	Off Peak
4	0.37	0.37	0.00	-0.3%	-0.01	0.00	$0.24	Off Peak
5	0.39	0.39	0.00	-0.1%	-0.01	0.01	$0.24	Off Peak
6	0.45	0.44	0.00	0.8%	0.00	0.01	$0.24	Off Peak
7	0.55	0.55	0.00	-0.5%	-0.01	0.00	$0.24	Off Peak
8	0.63	0.63	0.00	-0.6%	-0.01	0.00	$0.24	Off Peak
9	0.61	0.61	0.00	0.5%	0.00	0.01	$0.24	Off Peak
10	0.59	0.58	0.01	1.6%	0.00	0.02	$0.24	Off Peak
11	0.58	0.57	0.00	0.7%	0.00	0.01	$0.24	Off Peak
12	0.57	0.57	0.00	0.1%	-0.01	0.01	$0.24	Off Peak
13	0.56	0.56	0.00	0.3%	-0.01	0.01	$0.24	Off Peak
14	0.55	0.55	0.00	-0.5%	-0.01	0.00	$0.24	Off Peak
15	0.55	0.55	0.00	-0.5%	-0.01	0.00	$0.24	Off Peak
16	0.57	0.57	0.00	0.5%	0.00	0.01	$0.24	Off Peak
17	0.64	0.62	0.02	3.1%	0.01	0.03	$0.26	Peak
18	0.75	0.72	0.02	3.3%	0.02	0.03	$0.26	Peak
19	0.82	0.79	0.03	3.8%	0.02	0.04	$0.26	Peak
20	0.84	0.81	0.03	3.6%	0.02	0.04	$0.26	Peak
21	0.82	0.79	0.03	4.0%	0.02	0.04	$0.26	Peak
22	0.75	0.74	0.01	1.7%	0.01	0.02	$0.24	Off Peak
23	0.64	0.64	0.00	0.5%	0.00	0.01	$0.24	Off Peak
24	0.52	0.52	0.00	0.0%	-0.01	0.01	$0.24	Off Peak
Daily kWh	**13.96**	**13.79**	**0.17**	**1.2%**	**0.13**	**0.20**	**N/A**	**N/A**

3.3.1 Rate 1

PG&E's Rate 1 is a two-period rate with a peak-period from 4 to 9 PM on weekdays. In winter, for electricity usage above the baseline quantity, prices equal roughly 29.0 ¢/kWh[12] in the peak period and 27.1¢/kWh in the off-peak period. All usage on weekends is priced at the off-peak price. For usage below the baseline quantity, a credit of 11.7 ¢/kWh is applied.

Winter Load Impacts

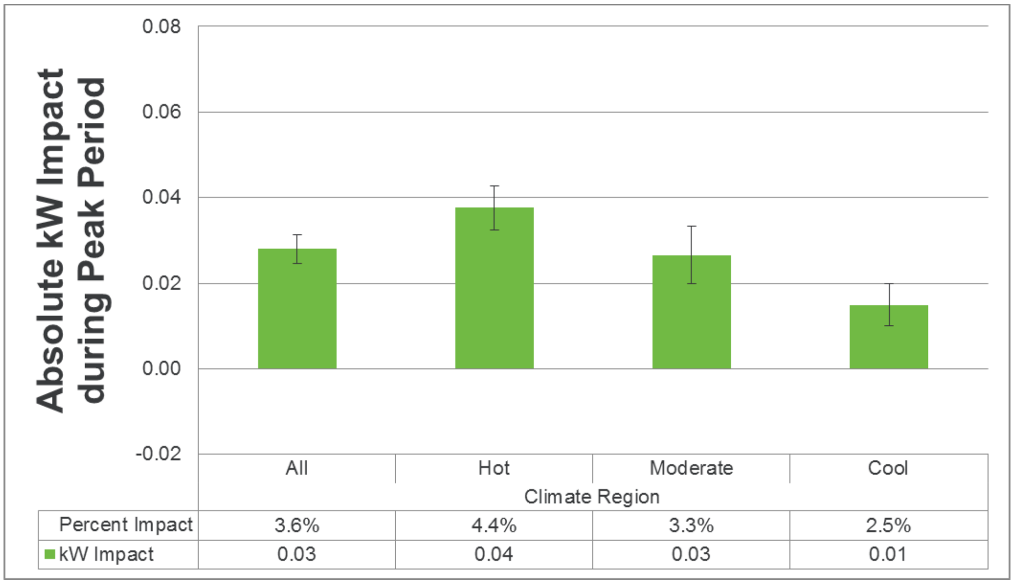
Figure 3.3-2 shows the absolute peak period load reduction for Rate 1 for PG&E's service territory as a whole and for each climate region. The lines bisecting the top of each bar in the figure shows the 90% confidence band for each estimate. If the confidence band includes 0, it means that the estimated load impacts are not statistically different from 0 at the 90% level of confidence. If the confidence bands for two bars do not overlap, it means that the observed difference in the load impacts is statistically significant. If they do overlap, it does not necessarily mean that the difference is not statistically significant[13]. In these cases, t-tests were calculated to determine whether the difference is statically significant.[14] It should also be noted that in many cases, the climate regions that are the hottest in the summer are also the coldest in the winter—often facing the most extreme temperature variation. This is important because under extreme temperature conditions (both hot and cold) it is more likely that customers are using more heating or cooling, leading to greater opportunities to curtail load, compared to customers in the moderate climate region who use less heating or cooling overall.

[12] Prices reflect tariffs in effect at the launch of the pilot through the end of February 2017. As indicated above and shown in Appendix B, rates changed on March 1, 2017.

[13] For further discussion of this topic, see https://www.cscu.cornell.edu/news/statnews/stnews73.pdf

[14] The test was applied at the 90% confidence level which means that a t-value exceeding 1.65 indicates statistical significance

Figure 3.3-2: Average Load Impacts for Peak Period for PG&E Rate 1[15]
(Positive values represent load reductions)



As seen in the figures, all of the average peak-period load impacts for the service territory as a whole and for each climate region are statistically significant at the 90% level of confidence. On average, pilot participants across PG&E's service territory reduced peak-period electricity use by 3.6% or 0.03 kW[16], across the five-hour peak period from 4 to 9 PM. The average peak-period load reductions range from a high of 4.4% and 0.04 kW in the hot climate region to a low of 2.5% and 0.01 kW in the cool climate region. In the moderate climate region, load reductions equal 3.3% or 0.03 kW. The variation in absolute impacts across climate regions is greater than the variation in percent impacts due in large part to variation in electricity usage (e.g., the reference load) across regions. The difference in load impacts is statistically significant between the three climate regions.

Table 3.3-1 shows the average percent and absolute load impacts for each rate period for weekdays and weekends and for the average monthly system peak day for the PG&E service territory as a whole and for the participant population in each climate region. The percent reduction equals the load impact in absolute terms (kW) divided by the reference load. Shaded cells in the table contain load impact estimates that are not statistically significant at the 90% confidence level. The percentage and absolute values in the first row of Table 3.3-1, which represent the load impacts in the peak period on the average weekday, equal the values shown in Figure 3.3-2, discussed above.

[15] PG&E Rate 1 winter impacts represent October 2016 through May 2017.

[16] The kW value represents the average kWh/hour across the five our peak period. It is not an instantaneous measure of peak demand during the period. The value can be multiplied by the number of hours in the peak period to determine the total reduction in energy use (kWh) that occurred over the period.

Table 3.3-1: Rate 1 Load Impacts by Rate Period and Day Type*
(Positive values represent load reductions, negative values represent load increases)

Rate 1														
Day Type	Period	Hours	All			Hot			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.77	0.03	3.6%	0.86	0.04	4.4%	0.80	0.03	3.3%	0.61	0.01	2.5%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.53	0.00	0.3%	0.60	0.01	1.1%	0.54	0.00	-0.5%	0.41	0.00	-0.1%
	Day	**All Hours**	**0.58**	**0.01**	**1.2%**	**0.66**	**0.01**	**2.0%**	**0.59**	**0.00**	**0.5%**	**0.45**	**0.00**	**0.6%**
Average Weekend	Off Peak	All Hours	0.61	0.01	0.9%	0.69	0.01	1.8%	0.62	0.00	0.1%	0.48	0.00	0.3%
	Day	**All Hours**	**0.61**	**0.01**	**0.9%**	**0.69**	**0.01**	**1.8%**	**0.62**	**0.00**	**0.1%**	**0.48**	**0.00**	**0.3%**
Monthly System Peak Day	Peak	4 PM to 9 PM	0.89	0.04	4.3%	1.00	0.06	6.3%	0.91	0.03	2.9%	0.67	0.02	2.4%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.58	0.00	0.8%	0.66	0.01	1.8%	0.58	0.00	-0.5%	0.44	0.00	1.1%
	Day	**All Hours**	**0.64**	**0.01**	**1.8%**	**0.73**	**0.02**	**3.0%**	**0.65**	**0.00**	**0.5%**	**0.49**	**0.01**	**1.5%**

* A shaded cell indicates estimate is not statistically significant

The reference loads shown in Table 3.3-1 are based on a control group and represent estimates of what customers on the TOU rate would have used if they had not responded to the price signals contained in the TOU tariff[17]. As seen in the table, average hourly usage during the peak period on weekdays is roughly 0.77 kW for the service territory as a whole, and around 0.58 kW over the 24 hour average weekday. In the hot climate region, average usage in the peak period is more than 10% larger, at 0.86 kW. Average usage in the moderate region is 0.80 kW and in the cool region, at 0.61 kW, it is roughly two thirds what it is in the hot region.

When examining the change in usage across rate periods, it is important to keep in mind a reduction in peak-period usage could result from conservation (e.g., using less electric space heating without significantly pre-heating ahead of time or increasing the thermostat significantly afterwards) or from load shifting (doing laundry in the off-peak period rather than the peak period). An increase in off-peak usage could be the result of load shifting from the peak to the off-peak period, from increased energy use during the off-peak period unrelated to load shifting (e.g., less careful attention to lighting usage because rates are lower in the off-peak period), or both.

In the hot region, there was a statistically significant reduction in average electricity use in the off-peak period on the average weekday. This indicates that customers are conserving energy rather than shifting their loads to off-peak periods. This was not the case in the moderate and cool climate region, where customers reduced peak period usage but did not make significant changes during the other hours of the day.

A reduction in daily electricity use (depicted by positive values in the row labeled Day in the table) means that the combination of changes in use across all rate periods resulted in less electricity use for the day as a whole. As seen in Table 3.3-1, for the service territory as a whole, there was a 1.2% reduction in daily electricity use on the average weekday. In the hot climate region, the estimated conservation effect equals 2.0% while in the moderate region, it is 0.5%. In the cool climate region, the estimated reduction in electricity use equals 0.6%.

While the daily reduction in electricity use for Rate 1 is small in percentage and absolute terms, this average is spread over 24 hours each day, so the average reduction in electricity use on weekdays equals roughly 0.17 kWh. Over eight months, this adds up to about 40.5 kWh per customer. If this average conservation effect was provided under default conditions and, say, 90% of the eligible population of roughly 3.5 million customers in PG&E's service territory remained on the rate, the total reduction in electricity use over the three-month period would equal more than 142 GWh. This is quite significant.

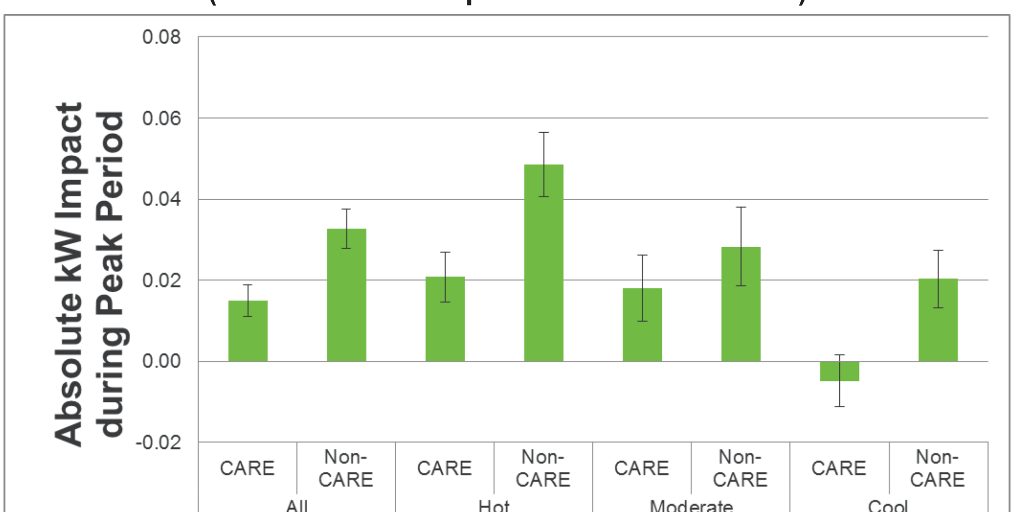
On PG&E's Rate 1, off-peak prices are in effect all day on the weekend. In spite of these lower prices, for the service territory as a whole, the load impact estimate indicates that participants reduced electricity usage on the weekend relative to what they would have used on the OAT. Statistically significant conservation savings are also seen on the weekend in the hot climate region.

[17] See Section 3.1 in the First Interim Report for more detail.

The monthly system peak day estimates represent the average across the eight monthly PG&E system peak days in the winter months. This day type is a standard one for which impacts are estimated for all demand response programs and is included here so that results can be compared with other rate and demand response programs at PG&E. Peak period reference loads are higher on these days than on the average weekday. For the service territory as a whole, the percent reduction in peak period loads, 4.3%, is greater than on the average weekday (3.6%).

Figure 3.3-3 shows the absolute peak period load impacts for Rate 1 for CARE/FERA and non-CARE/FERA customers for the service territory as a whole and for each climate region. For the service territory as a whole, and in the hot and cool climate regions, both the percent and absolute load impacts in the peak period are greater for non-CARE/FERA customers than for CARE/FERA customers, often significantly greater. For example, in the hot climate region, the average weekday peak period reduction is 5.4% and 0.05 kW for non-CARE/FERA customers whereas for CARE/FERA customers, the average reduction is 2.6% or 0.02 kW, which is less than half as much as for non-CARE/FERA customers. Load reductions in the cool climate region are significantly less than in the hot region for both segments and the difference between the two segments is also significant. Interestingly, CARE/FERA customers had small but not statistically significant load increases during the peak period in the cool climate region.

Figure 3.3-3: Average Load Impacts for Peak Period for PG&E Rate 1 for CARE/FERA and Non-CARE/FERA Customers (Positive values represent load reductions)



	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
	All		Hot		Moderate		Cool	
Percent Impact	2.1%	4.1%	2.6%	5.4%	2.5%	3.5%	-0.9%	3.3%
kW Impact	0.02	0.03	0.02	0.05	0.02	0.03	0.00	0.02

Table 3.3-2 shows the estimated load impacts for each rate period and day type by climate zone and for the service territory as a whole for non-CARE/FERA customers and Table 3.3-3 shows the estimated

values for CARE/FERA customers. It should be noted that, for the service territory as a whole and within each climate region, CARE/FERA customers have average peak-period loads that are slightly smaller than non-CARE/FERA customers (0.72 kW for CARE/FERA and 0.79 kW for non-CARE/FERA).

For the service territory as a whole, both customer segments reduced average daily usage on weekdays by a statistically significant amount. On weekends, non-CARE/FERA customers reduced electricity use by 1.1% while CARE/FERA customers had a statistically insignificant reduction in electricity use (0.3%). In the hot climate region, non-CARE/FERA customers reduced total daily electricity use on weekdays by 2.5%, nearly three times more than for CARE/FERA customers (1.1%). In the cool climate region, CARE/FERA customers had a small but statistically significant increase in daily electricity use on weekdays while non-CARE/FERA customers had a small, statistically significant reduction in electricity use.

Table 3.3-2: Rate 1 Load Impacts by Rate Period and Day Type – Non-CARE/FERA Customers*
(Positive values represent load reductions, negative values represent load increases)

Rate 1														
Day Type	Period	Hours	All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.79	0.03	4.1%	0.90	0.05	5.4%	0.81	0.03	3.5%	0.62	0.02	3.3%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.54	0.00	0.3%	0.64	0.01	1.5%	0.55	-0.01	-0.9%	0.42	0.00	0.5%
	Day	**All Hours**	**0.60**	**0.01**	**1.4%**	**0.69**	**0.02**	**2.5%**	**0.60**	**0.00**	**0.3%**	**0.47**	**0.01**	**1.3%**
Average Weekend	Off Peak	All Hours	0.63	0.01	1.1%	0.73	0.02	2.4%	0.64	0.00	-0.1%	0.49	0.01	1.0%
	Day	**All Hours**	**0.63**	**0.01**	**1.1%**	**0.73**	**0.02**	**2.4%**	**0.64**	**0.00**	**-0.1%**	**0.49**	**0.01**	**1.0%**
Monthly System Peak Day	Peak	4 PM to 9 PM	0.90	0.04	4.6%	1.04	0.07	6.9%	0.94	0.03	3.1%	0.69	0.02	3.4%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.59	0.00	0.8%	0.69	0.01	1.8%	0.59	0.00	-0.6%	0.45	0.01	1.8%
	Day	**All Hours**	**0.65**	**0.01**	**1.9%**	**0.77**	**0.02**	**3.3%**	**0.66**	**0.00**	**0.5%**	**0.50**	**0.01**	**2.3%**

* A shaded cell indicates estimate is not statistically significant

Table 3.3-3: Rate 1 Load Impacts by Rate Period and Day Type – CARE/FERA Customers*
(Positive values represent load reductions, negative values represent load increases)

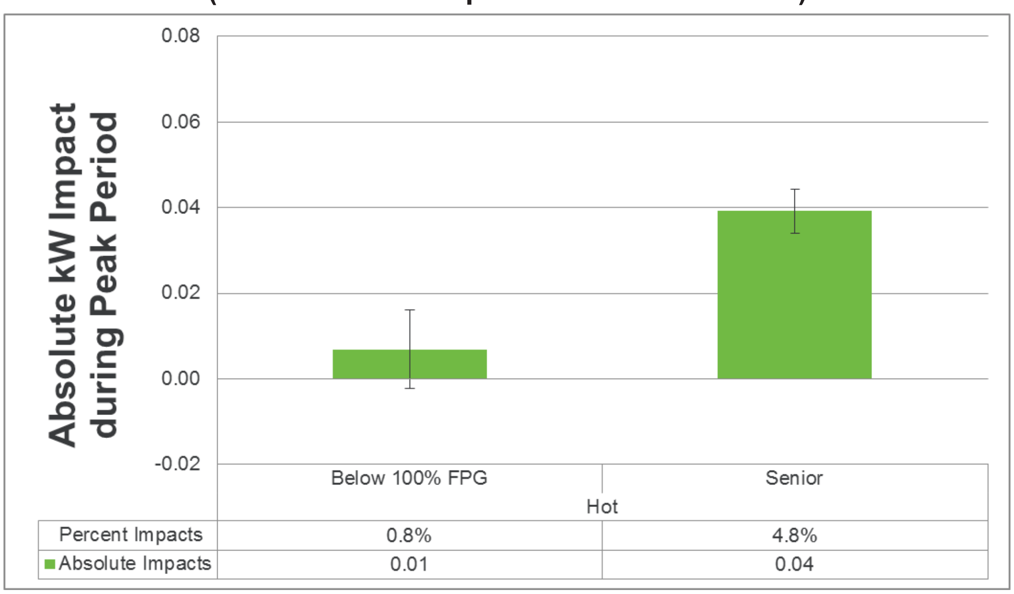
Day Type	Period	Hours	Rate 1											
			All, CARE			Hot, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.72	0.02	2.1%	0.79	0.02	2.6%	0.71	0.02	2.5%	0.55	0.00	-0.9%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.50	0.00	0.3%	0.55	0.00	0.5%	0.49	0.01	1.6%	0.36	-0.01	-2.8%
	Day	**All Hours**	**0.54**	**0.00**	**0.8%**	**0.60**	**0.01**	**1.1%**	**0.53**	**0.01**	**1.9%**	**0.40**	**-0.01**	**-2.3%**
Average Weekend	Off Peak	All Hours	0.57	0.00	0.3%	0.62	0.00	0.7%	0.56	0.01	1.3%	0.42	-0.01	-3.1%
	Day	**All Hours**	**0.57**	**0.00**	**0.3%**	**0.62**	**0.00**	**0.7%**	**0.56**	**0.01**	**1.3%**	**0.42**	**-0.01**	**-3.1%**
Monthly System Peak Day	Peak	4 PM to 9 PM	0.84	0.03	3.3%	0.93	0.05	5.1%	0.80	0.01	1.4%	0.60	-0.01	-1.9%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.55	0.00	0.8%	0.61	0.01	1.7%	0.53	0.00	-0.3%	0.39	-0.01	-1.7%
	Day	**All Hours**	**0.61**	**0.01**	**1.5%**	**0.68**	**0.02**	**2.7%**	**0.58**	**0.00**	**0.2%**	**0.43**	**-0.01**	**-1.8%**

* A shaded cell indicates estimate is not statistically significant

Figure 3.3-4 shows the absolute load reduction during the peak period on average weekdays for seniors and households with incomes below 100% of FPG in the hot climate region. Table 3.3-4 shows the estimated values for other rate periods and day types for each segment and for the hot climate region as a whole.

A comparison of the values in Figure 3.3-4 with those for the hot region in Figure 3.3-2 shows that load impacts for senior households were very similar to the hot climate region, participant population as a whole in both percentage (well over 4%) and absolute (0.04 kW) terms. The reference load for senior households (0.81 kW) is also similar to that of the general participant population in the hot climate region (0.86 kW). That is, senior households do not, on average, consume materially less electricity than the average customer in PG&E’s hot climate region. Estimated load impacts in the off-peak period, which were statistically different from 0, and a 2.6% reduction in daily energy use on weekdays indicates that senior households did more conservation than load shifting. This conservation effect carried over into the weekend, which showed a 2.2% load reduction on average over the winter. Peak-period load reductions on the average monthly system peak day were greater in percentage terms (5.3%) than on weekdays and were higher in absolute terms because average reference loads were higher on the monthly system peak days.

Figure 3.3-4: Average Load Impacts for Peak Period for PG&E Rate 1 for Senior Households and Households with Incomes Below 100% FPG in the Hot Climate Region (Positive values represent load reductions)



Load impacts for households with incomes less than or equal to 100% of FPG were quite different from those of senior households or the general population. These households did not reduce load at all during the peak period (the estimated values were not statistically different from 0). In fact, low income households increased usage significantly in the off-peak period on average weekdays. It is also worth noting that reference loads for these households were nearly identical to loads for CARE/FERA customers in the hot climate region (as shown previously in Table 3.3-3). Put another way, low income households are not, on average, low users of electricity in PG&E's hot climate region but they are low responders to TOU price signals in this instance.

Table 3.3-4: Rate 1 Load Impacts by Rate Period and Day Type for PG&E for Senior Households and Households with Incomes Below 100% FPG in the Hot Climate Region* (Positive values represent load reductions, negative values represent load increases)

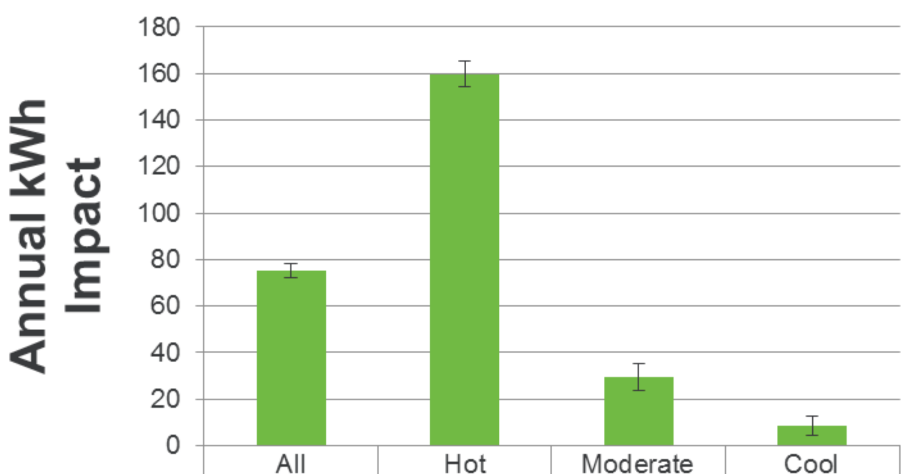
Rate 1								
Day Type	Period	Hours	Hot, Below 100% FPG			Hot, Senior		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.81	0.01	0.8%	0.81	0.04	4.8%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.56	-0.01	-1.2%	0.60	0.01	1.8%
	Day	**All Hours**	**0.61**	**0.00**	**-0.7%**	**0.65**	**0.02**	**2.6%**
Average Weekend	Off Peak	All Hours	0.63	0.00	-0.6%	0.66	0.01	2.2%
	Day	**All Hours**	**0.63**	**0.00**	**-0.6%**	**0.66**	**0.01**	**2.2%**
Monthly System Peak Day	Peak	4 PM to 9 PM	0.95	0.03	3.1%	0.93	0.05	5.3%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.62	-0.01	-1.0%	0.65	0.01	1.8%
	Day	**All Hours**	**0.69**	**0.00**	**0.2%**	**0.71**	**0.02**	**2.7%**

* A shaded cell indicates estimate is not statistically significant

Annual Conservation Effect

Figure 3.3-5 shows the annual conservation effect for customers in each climate region. Each region showed statistically significant reductions in annual energy use. On average, customers reduced their consumption by 1.4% or 75.2 kWh per customer during the first year of the pilot. Customers in the hot climate region had the greatest conservation effect of 2.3% or 159.7 kWh. Those in the cool climate region saw the smallest, but still statistically significant, reduction of 0.2% or 8.4 kWh. These impacts are in line with what was presented in Table 3.3-1. During the winter months (eight months out of the year) customers reduced their daily usage on the average weekday and in some cases on the average weekend.

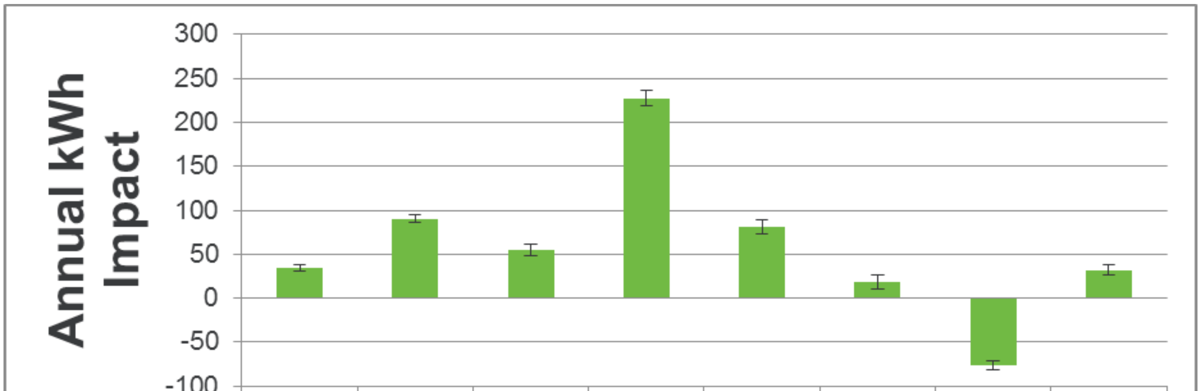
Figure 3.3-5: Average Annual Conservation Effect for PG&E Rate 1 (Positive values represent usage reductions)



	All	Hot	Moderate	Cool
Percent Impact	1.4%	2.3%	0.6%	0.2%
kWh Impact	75.2	159.7	29.3	8.4

Figure 3.3-6 shows annual energy impacts for Rate 1 for CARE/FERA and non-CARE/FERA customers for the service territory as a whole and for each climate region. Each customer segment had statistically significant reductions in energy usage except for CARE/FERA customers in the cool climate region, who showed statistically significant increases in usage. As shown in Table 3.3-3, these customers increased their daily consumption by 2.3% on weekdays and 3.1% on weekends in the winter months, so this is not surprising.

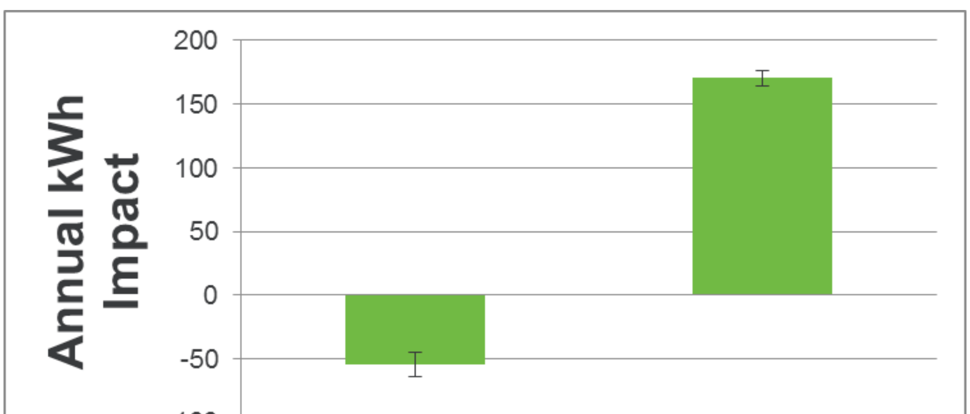
Figure 3.3-6: Average Annual Conservation Effect for PG&E Rate 1 for CARE/FERA and Non-CARE/FERA Customers (Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	0.6%	1.6%	0.9%	3.1%	1.7%	0.3%	-2.2%	0.8%
kWh Impact	34.6	90.1	54.9	227.3	81.0	18.6	-76.5	31.7

Figure 3.3-7 shows the average annual kWh impact for the households with incomes below 100% FPG and senior households in the hot climate region. Senior households saved just over 170 kWh during the first year of the pilot, which is equal to 2.6%. Households with incomes below 100% of FPG, on the other hand, increased their energy consumption by 0.9%.

Figure 3.3-7: Average Annual Conservation Effect for PG&E Rate 1 for Senior Households and Households with Incomes Below 100% FPG (Positive values represent load reductions)



	Hot	
	Below 100% FPG	Senior
Percent Impact	-0.9%	2.6%
kWh Impact	-54.7	170.2

3.3.2 Rate 2

PG&E's Rate 2 differs from Rate 1 in two important ways. First, on weekends, the same two rate periods as on weekdays are in effect with Rate 2, whereas for Rate 1, all weekend hours are charged at the off-peak, weekday price. Second, the Rate 2 peak period is shorter, with a three-hour peak period covering only the evening hours from 6 to 9 PM compared with the five-hour peak period from 4 to 9 PM in Rate 1. Rate 2 peak-period prices above the baseline usage amount are similar to Rate 1, at 29.6 ¢/kWh and off-peak prices are nearly identical (27.0 ¢/kWh)[18].

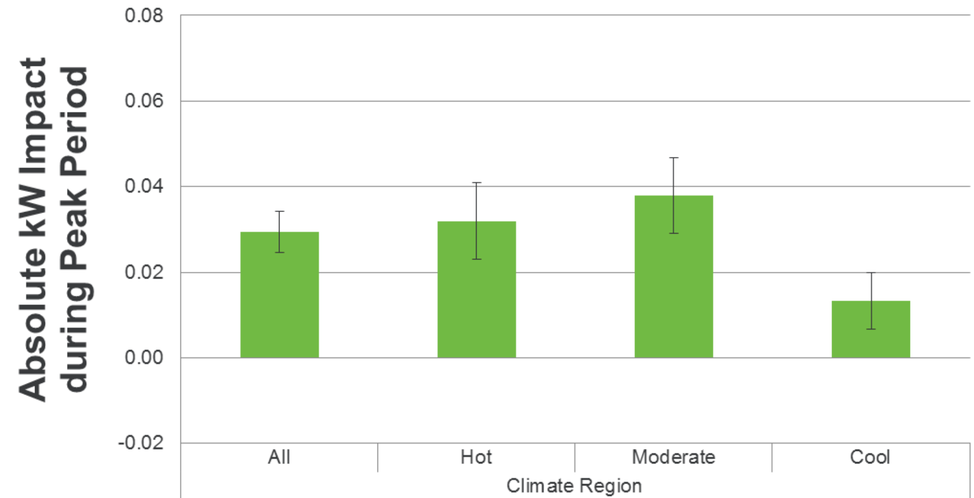
Winter Load Impacts

Figure 3.3-8 shows the absolute load impacts for the weekday peak period for Rate 2 for PG&E's service territory as a whole and for each climate region. From a policy perspective, it is important to note that there are statistically significant and materially significant load reductions in the Rate 2 peak period, which coincides completely with evening hours from 6 to 9 PM. The magnitude and pattern of load reductions across climate regions are similar for Rate 2 compared with Rate 1. The average weekday peak-period load reduction for Rate 2 equals 3.6% and 0.03 kW, the same as the peak-period load reductions for Rate 1. The estimated impact in the hot region is also 3.6% or 0.03 kW. In the moderate climate region, the percent reduction in the peak period on weekdays for Rate 2, 4.4%, is higher than the 3.3% reduction for Rate 1. The difference in peak-period impacts between the moderate and hot climate regions is not statistically significant, but the difference between the moderate and cool climate region is.

Table 3.3-5 contains load impact estimates for each rate period and day type for Rate 2. Importantly, peak-period load reductions are similar on weekends, weekdays, and monthly system peak days. All day types show statistically significant decreases in daily usage for Rate 2, but the reductions were smaller than those seen for Rate 1. Load impacts in the off-peak period are not statistically significant in the majority of instances.

[18] Prices reflect tariffs in effect at the launch of the pilot through the end of February 2017. As indicated above and shown in Appendix B, rates changed on March 1, 2017.

Figure 3.3-8: Average Load Impacts for Peak Period for PG&E Rate 2[19] (Positive values represent load reductions)



	All	Hot	Moderate	Cool
Percent Impact	3.6%	3.6%	4.4%	2.0%
kW Impact	0.03	0.03	0.04	0.01

[19] PG&E Rate 2 winter impacts represent October 2016 through May 2017.

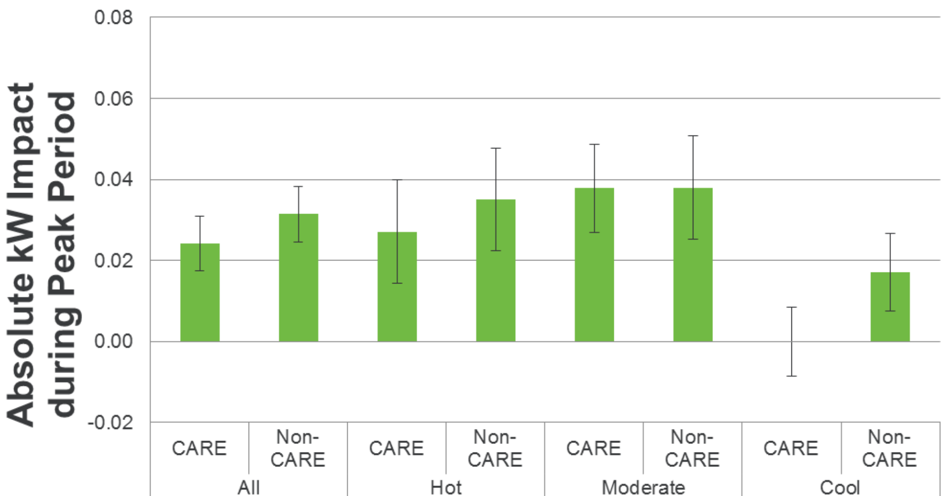
Table 3.3-5: Rate 2 Load Impacts by Rate Period and Day Type*
(Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 2											
			All			Hot			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	6 PM to 9 PM	0.83	0.03	3.6%	0.90	0.03	3.6%	0.86	0.04	4.4%	0.66	0.01	2.0%
	Off Peak	12 AM to 6 PM, 9 PM to 12 AM	0.55	0.00	-0.3%	0.62	0.00	-0.5%	0.55	0.00	0.2%	0.42	0.00	-0.7%
	Day	**All Hours**	**0.58**	**0.00**	**0.4%**	**0.66**	**0.00**	**0.2%**	**0.59**	**0.01**	**1.0%**	**0.45**	**0.00**	**-0.2%**
Average Weekend	Peak	6 PM to 9 PM	0.82	0.03	3.1%	0.90	0.03	3.6%	0.86	0.03	3.1%	0.66	0.01	2.1%
	Off Peak	12 AM to 6 PM, 9 PM to 12 AM	0.58	0.00	0.0%	0.66	0.00	0.3%	0.59	0.00	-0.1%	0.45	0.00	-0.5%
	Day	**All Hours**	**0.61**	**0.00**	**0.5%**	**0.69**	**0.01**	**0.9%**	**0.62**	**0.00**	**0.5%**	**0.48**	**0.00**	**-0.1%**
Monthly System Peak Day	Peak	6 PM to 9 PM	0.94	0.03	3.4%	1.03	0.04	4.3%	0.98	0.03	3.6%	0.73	0.01	1.3%
	Off Peak	12 AM to 6 PM, 9 PM to 12 AM	0.60	0.00	0.3%	0.69	0.00	0.5%	0.60	0.00	0.1%	0.45	0.00	0.1%
	Day	**All Hours**	**0.64**	**0.01**	**0.9%**	**0.73**	**0.01**	**1.2%**	**0.65**	**0.00**	**0.8%**	**0.49**	**0.00**	**0.3%**

* A shaded cell indicates estimate is not statistically significant

Figure 3.3-9 shows the estimated peak period load impacts for Rate 2 for CARE/FERA and non-CARE/FERA households for the service territory as a whole and for each climate region. All of the peak period load reductions are statistically significant except for CARE/FERA customers in the cool climate region. There is not a statistically significant difference between reductions among CARE/FERA and non-CARE/FERA customers in the hot or moderate climate regions. In fact, all four of these groups had very similar absolute load reductions (about 0.04 kW).

Figure 3.3-9: Average Load Impacts for Peak Period for PG&E Rate 2 for CARE/FERA and Non-CARE/FERA Customers (Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	3.2%	3.7%	3.3%	3.7%	5.0%	4.3%	0.0%	2.5%
kW Impact	0.02	0.03	0.03	0.04	0.04	0.04	0.00	0.02

Table 3.3-6 and Table 3.3-7 show the load impacts for non-CARE/FERA and CARE/FERA customers, respectively, for each rate period and day-type. As a reminder, the values in the first row of each table are the same as those found in Figure 3.3-9. CARE/FERA customers had statistically significant daily load reductions on the average weekday and weekend in the hot and moderate climate regions and in the PG&E territory as a whole, while CARE/FERA customers in the cool climate region increased their daily consumption by a statistically significant amount. Non-CARE/FERA customers generally did not reduce their consumption by a significant amount in the off-peak periods.

Table 3.3-6: Rate 2 Load Impacts by Rate Period and Day Type – Non-CARE/FERA Customers*
(Positive values represent load reductions, negative values represent load increases)

Rate 2														
Day Type	Period	Hours	All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	6 PM to 9 PM	0.85	0.03	3.7%	0.95	0.04	3.7%	0.89	0.04	4.3%	0.68	0.02	2.5%
	Off Peak	12 AM to 6 PM, 9 PM to 12 AM	0.56	0.00	-0.5%	0.66	-0.01	-1.0%	0.56	0.00	-0.2%	0.43	0.00	-0.1%
	Day	**All Hours**	**0.60**	**0.00**	**0.2%**	**0.69**	**0.00**	**-0.2%**	**0.60**	**0.00**	**0.6%**	**0.47**	**0.00**	**0.4%**
Average Weekend	Peak	6 PM to 9 PM	0.85	0.03	3.5%	0.96	0.04	4.6%	0.88	0.03	2.9%	0.68	0.02	2.7%
	Off Peak	12 AM to 6 PM, 9 PM to 12 AM	0.60	0.00	-0.2%	0.70	0.00	0.0%	0.60	0.00	-0.6%	0.46	0.00	0.1%
	Day	**All Hours**	**0.63**	**0.00**	**0.4%**	**0.73**	**0.01**	**0.7%**	**0.64**	**0.00**	**0.0%**	**0.49**	**0.00**	**0.5%**
Monthly System Peak Day	Peak	6 PM to 9 PM	0.96	0.03	3.5%	1.08	0.05	4.4%	1.01	0.04	3.6%	0.76	0.01	1.9%
	Off Peak	12 AM to 6 PM, 9 PM to 12 AM	0.61	0.00	0.0%	0.72	0.00	-0.2%	0.61	0.00	-0.2%	0.47	0.00	0.6%
	Day	**All Hours**	**0.65**	**0.00**	**0.6%**	**0.77**	**0.00**	**0.6%**	**0.66**	**0.00**	**0.5%**	**0.50**	**0.00**	**0.8%**

* A shaded cell indicates estimate is not statistically significant

Table 3.3-7: Rate 2 Load Impacts by Rate Period and Day Type – CARE/FERA Customers*
(Positive values represent load reductions, negative values represent load increases)

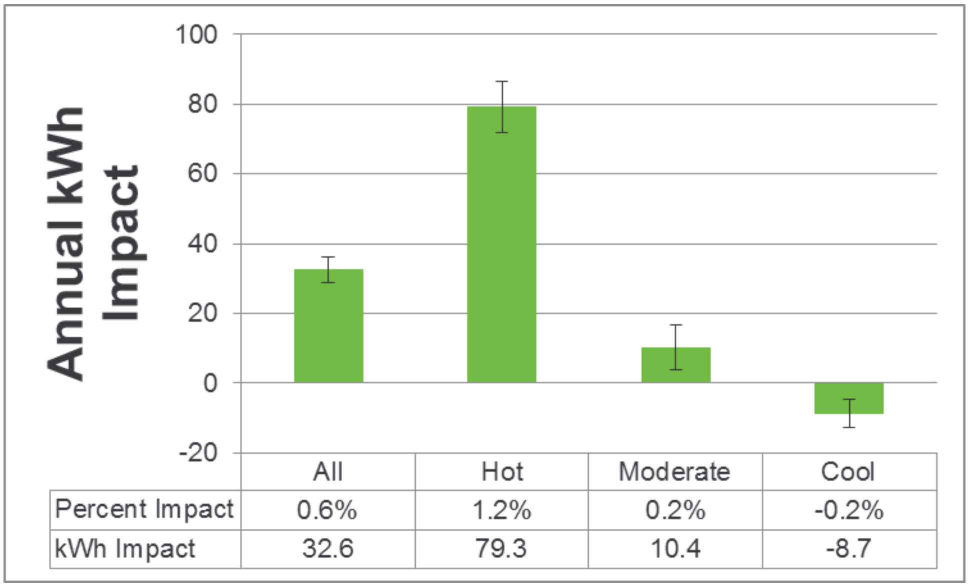
Day Type	Period	Hours	Rate 2											
			All, CARE			Hot, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	6 PM to 9 PM	0.76	0.02	3.2%	0.82	0.03	3.3%	0.76	0.04	5.0%	0.59	0.00	0.0%
	Off Peak	12 AM to 6 PM, 9 PM to 12 AM	0.51	0.00	0.3%	0.57	0.00	0.3%	0.50	0.01	2.6%	0.38	-0.01	-3.4%
	Day	**All Hours**	**0.54**	**0.00**	**0.8%**	**0.60**	**0.01**	**0.8%**	**0.53**	**0.02**	**3.0%**	**0.40**	**-0.01**	**-2.8%**
Average Weekend	Peak	6 PM to 9 PM	0.74	0.01	2.0%	0.80	0.02	1.9%	0.74	0.03	4.1%	0.57	0.00	-0.8%
	Off Peak	12 AM to 6 PM, 9 PM to 12 AM	0.54	0.00	0.8%	0.60	0.01	1.0%	0.53	0.01	2.6%	0.40	-0.01	-3.0%
	Day	**All Hours**	**0.57**	**0.01**	**1.0%**	**0.62**	**0.01**	**1.2%**	**0.56**	**0.02**	**2.8%**	**0.42**	**-0.01**	**-2.6%**
Monthly System Peak Day	Peak	6 PM to 9 PM	0.87	0.03	3.2%	0.95	0.04	4.1%	0.85	0.03	3.6%	0.64	-0.01	-1.1%
	Off Peak	12 AM to 6 PM, 9 PM to 12 AM	0.57	0.01	1.2%	0.64	0.01	1.7%	0.55	0.01	1.7%	0.40	-0.01	-1.9%
	Day	**All Hours**	**0.61**	**0.01**	**1.6%**	**0.68**	**0.01**	**2.1%**	**0.58**	**0.01**	**2.1%**	**0.43**	**-0.01**	**-1.8%**

* A shaded cell indicates estimate is not statistically significant

Annual Conservation Effect

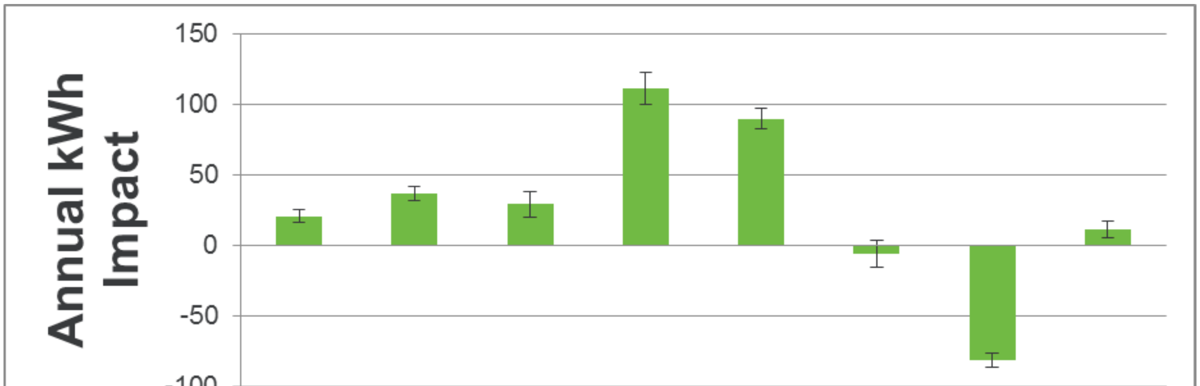
Figure 3.3-10 shows the annual conservation effect for PG&E's Rate 2. While the pattern is similar to Rate 1, with customers in the hot climate zone reducing their consumption the most, the magnitude of savings is about half as large. For example, for the service territory as a whole, customers on Rate 1 saved 75.2 kWh while those on Rate 2 saved 32.6 kWh. This may be due in some part to the shorter three hour peak period for Rate 2 compared to the 5 hour peak period for Rate 1.

Figure 3.3-10: Average Annual Conservation Effect for PG&E Rate 2 (Positive values represent usage reductions)



The increase in annual energy use in the cool climate region is attributable to CARE/FERA customers, as seen in Figure 3.3-11. These customers increased their energy use by 82.1 kWh over the course of the year. Like Rate 1, non-CARE/FERA customers in the hot climate region had the greatest energy savings of about 1.5% or 111.6 kWh during the first year of the pilot. It is interesting that non-CARE/FERA customers saved more than their CARE/FERA counterparts in the hot and cool climate regions, but not in the moderate climate region. The same was true for Rate 1 and Rate 3.

Figure 3.3-11: Average Annual Conservation Effect for PG&E Rate 2 for CARE/FERA and Non-CARE/FERA Customers (Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	0.4%	0.7%	0.5%	1.5%	1.9%	-0.1%	-2.4%	0.3%
kWh Impact	20.9	36.9	29.1	111.6	90.0	-6.1	-82.1	11.5

3.3.3 Rate 3

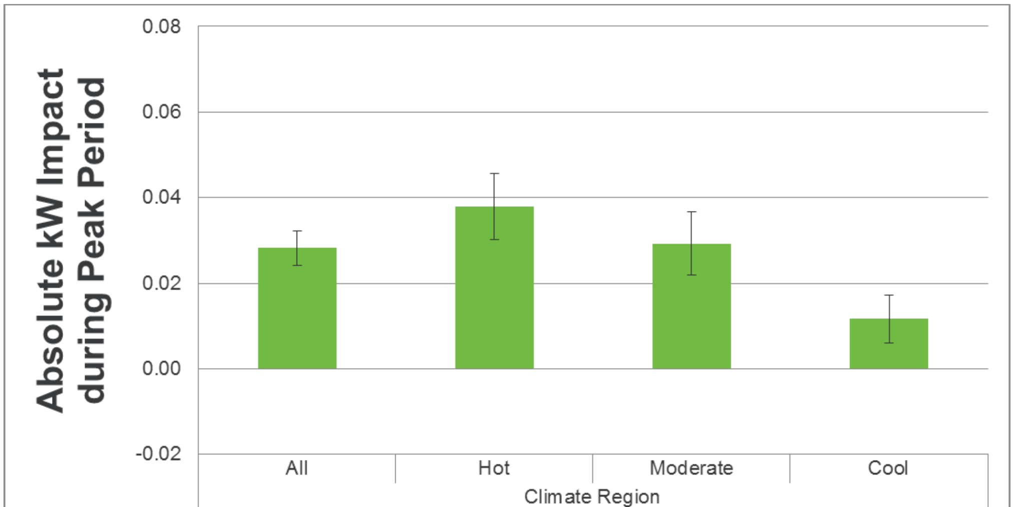
PG&E's Rate 3 is structurally identical to Rate 1 in the winter periods, with a peak period from 4 to 9 PM on weekdays and off-peak prices in effect for all hours on the weekends. In spring, Rate 3 has a super off-peak price in effect from 10 AM to 4 PM on weekdays to encourage increased electricity use during a time when high levels of hydroelectric generation combined with below average electricity use create minimum load issues for the CAISO. In winter the Rate 3 peak period and off-peak prices are similar to the other rates (29.0 ¢/kWh and 27.1 ¢/kWh). In the spring, the peak period, super off-peak, and off-peak prices are 36.1 ¢/kWh, 18.0 ¢/kWh and 26.7 ¢/kWh, respectively[20].

Winter Load Impacts

Figure 3.3-12 shows the peak period load reductions on average weekdays for Rate 3. Once again, the overall load reduction and the pattern in the load reductions across climate regions are very similar to Rates 1 and 2. There are no statistically significant differences in the load reductions between Rate 3 and Rate 2. The differences in absolute load impacts across climate regions are all statistically significant and the difference in percentage impacts between hot and moderate regions is also statistically significant. The difference between moderate and cool percentage impacts is also statistically significant.

[20] Prices reflect tariffs in effect at the launch of the pilot through the end of February 2017. As indicated above and shown in Appendix B, rates changed on March 1, 2017.

Figure 3.3-12: Average Load Impacts for Peak Period for PG&E Rate 3[21]
(Positive values represent load reductions)



	All	Hot	Moderate	Cool
Percent Impact	3.5%	4.3%	3.4%	1.8%
kW Impact	0.03	0.04	0.03	0.01

Table 3.3-8 contains estimates of load impacts for all relevant rate periods and day types. On weekdays, the change in usage in the off-peak period is not statistically significant in any climate region. There is an overall conservation effect of 1.1% for the service territory as a whole with a larger, 1.5%, reduction in the hot region. In the cool climate region, there was no change in daily electricity use on weekdays. The reduction in daily electricity use on weekends is similar to the reduction on weekdays for the for the hot climate region.

[21] PG&E Rate 3 winter impacts represent October 2016 through February 2017.

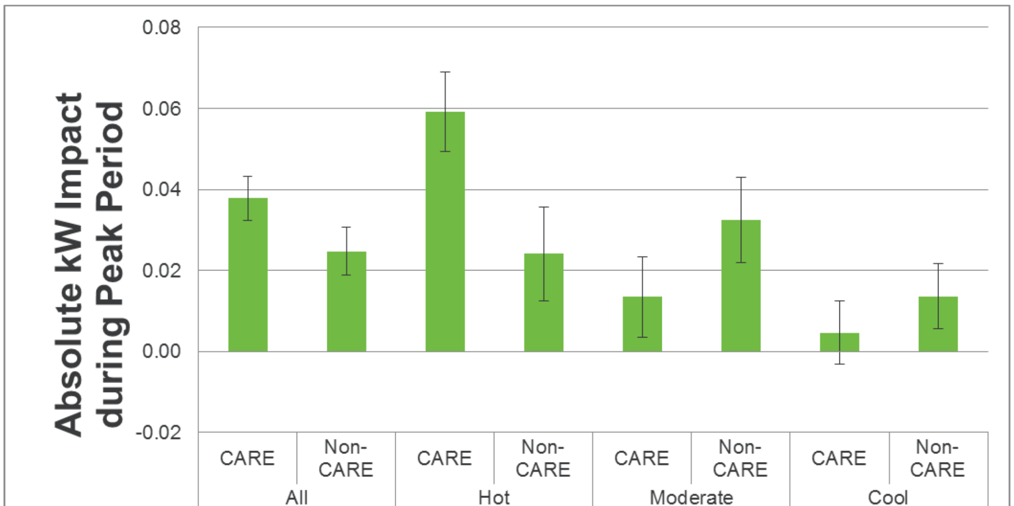
Table 3.3-8: Rate 3 Load Impacts by Rate Period and Day Type*
(Positive values represent load reductions, negative values represent load increases)

Rate 3														
Day Type	Period	Hours	All			Hot			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.82	0.03	3.5%	0.89	0.04	4.3%	0.85	0.03	3.4%	0.65	0.01	1.8%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.55	0.00	0.2%	0.63	0.00	0.5%	0.56	0.00	0.2%	0.43	0.00	-0.6%
	Day	**All Hours**	**0.61**	**0.01**	**1.1%**	**0.68**	**0.01**	**1.5%**	**0.62**	**0.01**	**1.1%**	**0.47**	**0.00**	**0.1%**
Average Weekend	Off Peak	All Hours	0.64	0.00	0.5%	0.72	0.01	1.3%	0.65	0.00	-0.2%	0.50	0.00	-0.2%
	Day	**All Hours**	**0.64**	**0.00**	**0.5%**	**0.72**	**0.01**	**1.3%**	**0.65**	**0.00**	**-0.2%**	**0.50**	**0.00**	**-0.2%**
Monthly System Peak Day	Peak	4 PM to 9 PM	0.89	0.04	4.1%	0.98	0.05	4.7%	0.93	0.04	4.2%	0.71	0.02	2.6%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.59	0.00	-0.2%	0.67	0.00	-0.5%	0.59	0.00	-0.1%	0.45	0.00	0.1%
	Day	**All Hours**	**0.65**	**0.01**	**1.0%**	**0.73**	**0.01**	**0.9%**	**0.66**	**0.01**	**1.2%**	**0.51**	**0.00**	**0.8%**

* A shaded cell indicates estimate is not statistically significant

Figure 3.3-13 shows the peak period load reductions on weekdays for non-CARE/FERA and CARE/FERA customers and Table 3.3-12 and Table 3.3-13 show the load impacts for each rate period and day type for the two segments. As seen in the figures, there are large and statistically significant differences in peak period reductions between CARE/FERA and non-CARE/FERA customers in the service territory as a whole and in the hot region. The pattern here is different from what was shown for Rate 1 in that CARE/FERA customers in the hot climate region had greater impacts than non-CARE/FERA customers.

Figure 3.3-13: Average Load Impacts for Peak Period for PG&E Rate 3 for CARE/FERA and Non-CARE/FERA Customers (Positive values represent load reductions)



	All CARE	All Non-CARE	Hot CARE	Hot Non-CARE	Moderate CARE	Moderate Non-CARE	Cool CARE	Cool Non-CARE
Percent Impact	5.0%	2.9%	7.3%	2.6%	1.8%	3.7%	0.8%	2.0%
kW Impact	0.04	0.02	0.06	0.02	0.01	0.03	0.00	0.01

As seen in Table 3.3-9 and Table 3.3-10 there are also significant differences in the load impacts between CARE/FERA and non-CARE/FERA customers for other rate periods and day types. While non-CARE/FERA customers generally did not reduce their daily electricity use, CARE/FERA customers did in the hot and moderate climate zones and in the PG&E territory as a whole – both on weekdays and weekends.

Table 3.3-9: Rate 3 Load Impacts by Rate Period and Day Type – Non-CARE/FERA*
(Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 3											
			All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.84	0.02	2.9%	0.94	0.02	2.6%	0.87	0.03	3.7%	0.67	0.01	2.0%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.57	0.00	-0.7%	0.66	-0.01	-1.8%	0.57	0.00	0.1%	0.44	0.00	-0.2%
	Day	**All Hours**	**0.62**	**0.00**	**0.4%**	**0.72**	**0.00**	**-0.6%**	**0.63**	**0.01**	**1.2%**	**0.49**	**0.00**	**0.4%**
Average Weekend	Off Peak	All Hours	0.66	0.00	-0.3%	0.77	0.00	-0.5%	0.67	0.00	-0.4%	0.52	0.00	0.1%
	Day	**All Hours**	**0.66**	**0.00**	**-0.3%**	**0.77**	**0.00**	**-0.5%**	**0.67**	**0.00**	**-0.4%**	**0.52**	**0.00**	**0.1%**
Monthly System Peak Day	Peak	4 PM to 9 PM	0.91	0.03	3.5%	1.02	0.02	2.0%	0.94	0.05	5.1%	0.73	0.02	2.6%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.60	-0.01	-1.0%	0.70	-0.02	-2.9%	0.60	0.00	0.3%	0.47	0.00	0.2%
	Day	**All Hours**	**0.66**	**0.00**	**0.3%**	**0.77**	**-0.01**	**-1.6%**	**0.67**	**0.01**	**1.7%**	**0.52**	**0.00**	**0.9%**

* A shaded cell indicates estimate is not statistically significant

Table 3.3-10: Rate 3 Load Impacts by Rate Period and Day Type – CARE/FERA*
(Positive values represent load reductions, negative values represent load increases)

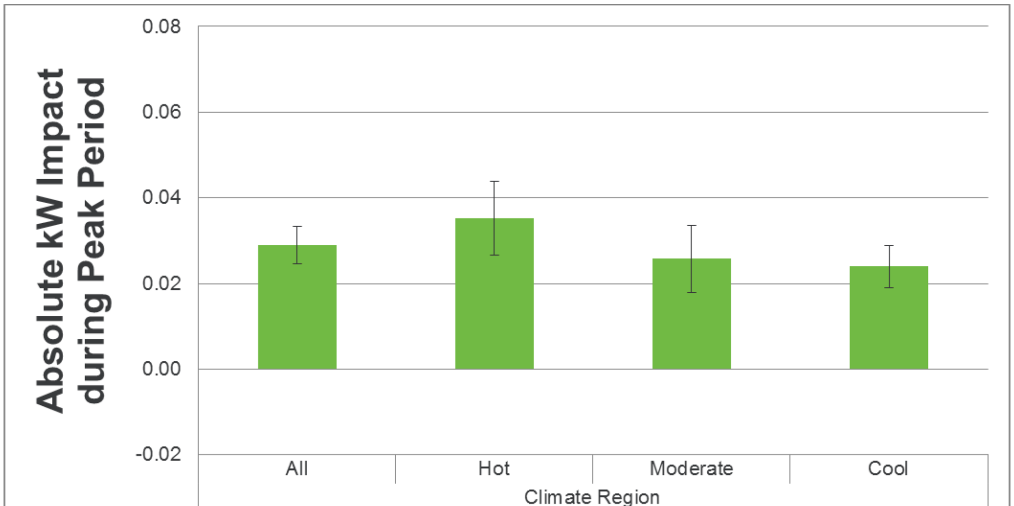
			Rate 3											
			All, CARE			Hot, CARE			Moderate, CARE			Cool, CARE		
Day Type	Period	Hours	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.76	0.04	5.0%	0.81	0.06	7.3%	0.77	0.01	1.8%	0.59	0.00	0.8%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.52	0.01	2.7%	0.57	0.03	4.6%	0.51	0.00	0.5%	0.38	-0.01	-2.2%
	Day	**All Hours**	**0.57**	**0.02**	**3.3%**	**0.62**	**0.03**	**5.3%**	**0.57**	**0.01**	**0.9%**	**0.42**	**-0.01**	**-1.4%**
Average Weekend	Off Peak	All Hours	0.60	0.02	2.8%	0.65	0.03	4.4%	0.59	0.01	1.2%	0.44	-0.01	-1.7%
	Day	**All Hours**	**0.60**	**0.02**	**2.8%**	**0.65**	**0.03**	**4.4%**	**0.59**	**0.01**	**1.2%**	**0.44**	**-0.01**	**-1.7%**
Monthly System Peak Day	Peak	4 PM to 9 PM	0.84	0.05	6.0%	0.92	0.09	9.3%	0.84	-0.01	-0.9%	0.64	0.02	2.7%
	Off Peak	12 AM to 4 PM, 9 PM to 12 AM	0.56	0.01	1.9%	0.62	0.02	3.8%	0.54	-0.01	-1.9%	0.40	0.00	-0.5%
	Day	**All Hours**	**0.62**	**0.02**	**3.1%**	**0.68**	**0.04**	**5.3%**	**0.60**	**-0.01**	**-1.6%**	**0.45**	**0.00**	**0.4%**

* A shaded cell indicates estimate is not statistically significant

Spring Load Impacts

Figure 3.3-14 shows the average load impacts for the peak period in the spring for Rate 3 for the service territory as a whole and for each climate region. Spring and winter load impacts are very similar for Rate 3, except in the cool climate regions where winter percent impacts were 1.8% and spring percent impacts were equal to 4.6%. Differences between the climate regions were not statistically significant during the spring months. Customers in the hot climate zone provided the greatest peak-period impacts at 4.4% or 0.04 kW.

Figure 3.3-14: Average Load Impacts for Peak Period for PG&E Rate 3[22]
(Positive values represent load reductions)



	All	Hot	Moderate	Cool
Percent Impact	4.2%	4.4%	3.7%	4.6%
kW Impact	0.03	0.04	0.03	0.02

Table 3.3-11 contains estimates of load impacts for all relevant rate periods and day types. On weekdays, the change in usage in the off-peak period is not statistically significant in any climate region, but it is in the territory as a whole. There is an overall conservation effect of 1.2% for the service territory as a whole with a larger, 1.4%, reduction in the hot region. In the moderate climate region, there was no change in daily electricity use on weekdays.

A key feature of Rate 3 is the low price during the hours from 10 AM to 4 PM. These prices are meant to encourage greater electricity use in order to address minimum load issues that can occur in the spring in PG&E's service territory. As seen in Table 3.2-11, in the majority of day types and climate regions, the lower prices did not produce statistically significant increases in loads. An exception is the increase of 2.5% on the average weekday in the moderate climate region. In the hot climate region and in the service territory as a whole, load reductions, not increases, occurred during the super off-peak period on the weekend.

[22] PG&E Rate 3 winter impacts represent March 2017 through May 2017.

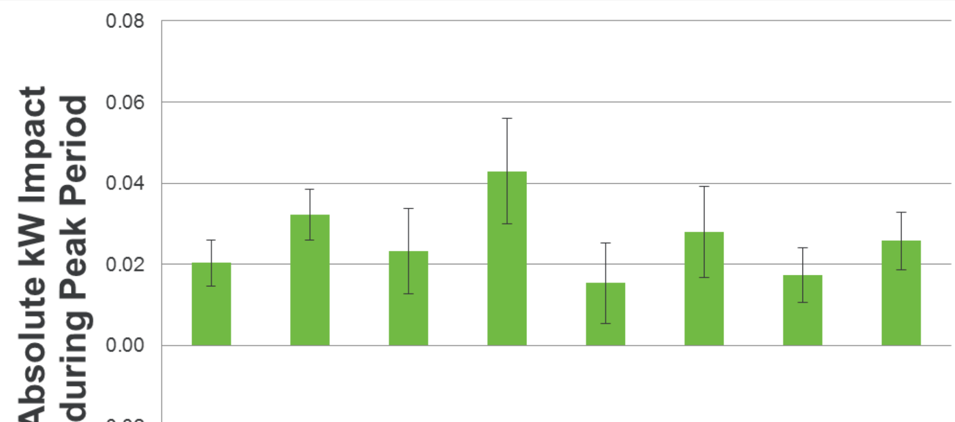
Table 3.3-11: Rate 3 Load Impacts by Rate Period and Day Type*
(Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 3											
			All			Hot			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.70	0.03	4.2%	0.81	0.04	4.4%	0.70	0.03	3.7%	0.52	0.02	4.6%
	Off Peak	12 AM to 10 AM, 9 PM to 12 AM	0.48	0.00	0.5%	0.54	0.00	0.5%	0.48	0.00	0.6%	0.38	0.00	0.6%
	Super Off Peak	10 AM to 4 PM	0.53	0.00	-0.7%	0.61	0.00	0.0%	0.54	-0.01	-2.5%	0.39	0.00	1.2%
	Day	**All Hours**	**0.54**	**0.01**	**1.2%**	**0.61**	**0.01**	**1.4%**	**0.54**	**0.00**	**0.6%**	**0.41**	**0.01**	**1.8%**
Average Weekend	Off Peak	12 AM to 10 AM, 4 PM to 12 AM	0.54	0.01	2.3%	0.61	0.02	2.5%	0.54	0.01	2.7%	0.42	0.00	0.9%
	Super Off Peak	10 AM to 4 PM	0.61	0.01	1.5%	0.70	0.02	3.2%	0.63	0.00	-0.1%	0.46	0.00	0.4%
	Day	**All Hours**	**0.56**	**0.01**	**2.0%**	**0.63**	**0.02**	**2.7%**	**0.56**	**0.01**	**1.9%**	**0.43**	**0.00**	**0.8%**
Monthly System Peak Day	Peak	4 PM to 9 PM	0.87	0.04	4.5%	1.03	0.06	5.6%	0.89	0.02	1.9%	0.60	0.04	7.0%
	Off Peak	12 AM to 10 AM, 9 PM to 12 AM	0.53	0.01	1.3%	0.61	0.01	1.8%	0.53	0.00	0.9%	0.41	0.00	0.8%
	Super Off Peak	10 AM to 4 PM	0.62	0.00	0.1%	0.74	0.00	0.0%	0.63	0.00	-0.7%	0.43	0.01	1.9%
	Day	**All Hours**	**0.63**	**0.01**	**1.9%**	**0.73**	**0.02**	**2.5%**	**0.63**	**0.00**	**0.8%**	**0.45**	**0.01**	**2.8%**

* A shaded cell indicates estimate is not statistically significant

Figure 3.3-15 shows the peak period load reductions on weekdays for non-CARE/FERA and CARE/FERA customers and Table 4.3-13 and Table 4.3-14 show the load impacts for each rate period and day type for the two segments. As seen in the figures, there are large and statistically significant differences in peak period reductions between CARE/FERA and non-CARE/FERA customers in the service territory as a whole and in the hot region. However, the differences in the moderate and cool regions are much smaller and are not statistically significant.

Figure 3.3-15: Average Load Impacts for Peak Period for PG&E Rate 3 for CARE/FERA and Non-CARE/FERA Customers (Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	3.0%	4.5%	3.1%	5.1%	2.5%	3.9%	3.7%	4.8%
kW Impact	0.02	0.03	0.02	0.04	0.02	0.03	0.02	0.03

As seen in Table 3.3-12 and Table 3.3-13 there are also significant differences in the load impacts between CARE/FERA and non-CARE/FERA customers for other rate periods and day types. For the service territory as a whole, non-CARE/FERA did not change their super off peak energy use. CARE/FERA customers, on the other hand, increased their usage during this period by 1.5% or 0.01 kW. This indicates that CARE/FERA customers may be shifting their usage to the period of time with lower prices.

Table 3.3-12: Rate 3 Load Impacts by Rate Period and Day Type – Non-CARE/FERA*
(Positive values represent load reductions, negative values represent load increases)

			Rate 3											
			All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
Day Type	Period	Hours	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.71	0.03	4.5%	0.84	0.04	5.1%	0.72	0.03	3.9%	0.54	0.03	4.8%
	Off Peak	12 AM to 10 AM, 9 PM to 12 AM	0.49	0.00	0.4%	0.58	0.00	0.0%	0.49	0.00	0.6%	0.39	0.00	0.8%
	Super Off Peak	10 AM to 4 PM	0.54	0.00	-0.4%	0.64	0.01	0.9%	0.55	-0.01	-2.4%	0.40	0.00	1.1%
	Day	**All Hours**	**0.55**	**0.01**	**1.3%**	**0.65**	**0.01**	**1.6%**	**0.55**	**0.00**	**0.8%**	**0.42**	**0.01**	**1.9%**
Average Weekend	Off Peak	12 AM to 10 AM, 4 PM to 12 AM	0.56	0.01	2.6%	0.66	0.02	3.0%	0.55	0.02	3.1%	0.44	0.00	1.0%
	Super Off Peak	10 AM to 4 PM	0.63	0.01	2.0%	0.74	0.03	4.6%	0.64	0.00	0.6%	0.47	0.00	0.0%
	Day	**All Hours**	**0.57**	**0.01**	**2.5%**	**0.68**	**0.02**	**3.5%**	**0.58**	**0.01**	**2.4%**	**0.45**	**0.00**	**0.7%**
Monthly System Peak Day	Peak	4 PM to 9 PM	0.89	0.04	4.4%	1.08	0.06	5.5%	0.92	0.02	1.8%	0.62	0.05	7.7%
	Off Peak	12 AM to 10 AM, 9 PM to 12 AM	0.54	0.01	1.0%	0.65	0.01	1.5%	0.54	0.00	0.5%	0.42	0.00	1.1%
	Super Off Peak	10 AM to 4 PM	0.63	-0.01	-0.8%	0.77	-0.01	-1.7%	0.65	-0.01	-1.3%	0.44	0.01	2.1%
	Day	**All Hours**	**0.64**	**0.01**	**1.5%**	**0.77**	**0.01**	**1.9%**	**0.65**	**0.00**	**0.4%**	**0.47**	**0.01**	**3.2%**

* A shaded cell indicates estimate is not statistically significant

Table 3.3-13: Rate 3 Load Impacts by Rate Period and Day Type – CARE/FERA*
(Positive values represent load reductions, negative values represent load increases)

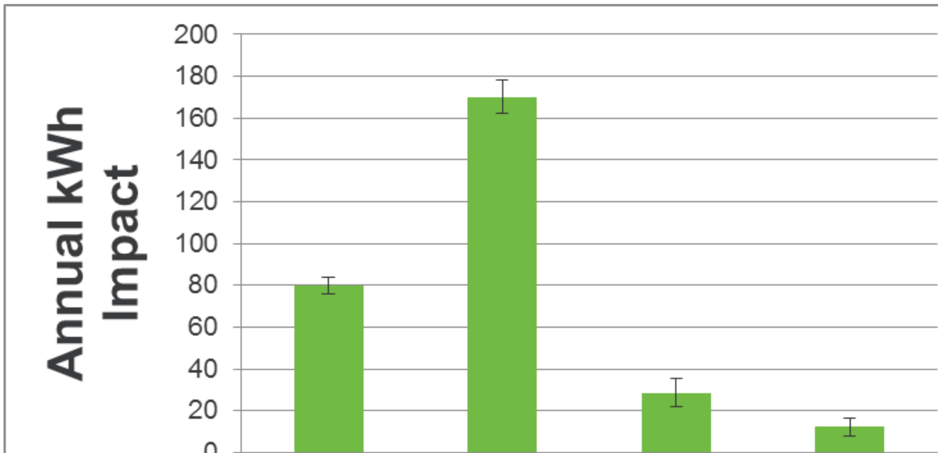
			Rate 3											
Day Type	Period	Hours	All, CARE			Hot, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.67	0.02	3.0%	0.75	0.02	3.1%	0.62	0.02	2.5%	0.47	0.02	3.7%
	Off Peak	12 AM to 10 AM, 9 PM to 12 AM	0.44	0.00	0.9%	0.48	0.01	1.4%	0.42	0.00	0.2%	0.33	0.00	-0.1%
	Super Off Peak	10 AM to 4 PM	0.50	-0.01	-1.5%	0.56	-0.01	-1.7%	0.48	-0.01	-3.1%	0.35	0.01	1.7%
	Day	**All Hours**	**0.50**	**0.00**	**0.9%**	**0.56**	**0.01**	**1.1%**	**0.48**	**0.00**	**0.0%**	**0.37**	**0.00**	**1.3%**
Average Weekend	Off Peak	12 AM to 10 AM, 4 PM to 12 AM	0.49	0.01	1.1%	0.55	0.01	1.6%	0.47	0.00	0.3%	0.37	0.00	0.5%
	Super Off Peak	10 AM to 4 PM	0.57	0.00	-0.1%	0.64	0.01	0.8%	0.55	-0.02	-4.3%	0.41	0.01	2.0%
	Day	**All Hours**	**0.51**	**0.00**	**0.8%**	**0.57**	**0.01**	**1.3%**	**0.49**	**0.00**	**-1.0%**	**0.38**	**0.00**	**0.9%**
Monthly System Peak Day	Peak	4 PM to 9 PM	0.82	0.04	4.9%	0.96	0.06	5.9%	0.74	0.02	2.6%	0.53	0.02	3.6%
	Off Peak	12 AM to 10 AM, 9 PM to 12 AM	0.50	0.01	2.0%	0.56	0.01	2.2%	0.48	0.02	3.1%	0.36	0.00	-0.5%
	Super Off Peak	10 AM to 4 PM	0.60	0.02	2.5%	0.70	0.02	2.9%	0.55	0.01	2.3%	0.39	0.00	1.1%
	Day	**All Hours**	**0.59**	**0.02**	**3.0%**	**0.68**	**0.02**	**3.5%**	**0.55**	**0.02**	**2.8%**	**0.40**	**0.00**	**1.0%**

* A shaded cell indicates estimate is not statistically significant

Annual Conservation Effect

Figure 3.3-16 shows the annual conservation effect for each climate region and for the territory as a whole for customers on PG&E's Rate 3. Each climate zone reduced their annual energy consumption by a statistically significant amount. Most notably, customers in the hot climate region had a conservation effect of 2.5%, or 170.2 kWh. Customers in the moderate climate region had usage reductions of about 0.5% or 28.7 kWh and customers in the cool climate region saved 0.3% or 12.3 kWh. These estimates are similar to those for Rate 1.

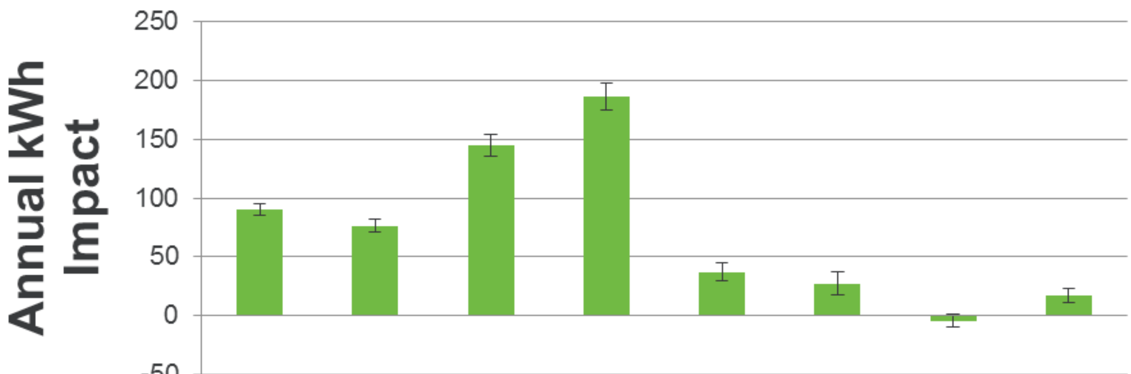
Figure 3.3-16: Average Annual Conservation Effect for PG&E Rate 3 (Positive values represent usage reductions)



	All	Hot	Moderate	Cool
Percent Impact	1.4%	2.5%	0.5%	0.3%
kWh Impact	80.0	170.2	28.7	12.3

Figure 3.3-17 shows the annual conservation effect for CARE/FERA and non-CARE/FERA customers. Unlike Rate 1 and Rate 2, the two groups had similar conservation effects within each climate region. Each group had statistically significant energy savings with the exception of CARE/FERA customers in the cool climate region. Non-CARE/FERA customers in the hot region had the greatest energy savings of 2.6% or 186.4 kWh.

Figure 3.3-17: Average Annual Conservation Effect for PG&E Rate 3 for CARE/FERA and Non-CARE/FERA Customers (Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	1.7%	1.4%	2.3%	2.6%	0.8%	0.5%	-0.1%	0.4%
kWh Impact	90.4	76.2	145.2	186.4	37.1	27.0	-4.5	16.9

3.3.4 Comparison Across Rates

Figure 3.3-18 compares the load impacts for the three rates tested by PG&E for the common set of peak-period hours from 6 to 9 PM for the entire winter. Using a common set of hours reduces differences in impacts across rates that might be due to differences in the number of hours included in the peak period or the timing of those hours. The hours from 6 to 9 PM define the peak period for Rate 2, which is a two period rate in the winter. Rates 1 and 3 are two period rates with the same peak period, from 4 to 9 PM. During the winter period, the peak-to-off-peak ratio[23] is similar for all three rates, so we would expect to see similar impacts during the common peak periods.

As seen in Figure 3.3-18, there are no statistically significant differences in load impacts for the common hours from 6 to 9 PM across the three rates in absolute terms overall or in any climate region. Figure 3.3-19 shows the average daily kWh impact for each rate. The reduction in daily usage differs between Rate 2 and the other two rates for the service territory as a whole as well as in the hot climate region. This could be attributable to the shorter peak period on Rate 2. Daily impacts also vary across rates in the moderate and cool climate regions but the differences are not statistically significant.

[23] The peak-to-off-peak price ratio is equal to the peak price divided by the off-peak price as defined in Figures 3.1-1 through 3.1-3

Figure 3.3-18: Average Impacts from 6 to 9 PM Across Rates

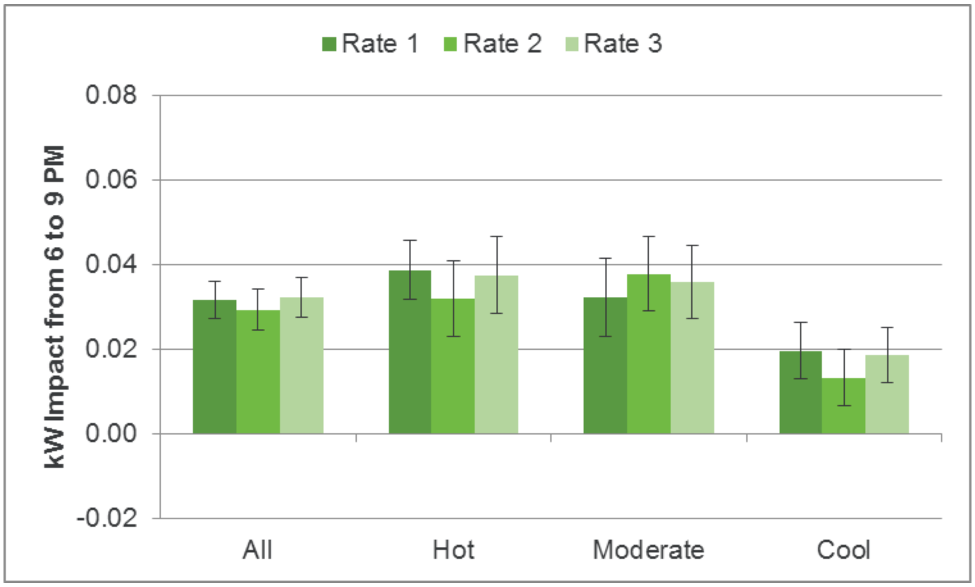
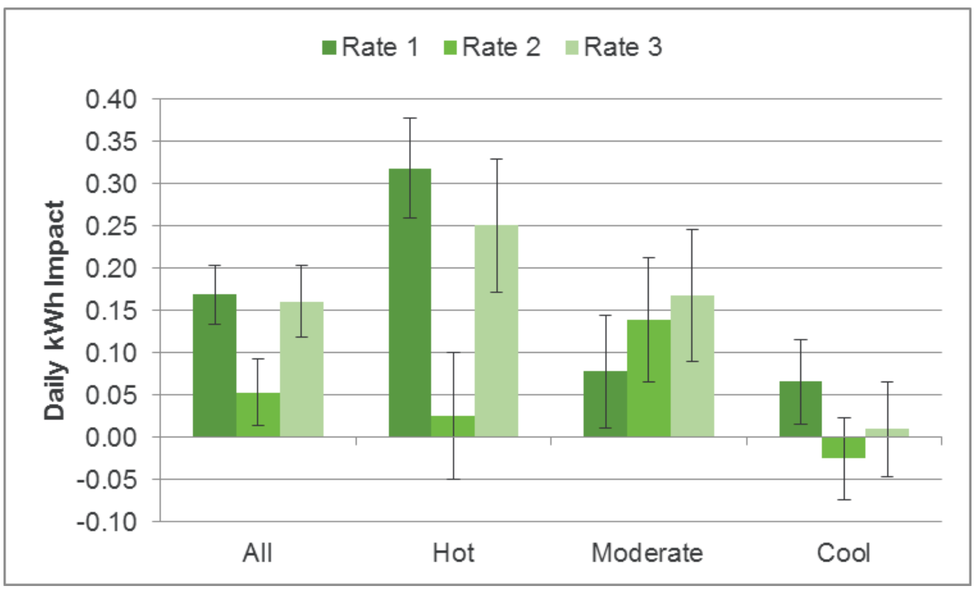


Figure 3.3-19: Average Daily kWh Impacts Across Rates



3.4 Bill Impacts

This section summarizes the bill impact estimates for the three rate treatments tested by PG&E. The CPUC resolution approving PG&E's pilot requires that bill impacts be estimated for the following rates, customer segments, and climate regions:

- **For Rate 1-** Seniors, CARE/FERA customers, non-CARE/FERA customers, households with incomes below 100% of FPG, and households with incomes between 100% and 200% of FPG in PG&E's hot climate region; and
- **For all rates-** For CARE/FERA and non-CARE/FERA customers on each rate across PG&E's service territory as a whole and for each climate region.

In addition to these required segments, Nexant estimated bill impacts for seniors, households with incomes below 100% of FPG, and households with incomes between 100% and 200% of FPG in PG&E's hot climate region for Rate 2 and Rate 3. Bill impacts are reported as the average monthly impact for the winter months of October, November, December, January, February, March, April, and May[24] and for the first full year of the pilot. Three analyses that were conducted for the First Interim Report were conducted again for this report:

- **Structural benefiter/non-benefiter analysis based on pretreatment usage**- Displaying proportions of structural benefiters and non-benefiters for each rate and relevant customer segment based on pretreatment data and on an annual and seasonal (winter and spring) basis;
- **Estimation of the total bill impact due to both the difference in the tariffs and behavior change[25]**- Displaying the bill impact for each rate and relevant customer segment due to structural differences in the rate mitigated by changes in behavior; and
- **Change in the distribution of bill impacts due to behavior change**- Displaying the distribution curves of bill impacts (percentage of customers with bill impacts within $10 incremental bins) with and without behavior change in the same graph to illustrate if the distribution for participants shifted to the left or changed shape compared with the distribution for control customers without behavior change.

A more detailed explanation of each type of analysis and how the analysis was conducted is contained in Section 3.7 of the First Interim Report. The remainder of this section is organized according to the three analysis types summarized above – that is, bill impacts are presented for each rate, relevant customer segment, and climate region for each of the three analyses.

Unlike in the First Interim Report which relied on only one tariff per pilot rate and OAT, the impacts presented in this report are based on two PG&E tariffs. All monthly bills from July 2016 through

[24] The winter period for Rate 3 ends in February. The spring period is March, April, and May.

[25] The structural benefiter/non-benefiter analysis involves straightforward mathematical calculations, and doesn't involve any tests for statistical significance. For example, 5-1=4 does not involve statistical significance. The impacts due to behavioral change require more complex estimation, and do involve tests for statistical significance. The total bill impacts are a combination of the two, and because the structural benefit component doesn't involve statistical significance, the overall outcome of the total bill impact also does not have a metric to help measure statistical significance. Generally speaking, the behavioral component is quite small compared to the structural component.

February 2017 (and their corresponding pretreatment months) are based on the tariffs that were in effect at the start of the pilot. Estimated bills for March 2017 through June 2017 (and their corresponding pretreatment months) are based on the March 2017 tariff. The reason for incorporating a second tariff was a significant change in the structure of PG&E's OAT. At the start of the pilot, the OAT was a three-tiered rate. In March 2017, the rate transitioned to a four-tiered structure. To better reflect the conditions customers actually experienced, Nexant chose to include this new rate in the analysis. Because of this change, the annual structural benefiter analysis was updated for this report.

3.4.1 Structural Benefiter/Non-Benefiter Analysis Based on Pretreatment Usage

The structural benefiter analysis was conducted for the winter, spring[26], and annual time periods using pretreatment usage data for the treatment group for each rate and relevant customer segment. Annual impacts were based on hourly load data from May 2015 through April 2016. Winter impacts were based on October 2015 through May 2015 for Rate 1 and Rate 2 and October 2015 through February 2016 for Rate 3. For Rate 3 only, spring impacts were based on May 2015[27], March 2016, and April 2016. Monthly bills were estimated for each treatment group customer on the OAT and TOU rate using the hourly load data. The difference in bills based on the TOU rate and the OAT determines if a customer is a structural benefiter, a structural non-benefiter, or falls in a neutral range defined as having a structural bill impact between ±$3.

Final results from the structural benefiter / non-benefiter analysis are presented in column graphs and shown as percentages for the individual seasons and on an annual basis. For each rate and relevant segment, the percentage of customers who are non-benefiters, neutral (+/- $3), or benefiters based on their average monthly bills for the time period of interest are shown as individual columns. The three columns within each rate and segment combination total to 100%, thus showing the distribution of structural benefiters and non-benefiters for each rate and segment of interest.

Figure 3.4-1 presents the outcome of the structural benefiter analysis for Rate 1 at the aggregate level across climate regions for all customers as well as for CARE/FERA and non-CARE/FERA. The graph on the left presents the analysis on an annual basis and the graph on the right presents the findings for the winter period. Nearly all customers are structural benefiters in the winter season and most customers are in the neutral category on an annual basis. While the number of benefiters is similar for CARE/FERA and non-CARE/FERA customers on an annual basis, a higher percentage of non-CARE/FERA customers (33%) are non-benefiters than the percentage of CARE/FERA customers (12%).

[26] Spring analysis was conducted for Rate 3 only

[27] Customers were aware of the pilot in May 2016; May 2015 was used instead

Figure 3.4-1: Rate 1 Structural Benefiter / Non-Benefiter Analysis All | CARE/FERA | Non-CARE/FERA

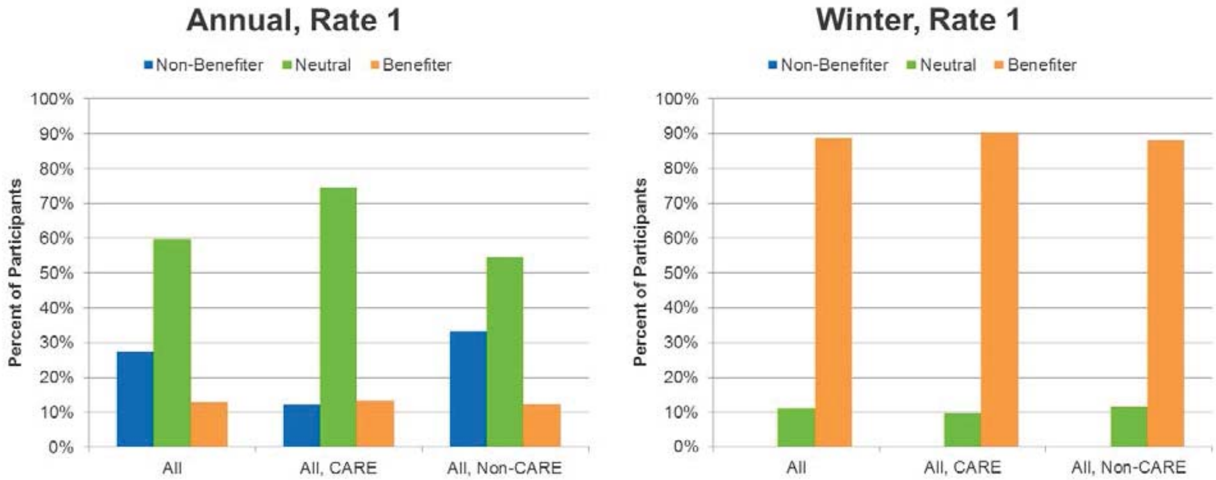


Figure 3.4-2 presents the outcome of the structural benefiter analysis for Rate 1 at the detailed segment level by climate region. The findings at the aggregate level still hold, with nearly all customers being structural benefiters in the winter season. On an annual basis, the hot climate region had a greater proportion of customers in the non-benefiter category than the moderate or cool regions, but most customers in each segment were neither benefiters nor non-benefiters. The one exception was non-CARE/FERA customers in the hot climate region, where 53% of customers were non-benefiters on an annual basis. There was also a substantial share (40%) of senior households in the hot climate region that were non-benefiters.

Figure 3.4-2: Rate 1 Structural Benefiter / Non-Benefiter Analysis Detailed Segments by Climate Region

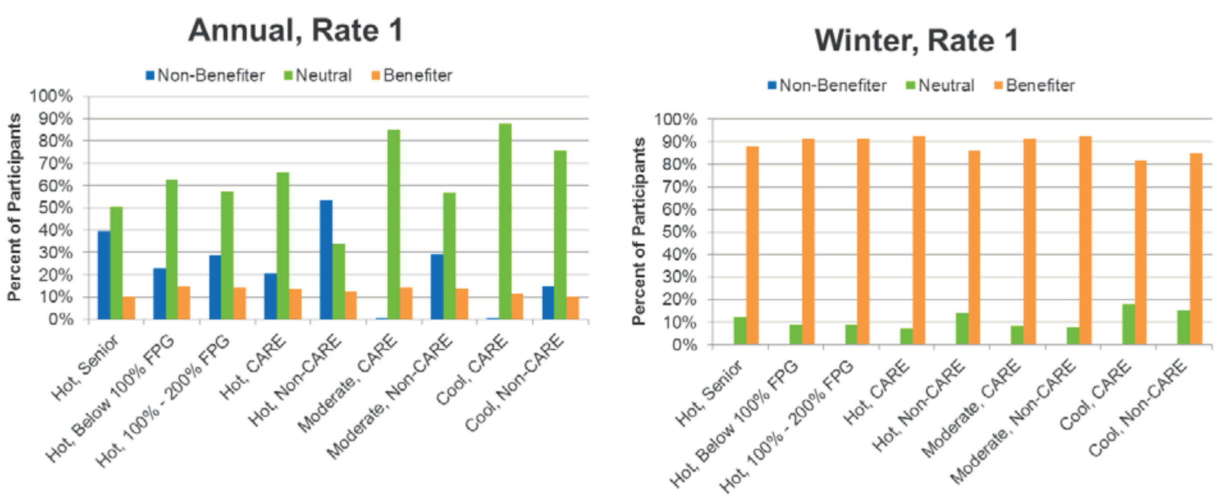


Figure 3.4-3 presents the outcome of the structural benefiter analysis for Rate 2 at the aggregate level across climate regions. Rate 2 differs from Rate 1 in several ways: the peak period is from 6 to 9 PM rather than 4 to 9 PM; it is a three period rate in the summer with a shoulder period from 4 to 6 PM and 9 to 10 PM, but has only two periods in the winter; and prices are the same on weekends and weekdays. Overall, the general pattern of structural benefiters, non-benefiters, and neutrals is similar between Rate 1 and Rate 2. Nearly all customers are structural benefiters in the winter season, and there is a higher proportion of non-benefiter customers among non-CARE/FERA customers than among CARE/FERA customers.

Figure 3.4-3: Rate 2 Structural Benefiter / Non-Benefiter Analysis
All | CARE/FERA | Non-CARE/FERA

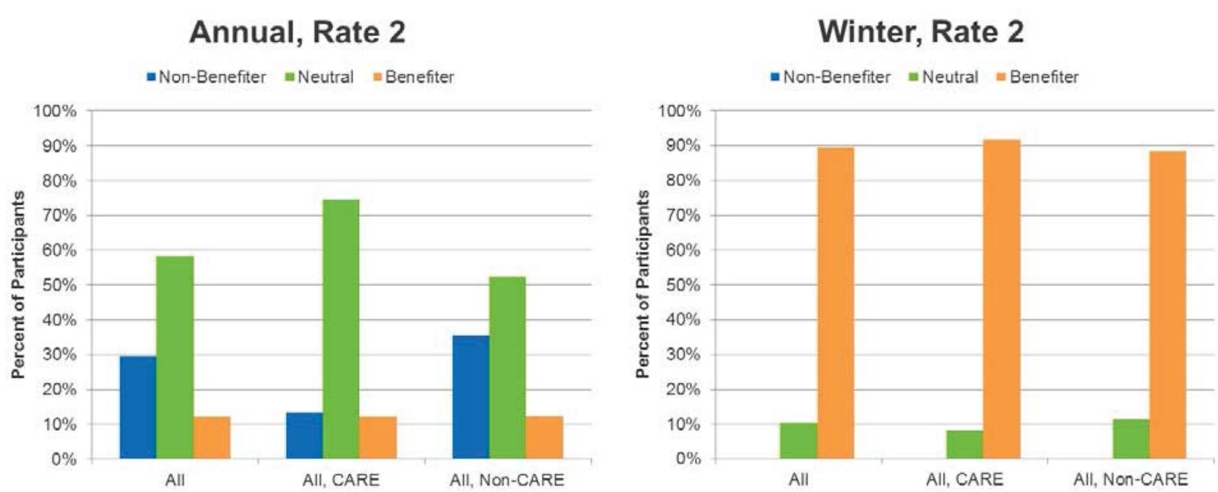


Figure 3.4-4 presents the outcome of the structural benefiter analysis for Rate 2 at the detailed segment level by climate region. The findings at the aggregate level still hold, with nearly all customers being structural benefiters in the winter season. On an annual basis, the hot climate region had a greater proportion of customers in the non-benefiter category than the moderate or cool regions. Overall the findings for Rate 2 at the detailed segment level are also very similar to the distribution of structural benefiters and non-benefiters from Rate 1. Here, too, about 40% of senior households in the hot climate region were non-benefiters on an annual basis.

Figure 3.4-4: Rate 2 Structural Benefiter / Non-Benefiter Analysis Detailed Segments by Climate Region

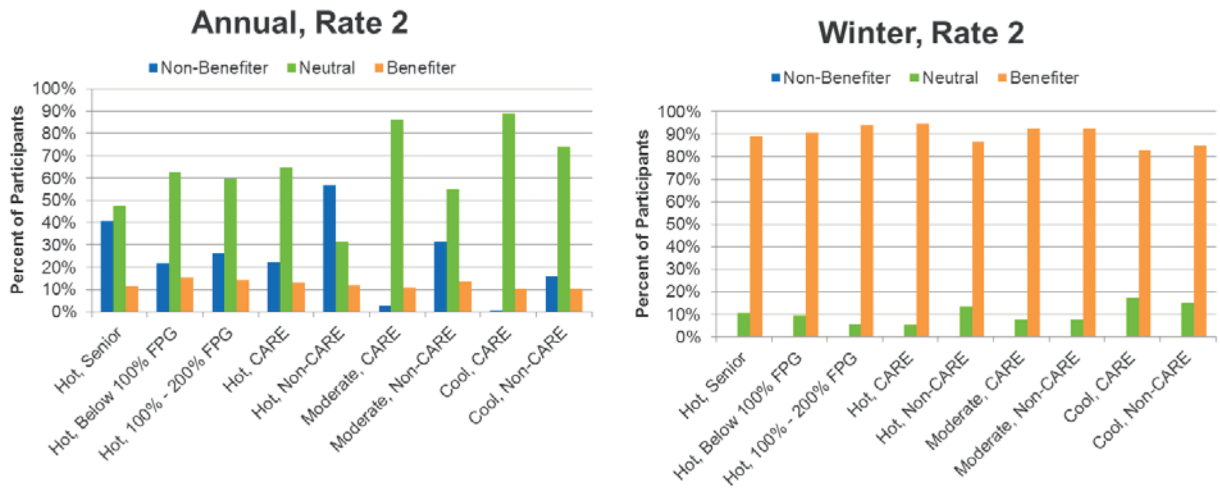
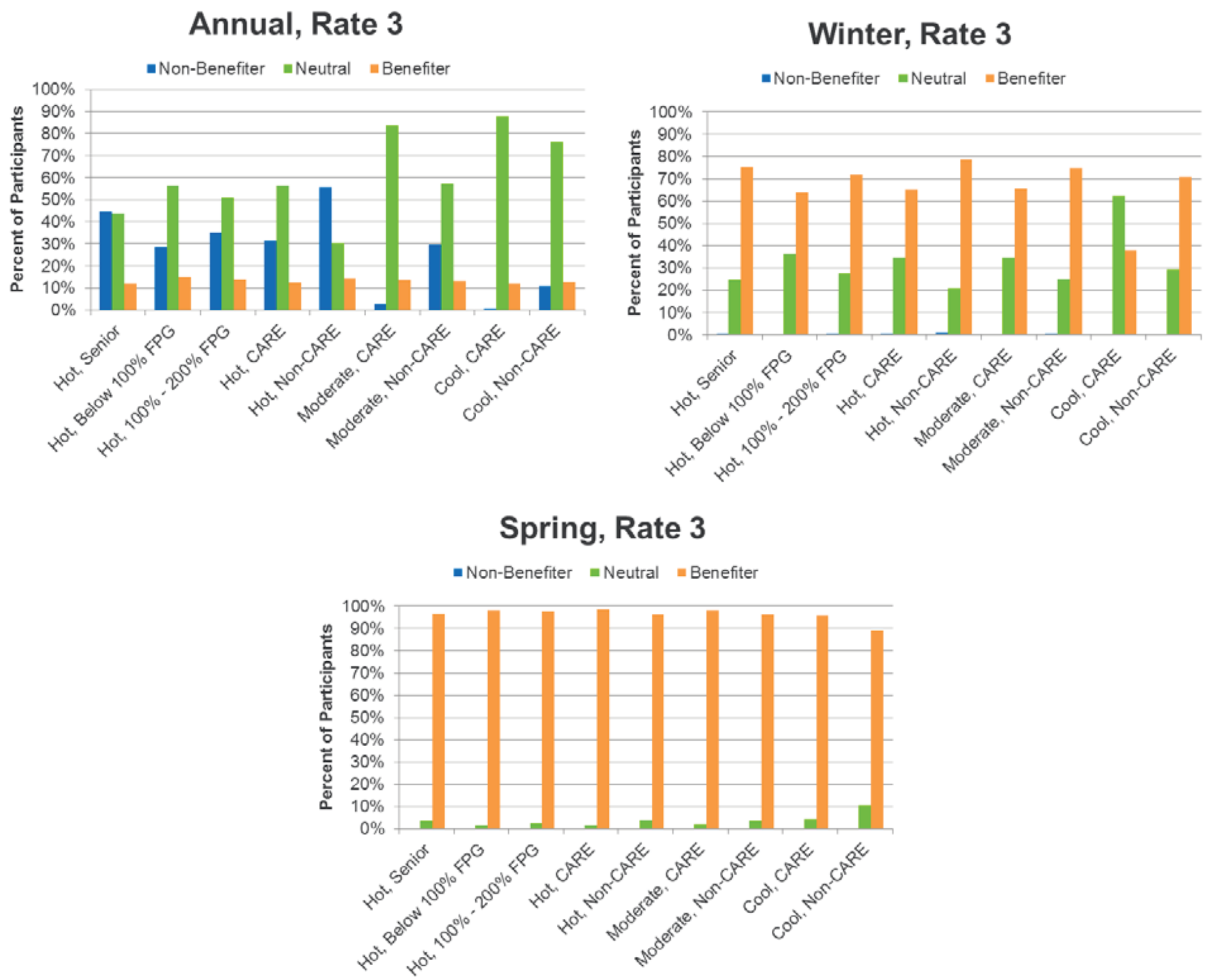


Figure 3.4-5 presents the outcome of the structural benefiter analysis for Rate 3 at the aggregate level across climate regions. PG&E's Rate 3 has the same peak period on weekdays as Rate 1 and a similar peak-to-off-peak price ratio to Rate 1. Like Rate 1, and unlike Rate 2, all weekend hours are priced at the off-peak rate. Additionally, in the spring, Rate 3 has a super off-peak price from 11 AM to 4 PM. As with the other two rates, a majority of customers are structural benefiters in the winter season (and nearly all customers are benefiters in the spring season). Non-CARE/FERA customers have a smaller proportion of neutral customers than CARE/FERA customers.

Figure 3.4-5: Rate 3 Structural Benefiter / Non-Benefiter Analysis
All | CARE/FERA | Non-CARE/FERA

Figure 3.4-6 presents the outcome of the structural benefiter analysis for Rate 3 at the detailed segment level by climate region. As with the other two rates, the findings at the aggregate level still hold. Once again, about half of non-CARE/FERA customers in the hot climate region are non-benefiters on an annual basis.

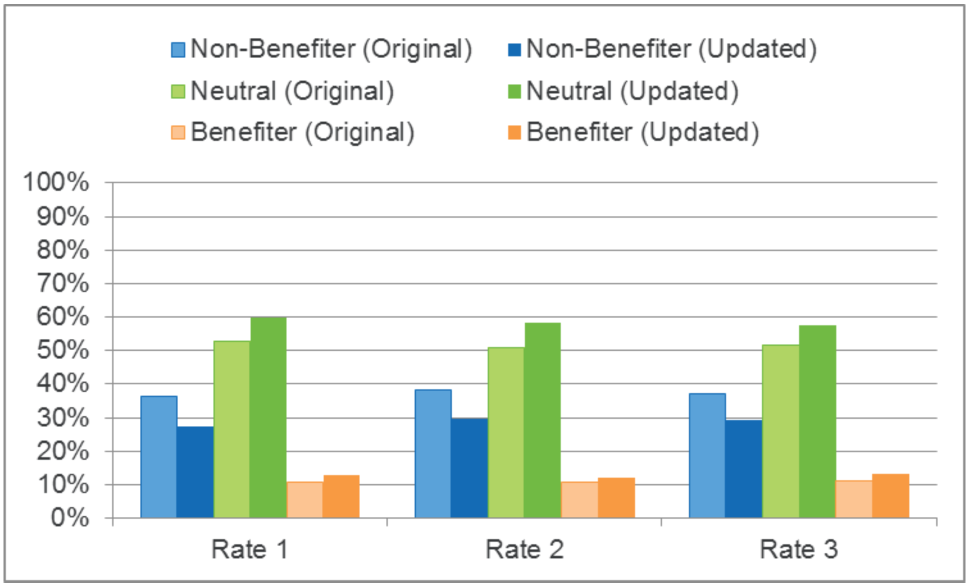
Figure 3.4-6: Rate 3 Structural Benefiter / Non-Benefiter Analysis Detailed Segments by Climate Region



Overall, a general pattern of structural benefiters and non-benefiters emerged that was consistent across all three rates. Nearly all customers were benefiters in the winter season, regardless of climate region or customer segment. On an annual basis, the hot climate region had a greater proportion of non-benefiters than the moderate or cool regions.

Figure 3.4-7 presents a comparison of the annual structural benefiter analysis using two versions of the pilot tariffs and the OAT. The lighter bars represent the outcome of the analysis based on the June 2016 tariffs, which were in effect at the launch of the pilot. The values here match what was reported in the First Interim Report. The darker bars are based on a combination of the original and March 2017 tariffs. The original tariff was used for the months of June through February, and the new tariffs were used for March through May. Incorporating the updated tariffs increases the number of customers in the neutral category and reduces the number of customers in the non-benefiter category. For a comparison of the two tariffs, see Appendix B.

Figure 3.4-7: Comparison of Structural Benefiter Analysis Between Original and Updated Tariffs



3.4.2 Estimation of the Total Bill Impact Due to Differences in the Tariffs and Behavior Change

Total bill impacts experienced by customers on a TOU rate can be decomposed into two components: the structural impact, and the behavioral impact. As discussed above, the structural impact represents the change in customer bills based solely on the change in the underlying structure of the rate. In this case, it is the change from the OAT to the time-differentiated TOU pilot rates. The behavioral impact represents how customers change their energy usage in response to the new pricing structure of the rate—which includes higher prices in the afternoon and evening and lower prices at other times of day. During the summer period, nearly all customers on the TOU rates experienced a structural increase in their bills. This was not the case in the winter period, where nearly all customers experienced a structural *decrease* in their bills. Customers had the opportunity to save even more money by either shifting their usage away from peak periods or reducing consumption altogether. As noted previously, it is the combination of structural and behavioral bill impacts that produces the total bill impact experienced by the average study participant on each rate.

The results from this analysis represent the average total bill across the first year of the pilot (July 2016 through June 2017) and the average monthly bill for winter and spring. Three different bills were calculated for each customer segment:[28]

- **No Change in Behavior or Tariff [1]:** This represents what the treatment group bills would have been in the post-treatment period if they were on the OAT and had not changed their behavior

[28] See Section 3.2.3 in the First Interim Report for additional details on the methodology.

- **No Change in Behavior, Change in Tariff [2]:** This represents what the treatment group bills would have been in the post-treatment period if they were on the TOU rate and had not changed their behavior
- **Change in Behavior and in Tariff [3]:** This represents what the treatment group bills were in the post-treatment period on the TOU rate with a change in behavior

Based on the components defined above, the following metrics were calculated:

- The difference between **[1]** and **[2]** is the structural bill impact (based on post-treatment usage after adjusting for any pretreatment difference between control and treatment customers);
- The difference between **[1]** and **[3]** is the bill impact due to structural differences in the rates, but mitigated by changes in behavior; and
- The difference between **[2]** and **[3]** is the amount customers were able reduce their bills by changing their behavior.

In the bill impact analysis, a major policy question is to better understand the relationship between structural bill impacts and how customers were able to respond. The outcome of this relationship is presented by the "Total Bill Impact" and "Percent Bill Impact" shown in the data table at the bottom of the figures below. These values represent the final outcome incorporating the structural change, and the customer's behavioral response. Results are organized by rate, climate region, and segment; similarly to the other bill impact analysis sections. For each rate, results are presented for the first year of the pilot, followed by winter (and for Rate 3, spring) estimates.

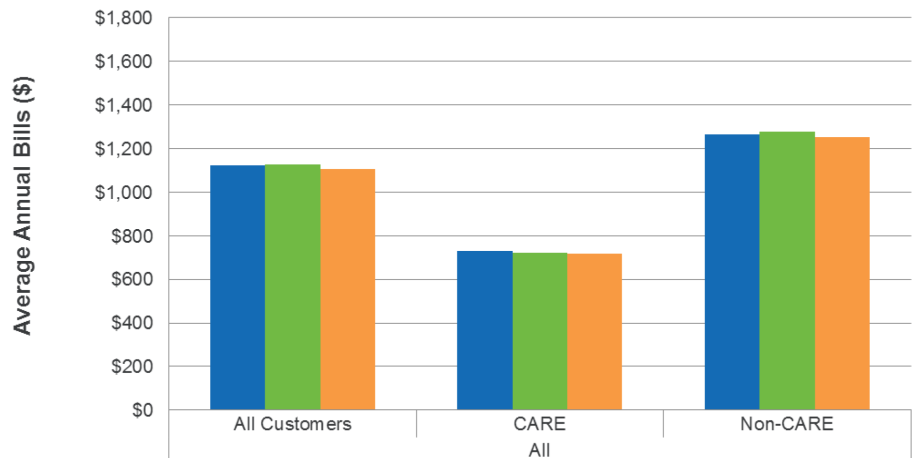
Annual

Figure 3.4-8 presents a set of three average annual bills (the total bill for twelve months, not the average monthly bill) as defined above for the first year of the pilot for all customers, CARE/FERA customers, and non-CARE/FERA customers on Rate 1. The blue bar represents a typical total yearly bill for a customer still on the OAT and not responding to a TOU rate— noted as "No Change in Behavior or Tariff." For the average customer on Rate 1, this dollar amount was $1,121. The green bar represents what a typical annual bill would be for a customer who was billed on a TOU rate, but didn't change their energy use behavior— noted as "No Change in Behavior, Change in Tariff." This dollar amount is $1,127 for the average Rate 1 customer. The difference between the two values, $5.69, is the average increase or decrease a customer would see in their bills by changing from the OAT to Rate 1, and not changing their energy use behavior; this is also referred to as the customer's structural loss or gain, but it is based on post treatment usage for control customers (adjusted for any pretreatment differences between control and treatment customers due to random chance) rather than the structural impact discussed in the prior section, which was based on pretreatment usage. The orange bar represents the average Rate 1 customer's total annual bill after factoring in the change in rate from the OAT to the Pilot Rate 1, and then also taking into account any changes in energy use behavior— noted as "With Change in Behavior and Tariff." This annual cost amount averaged $1,108 for the typical Rate 1 customer. Based on these values, it is possible to estimate the total change in the annual bill including both the change in tariff and in behavior, which, in this instance, is a decrease of $13 over the course of the year (1.1%). This total change is calculated by subtracting the orange ($1,121) from the blue ($1,108).

CARE/FERA customers experienced an average structural gain of $5.74 (1%). Through changes in energy use behavior they were able to offset an additional $4, resulting in a total annual cost decrease of $10

(1.4%) after factoring in both changes in the tariff and behavior. It should be noted that the bill impact due to behavior change for CARE/FERA customers on Rate 1 was statistically significant. Non-CARE/FERA customers experienced a structural loss of $9.89 (1%) over the course of the pilot. However, due to behavior change, they experienced an overall total bill reduction of $14, or about 1.1%.

Figure 3.4-8: Rate 1 Annual Bill Impact Due to Differences in the Tariff and Behavior Change[29]
All | CARE/FERA | Non-CARE/FERA

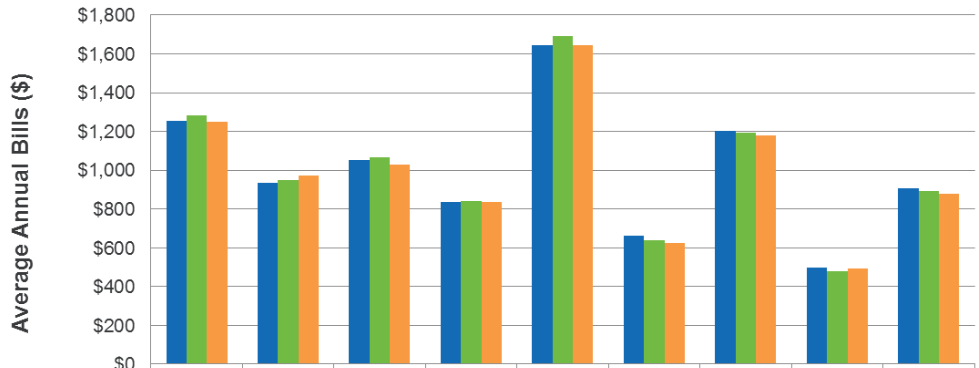


	All Customers	CARE	Non-CARE
No Change in Behavior or Tariff	$1,121	$729	$1,266
No Change in Behavior, Change in Tariff	$1,127	$723	$1,276
With Change in Behavior and Tariff	$1,108	$719	$1,252
Total Bill Impact	-$13	-$10	-$14
Percent Bill Impact	-1.1%	-1.4%	-1.1%

Figure 3.4-9 presents the three sets of average annual bills as defined above for the detailed segments by climate region on Rate 1. Most customer segments experienced small structural losses over the course of the pilot, but nearly every segment was able to reduce their bills by changing their electricity usage behavior. The exceptions to this general rule are households with incomes below 100% of FPG in the hot climate region, who experienced an annual increase in their bills of $37, CARE/FERA customers in the hot climate region who essentially experienced no change in their bills, and non-CARE/FERA households in the hot climate region, who saw a very small increase of $4 on an average annual bill of $1,643. As seen below in Section 3.4.3, which examines the distribution of bill impacts across customers, very few customers saw large bill increases (or decreases) on Rate 1.

[29] Unlike for load impacts, where negative values mean loads went up relative to the reference load, here a negative value means bills fall relative to what they would under the OAT.

**Figure 3.4-9: Rate 1 Annual Bill Impact Due to Differences in the Tariff and Behavior Change
Detailed Segments by Climate Region**

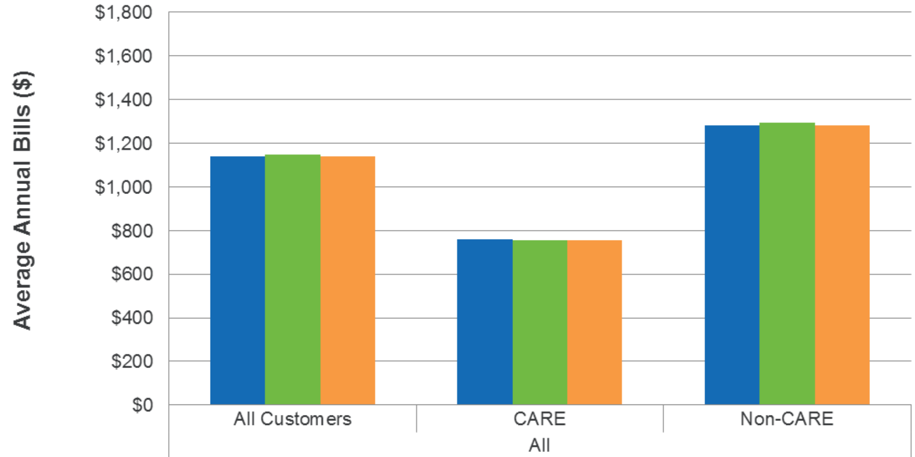


	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$1,256	$937	$1,054	$836	$1,643	$663	$1,201	$500	$905
No Change in Behavior, Change in Tariff	$1,284	$948	$1,067	$842	$1,692	$639	$1,195	$480	$891
With Change in Behavior and Tariff	$1,248	$974	$1,031	$835	$1,647	$627	$1,181	$492	$880
Total Bill Impact	-$8	$37	-$23	$0	$4	-$36	-$20	-$8	-$26
Percent Bill Impact	-0.6%	3.9%	-2.1%	0.0%	0.2%	-5.4%	-1.7%	-1.6%	-2.8%

Figure 3.4-10 presents the three sets of average annual bills for all customers, CARE/FERA customers, and non-CARE/FERA customers on Rate 2. The impacts are similar to those for Rate 1, although the change in the total annual bill for each group is even smaller than for Rate 1. Indeed, for all customers combined, there was no change at all in the annual bill, with the behavioral impact just offsetting the small structural increase in the annual bill. CARE/FERA customers experienced total bill reductions of about $4, or 0.5%, while non-CARE/FERA customers experienced bill increases of about $2, which is equal to 0.1%.

Figure 3.4-10: Rate 2 Annual Bill Impact Due to Differences in the Tariff and Behavior Change

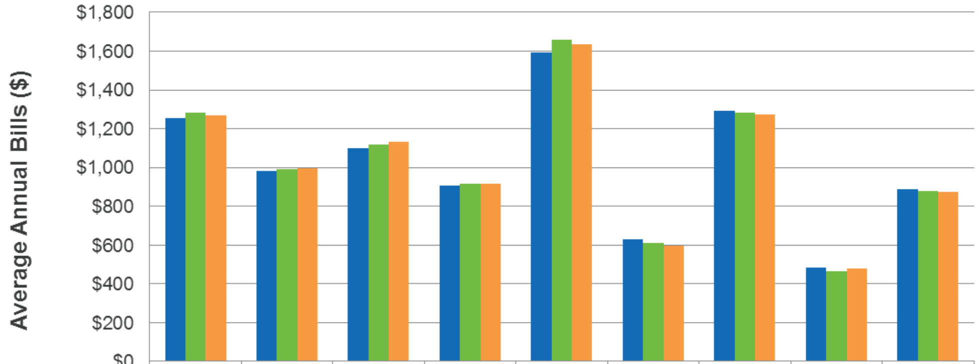
All | CARE/FERA | Non-CARE/FERA



	All Customers	CARE	Non-CARE
No Change in Behavior or Tariff	$1,141	$760	$1,281
No Change in Behavior, Change in Tariff	$1,150	$756	$1,295
With Change in Behavior and Tariff	$1,141	$756	$1,283
Total Bill Impact	$0	-$4	$2
Percent Bill Impact	0.0%	-0.5%	0.1%

Figure 3.4-11 presents the three sets of average annual bills for the detailed segments by climate region on Rate 2. While the average customer across the service territory on Rate 2 did not experience a bill increase, all segments in the hot climate regions saw their bills increase. Non-CARE/FERA households in the hot climate region saw the largest absolute bill increase, $40, while households with incomes between 100% and 200% of FPG saw the largest percentage increase, 2.6%. Customer segments in the moderate and cool climate regions saw small, annual bill decreases, ranging from a low of $4 for CARE/FERA households in the cool climate region to a high of $31 for CARE/FERA customers in the moderate climate region, which was a decrease of 5%.

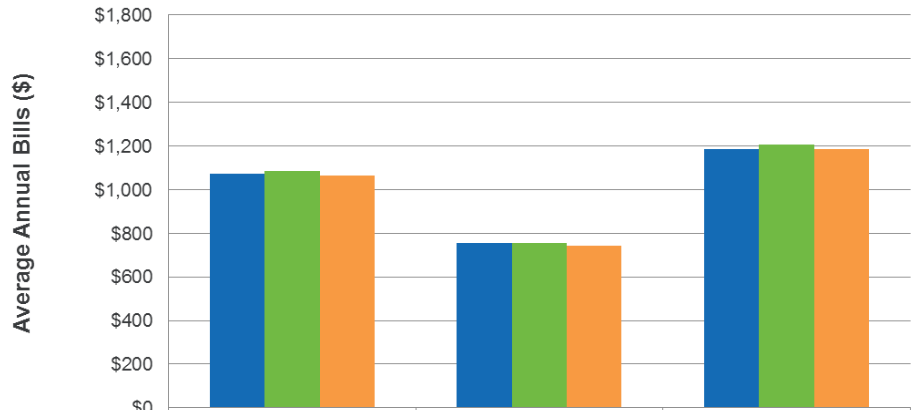
Figure 3.4-11: Rate 2 Annual Bill Impact Due to Differences in the Tariff and Behavior Change
Detailed Segments by Climate Region



	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$1,252	$984	$1,101	$909	$1,593	$629	$1,291	$484	$888
No Change in Behavior, Change in Tariff	$1,282	$990	$1,118	$916	$1,658	$612	$1,281	$465	$877
With Change in Behavior and Tariff	$1,269	$998	$1,130	$916	$1,633	$597	$1,273	$480	$872
Total Bill Impact	$16	$14	$29	$7	$40	-$31	-$18	-$4	-$16
Percent Bill Impact	1.3%	1.5%	2.6%	0.8%	2.5%	-5.0%	-1.4%	-0.8%	-1.8%

Figure 3.4-12 presents the three sets of average annual bills for all customers, CARE/FERA customers and non-CARE/FERA customers on Rate 3. For the average customer across the service territory, a small structural loss of $14 annually was offset by behavior change, resulting in a small decrease in the annual bill of $6, or roughly 5%. CARE/FERA customers saw essentially no change in their annual bill due to the structural change in the tariff, and saw a total bill decrease of $14, or just under 2%. Non-CARE/FERA customers essentially offset their structural loss of $20 by behavior change, resulting in a very small decrease of $3 in their annual average bill of nearly $1,200.

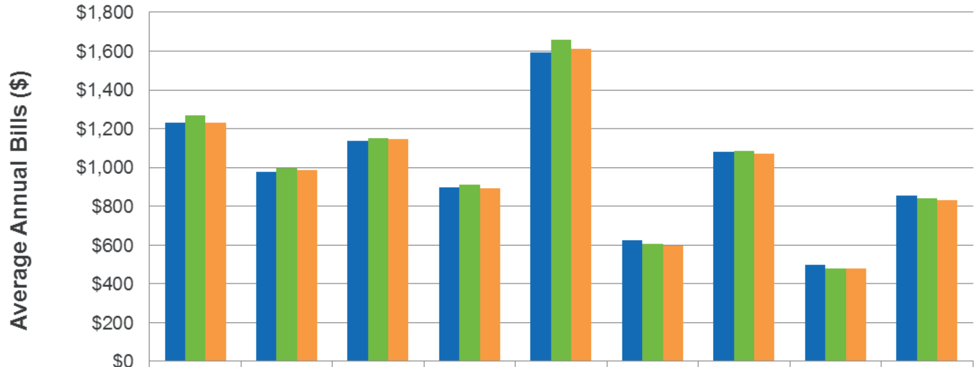
Figure 3.4-12: Rate 3 Annual Bill Impact Due to Differences in the Tariff and Behavior Change
All | CARE/FERA | Non-CARE/FERA



	All Customers	CARE	Non-CARE
		All	
No Change in Behavior or Tariff	$1,071	$756	$1,187
No Change in Behavior, Change in Tariff	$1,085	$755	$1,207
With Change in Behavior and Tariff	$1,065	$742	$1,184
Total Bill Impact	-$6	-$14	-$3
Percent Bill Impact	-0.5%	-1.8%	-0.2%

Figure 3.4-13 presents the three sets of average annual bills by climate region for the individual customer segments on Rate 3. In the hot climate region, all segments experience structural increases in their bills, but some segments were able to more than offset those losses through behavior change and other segments offset most of the loss by shifting or reducing usage. Non-CARE/FERA customers in the hot climate region saw the largest overall bill increase, equaling $21, or 1.3%. In the moderate and cool climate regions, the average CARE/FERA customers saw a decrease in their total bill of around 4.5%, while non-CARE/FERA customers were experienced bill decreases of 0.8% in the moderate climate region and 2.8% in the cool region.

Figure 3.4-13: Rate 3 Annual Bill Impact Due to Differences in the Tariff and Behavior Change
Detailed Segments by Climate Region



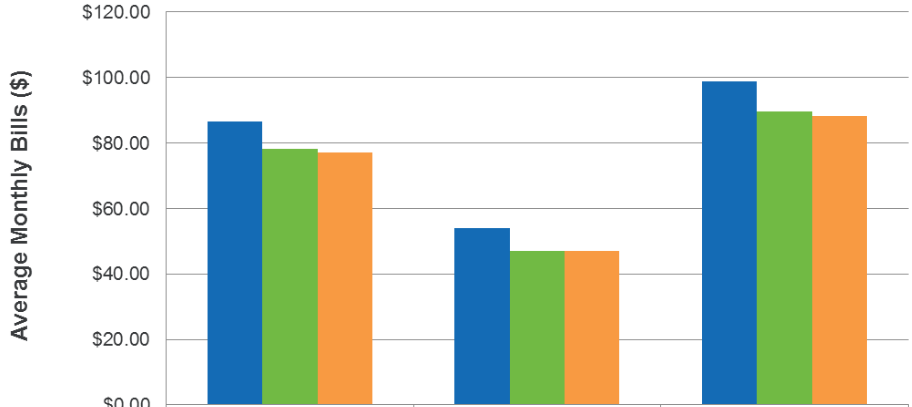
	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$1,231	$979	$1,136	$898	$1,591	$625	$1,082	$500	$857
No Change in Behavior, Change in Tariff	$1,269	$995	$1,153	$912	$1,660	$605	$1,087	$478	$839
With Change in Behavior and Tariff	$1,230	$985	$1,148	$893	$1,612	$597	$1,073	$478	$833
Total Bill Impact	-$1	$6	$12	-$5	$21	-$28	-$8	-$22	-$24
Percent Bill Impact	-0.1%	0.6%	1.0%	-0.5%	1.3%	-4.5%	-0.8%	-4.4%	-2.8%

In summary, for all rates, climate regions and customer segments, annual bill impacts were very small, generally between negative 5% and positive 5%. As seen in the First Interim Report, most customers were structural non-benefiters during the summer period and many saw significant bill increases. The next section shows that customers generally benefitted in the winter months, which offset the summer bill increases and resulted in the very modest annual bill impacts summarized above.

Winter and Spring

Figure 3.4-14 shows the three average monthly bills calculated with no change in behavior or tariff, a change in tariff only, and a change in tariff and behavior for the average winter month for customers on Rate 1. It should be noted that, unlike in the prior section, which presented the total change in the bill for the year, the values in this section represent average monthly bill impacts for winter and spring. As such, the total monthly bill impact of -$9.48 for the average customer, shown in Figure 3.4-14, represents a total savings of roughly $76 over the eight month winter period. Given that the annual bill impact for this same group (as shown previously in Figure 3.4-8) was only -$13, it means that bills across the four month summer period were higher by $63, or roughly $16 per month. Nearly all of the winter savings was due to the structural bill impact. Behavior change had a very minimal impact on the total bill for the average customer across the service territory. This was also true for CARE/FERA and non-CARE/FERA customers.

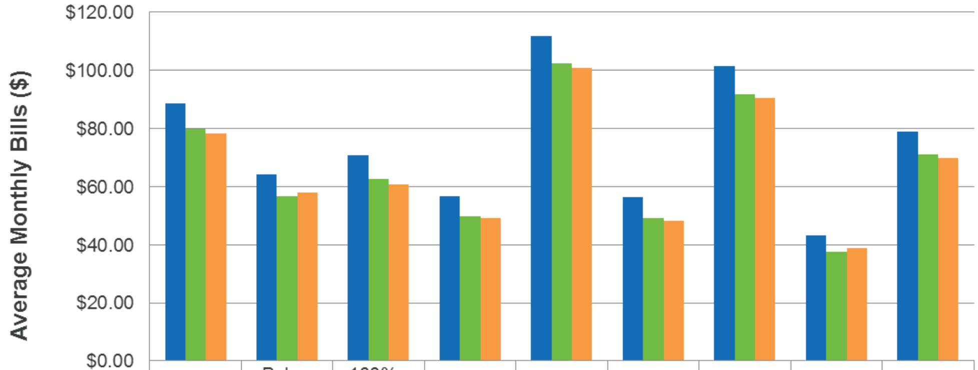
Figure 3.4-14: Rate 1 Winter Bill Impact Due to Differences in the Tariff and Behavior Change
All | CARE/FERA | Non-CARE/FERA



	All Customers	CARE	Non-CARE
		All	
No Change in Behavior or Tariff	$86.68	$53.95	$98.73
No Change in Behavior, Change in Tariff	$78.18	$47.12	$89.62
With Change in Behavior and Tariff	$77.19	$46.97	$88.33
Total Bill Impact	-$9.48	-$6.98	-$10.40
Percent Bill Impact	-10.9%	-12.9%	-10.5%

Figure 3.4-15 presents the three sets of average winter bills for the detailed segments by climate region. All customer segments experienced structural gains in the winter months, but bill impacts due to behavior change were minimal for all segments, typically $1 or less per month. Households with incomes between 100% and 200% of FPG had the greatest overall bill decreases on a percentage basis (14.2% or $10.03), while customers with incomes below 100% FPG had the smallest bill reductions (9.3% or $5.97).

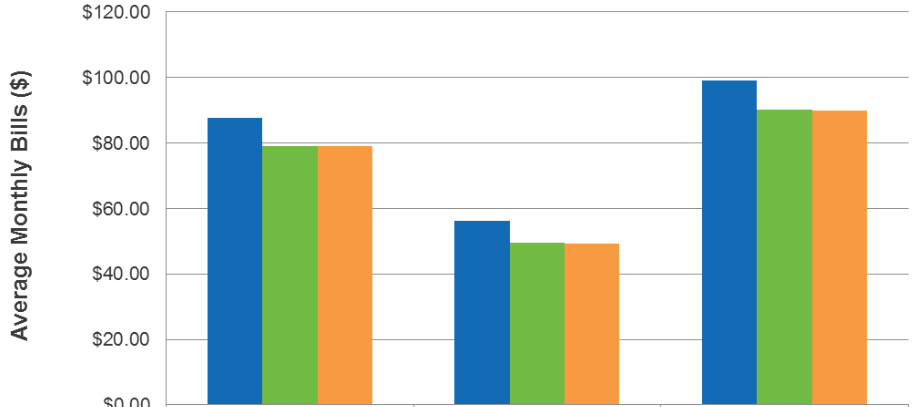
Figure 3.4-15: Rate 1 Winter Bill Impact Due to Differences in the Tariff and Behavior Change Detailed Segments by Climate Region



	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$88.54	$64.07	$70.79	$56.78	$111.83	$56.34	$101.34	$43.12	$78.89
No Change in Behavior, Change in Tariff	$79.86	$56.82	$62.72	$49.67	$102.32	$49.16	$91.74	$37.50	$70.99
With Change in Behavior and Tariff	$78.18	$58.10	$60.76	$49.26	$100.79	$48.36	$90.62	$38.82	$69.74
Total Bill Impact	-$10.36	-$5.97	-$10.03	-$7.52	-$11.04	-$7.98	-$10.72	-$4.30	-$9.15
Percent Bill Impact	-11.7%	-9.3%	-14.2%	-13.2%	-9.9%	-14.2%	-10.6%	-10.0%	-11.6%

Figure 3.4-16 presents the three sets of average monthly bills for all customers, CARE/FERA customers and non-CARE/FERA customers on Rate 2. The results are very similar to Rate 1 in that customers are structural benefiters, on average, with structural gains of about 9.8%. However, for the service territory as a whole and for the CARE/FERA and non-CARE/FERA segments, customers did not have statistically significant bill impacts from changes in behavior. This could be due to the fact that customers on Rate 1 had statistically significant usage reductions on the average weekday, while those on Rate 2 did not.

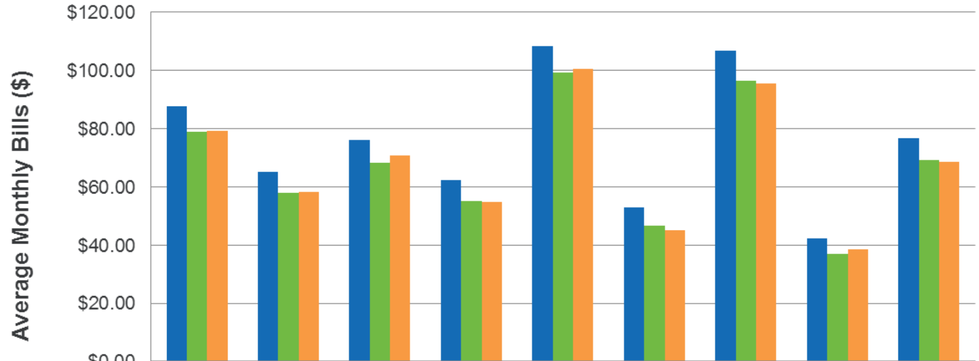
Figure 3.4-16: Rate 2 Winter Bill Impact Due to Differences in the Tariff and Behavior Change
All | CARE/FERA | Non-CARE/FERA



	All Customers	CARE	Non-CARE
		All	
No Change in Behavior or Tariff	$87.62	$56.14	$99.22
No Change in Behavior, Change in Tariff	$79.15	$49.51	$90.07
With Change in Behavior and Tariff	$79.00	$49.33	$89.93
Total Bill Impact	-$8.62	-$6.81	-$9.29
Percent Bill Impact	-9.8%	-12.1%	-9.4%

Figure 3.4-17 presents the three sets of average winter bills for the detailed segments by climate region for customers on Rate 2. Once again, customers were structural winners on average. No customer segments had statistically significant impacts due to behavior change, but overall bill impacts were statistically significant. CARE/FERA customers in the moderate climate region had the greatest bill reductions on a percentage basis, about 15% which is equal to $7.99.

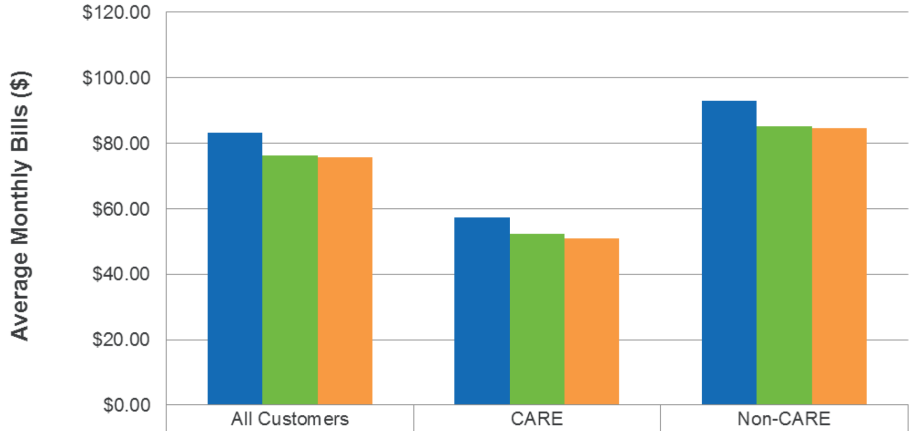
Figure 3.4-17: Rate 2 Winter Bill Impact Due to Differences in the Tariff and Behavior Change
Detailed Segments by Climate Region



	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$87.72	$65.21	$76.13	$62.23	$108.30	$53.07	$106.86	$42.29	$76.64
No Change in Behavior, Change in Tariff	$79.01	$57.82	$68.23	$55.04	$99.33	$46.76	$96.48	$36.88	$69.16
With Change in Behavior and Tariff	$79.10	$58.30	$70.77	$54.83	$100.43	$45.09	$95.51	$38.48	$68.75
Total Bill Impact	-$8.62	-$6.90	-$5.36	-$7.39	-$7.87	-$7.99	-$11.35	-$3.81	-$7.89
Percent Bill Impact	-9.8%	-10.6%	-7.0%	-11.9%	-7.3%	-15.0%	-10.6%	-9.0%	-10.3%

Figure 3.4-18 presents the three sets of average monthly bills for all customers, CARE/FERA customers and non-CARE/FERA customers on Rate 3. As a reminder, these estimates are based on the winter period for Rate 3, which differs from the winter period for Rate 1 and Rate 2. Only the months of October through February are included. The total bill decreases are slightly smaller than those for the previous two rates, about 9.3% or $7.71 for the service territory as a whole. CARE/FERA customers had statistically significant bill impacts as a result of changes in behavior, but non-CARE/FERA customers did not.

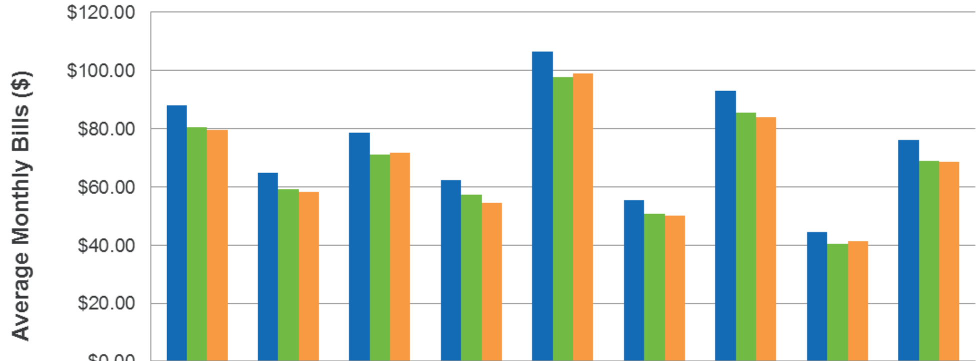
Figure 3.4-18: Rate 3 Winter Bill Impact Due to Differences in the Tariff and Behavior Change
All | CARE/FERA | Non-CARE/FERA



	All Customers	CARE	Non-CARE
		All	
No Change in Behavior or Tariff	$83.34	$57.25	$92.96
No Change in Behavior, Change in Tariff	$76.27	$52.40	$85.07
With Change in Behavior and Tariff	$75.63	$50.89	$84.74
Total Bill Impact	-$7.71	-$6.36	-$8.21
Percent Bill Impact	-9.3%	-11.1%	-8.8%

Figure 3.4-19 presents the three sets of average winter bills for the detailed segments by climate region for customers on Rate 3. All customer segments are structural benefiters, on average. CARE/FERA customers in the hot climate region had statistically significant bill impacts from changes in behavior, and were able to have total bill gains of $7.90 (12.6%). This is not surprising, as customers in this segment had large peak period impacts (7.3% or 0.06 kW) on the average winter weekday.

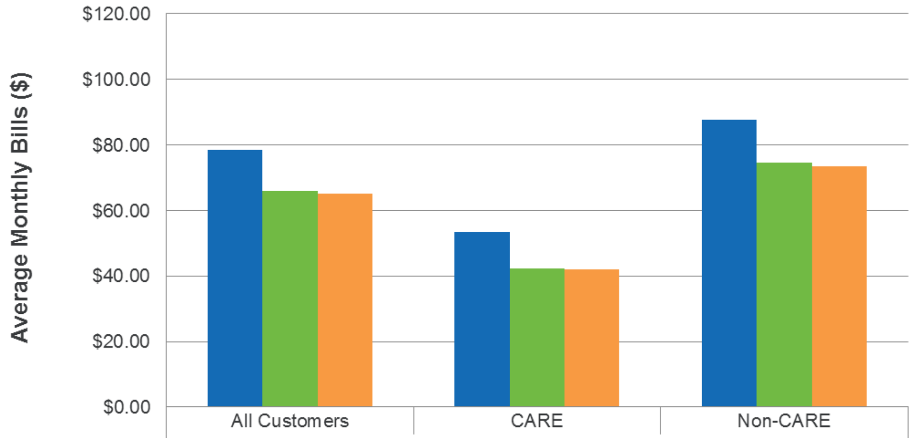
Figure 3.4-19: Rate 3 Winter Bill Impact Due to Differences in the Tariff and Behavior Change
Detailed Segments by Climate Region



	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$87.90	$64.86	$78.57	$62.47	$106.56	$55.46	$93.17	$44.40	$76.12
No Change in Behavior, Change in Tariff	$80.35	$59.31	$71.05	$57.32	$97.80	$50.64	$85.52	$40.38	$68.92
With Change in Behavior and Tariff	$79.56	$58.12	$71.77	$54.57	$98.85	$50.16	$84.02	$41.22	$68.72
Total Bill Impact	-$8.34	-$6.74	-$6.80	-$7.90	-$7.72	-$5.30	-$9.15	-$3.18	-$7.40
Percent Bill Impact	-9.5%	-10.4%	-8.7%	-12.6%	-7.2%	-9.6%	-9.8%	-7.2%	-9.7%

Figure 3.4-20 presents the three sets of average monthly bills for all customers, CARE/FERA customers and non-CARE/FERA customers on Rate 3 during the spring months of March, April, and May. Like the winter period, customers are structural winners on average, but to a greater extent. On average, customers could expect to save about $12.52 (16%) with a change in tariff and no change in behavior. Customers did not have statistically significant bill impacts as a result of behavior change, but they ultimately saved about $13.37 or 17%. CARE/FERA customers had greater structural gains (21%) than non-CARE/FERA customers (15%).

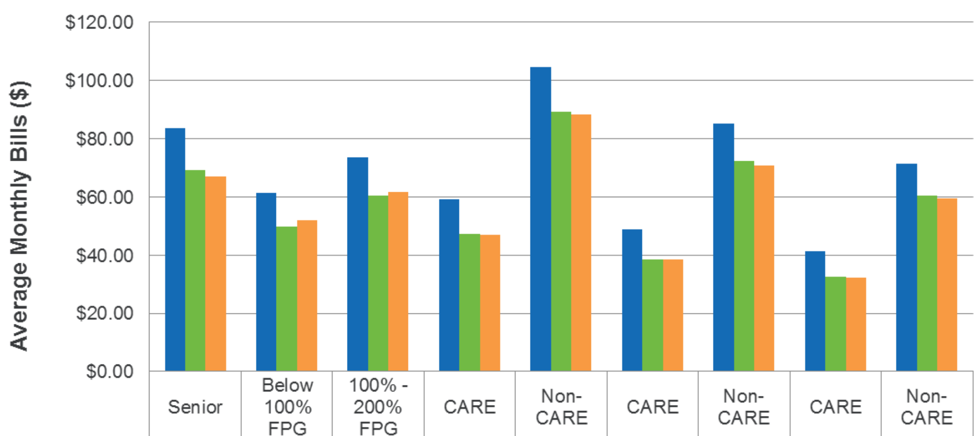
Figure 3.4-20: Rate 3 Spring Bill Impact Due to Differences in the Tariff and Behavior Change
All | CARE/FERA | Non-CARE/FERA



	All Customers	CARE	Non-CARE
		All	
No Change in Behavior or Tariff	$78.46	$53.32	$87.73
No Change in Behavior, Change in Tariff	$65.94	$42.38	$74.62
With Change in Behavior and Tariff	$65.10	$42.08	$73.58
Total Bill Impact	-$13.37	-$11.24	-$14.15
Percent Bill Impact	-17.0%	-21.1%	-16.1%

Figure 3.4-21 presents the three sets of average spring bills for the detailed segments by climate region for customers on Rate 3. Customers in each segment are structural benefiters, on average, with structural gains between 15% and 22%. Senior households had statistically significant bill impacts due to behavior change, bringing their total average savings to $16.64 or 19.9% during the spring period.

Figure 3.4-21: Rate 3 Spring Bill Impact Due to Differences in the Tariff and Behavior Change
Detailed Segments by Climate Region



	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
	Hot					Moderate		Cool	
No Change in Behavior or Tariff	$83.61	$61.37	$73.75	$59.29	$104.57	$48.86	$85.05	$41.38	$71.34
No Change in Behavior, Change in Tariff	$69.21	$49.77	$60.35	$47.43	$89.13	$38.45	$72.33	$32.46	$60.46
With Change in Behavior and Tariff	$66.97	$51.94	$61.58	$46.95	$88.49	$38.58	$70.93	$32.18	$59.50
Total Bill Impact	-$16.64	-$9.43	-$12.16	-$12.35	-$16.08	-$10.28	-$14.12	-$9.20	-$11.84
Percent Bill Impact	-19.9%	-15.4%	-16.5%	-20.8%	-15.4%	-21.0%	-16.6%	-22.2%	-16.6%

3.4.3 Change in the Distribution of Bill Impacts Due to Behavior Change

The third analysis presents the distribution of bill impacts[30] for customers with and without behavioral change, and is designed to show how the distribution shifts when customers respond to the rates by changing behavior. Impact distributions are based on the average monthly bills for the first year of the pilot. Bill impacts were estimated for two cases—with and without behavior change. Both are based on the structural bill impact calculations; however, impacts with behavior change show how behavioral impacts are able to affect the structural impact distribution. Customers were segmented into ranges of bill impacts. The percentage of customers in each $10 increment from negative $100 to positive $100 per month was determined with and without behavior change. The underlying calculations used to develop the distributions are based on a difference-in-differences approach that compares the treatment and control customers based on both pre- and post-treatment bill impacts.[31]

The two distributions are presented on a line graph, with the height of the line at any given $10 increment representing the percentage of customers experiencing a bill impact of the corresponding dollar amount. In this case, the bill impact is measured as the difference between the TOU bill and the OAT bill. If the line for the group with changes in behavior is to the left of the line representing the group with no change in behavior, it shows that at least some customers were able to modify their energy usage such that they had lower total bill impacts compared to if they had not changed their behavior.

Annual

Figure 3.4-22 presents the distribution of bill impacts with and without energy use behavior change. The blue line represents the structural bill impacts that result when customers are billed on the TOU rate and do not change their energy use behavior. The green line shows the total bill impacts when customers have responded to the TOU rate and, in some cases, changed their energy use behavior. Bill impacts are calculated as the difference between the TOU bill and the OAT bill. Each point along the line graph represents the percentage of customers within a specific bill impacts bin or range. For example, on Rate 1, approximately 46% of the customers have a structural bill impact between $1 and $10 per month—the blue line. In other words, approximately 46% of the Rate 1 customers would experience an increase of $1 to $10 per month on Rate 1 compared to the OAT without changing their behavior. The green line represents the total bill impacts when customers have had the opportunity to respond to the TOU rate. In this case, the percent of customers experiencing an increase of $1 to $10 per month on Rate 1 compared to the OAT is 44%.

It is important to note that customers could move up or down through the incremental impact bins, and could potentially move more than one bin—meaning that a customer could potentially experience a bill increase due to their behavioral response, or they could jump down several bins and go from a $21 to $30 per month bill impact down to $1 to $10 impact, for example.

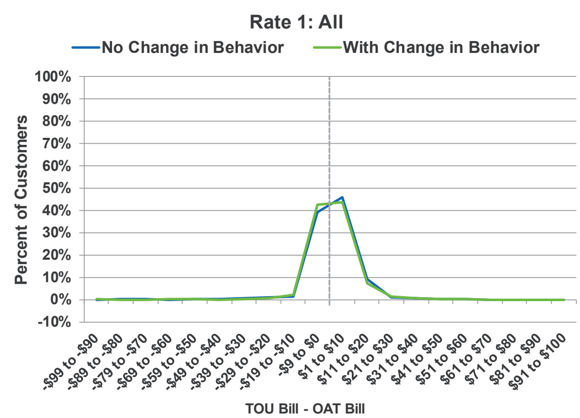
[30] Bill impacts without behavior change represent the structural bill impact distribution; bill impacts with behavior change show how behavioral impacts affect the structural bill impact distribution.

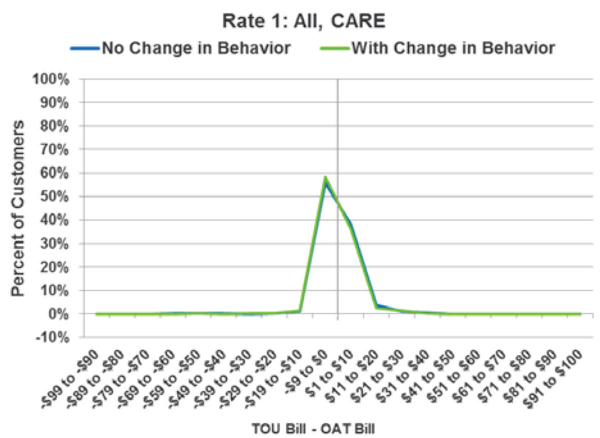
[31] See Section 3.2.4 in the First Interim Report for additional details on the methodology.

About half of the customers on Rate 1 are structural non-benefiters, as illustrated by 57% of customers falling to the right of the dashed line in Figure 3.4-22. Without changes in behavior, about 57% of customers would experience higher bills on Rate 1 versus the OAT. With changes in behavior, this number is reduced to 54%, meaning that some customers moved to the $0 to $9 bin. A large portion of customers, about 39%, face small structural bill savings between $0 and $9, and this percentage increases as customers shift across impact bins.

Figure 3.4-22: Rate 1 Change in Distribution of Bill Impacts Due to Behavior Change
All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0%	0%
-$89 to -$80	0%	0%
-$79 to -$70	0%	0%
-$69 to -$60	0%	0%
-$59 to -$50	0%	0%
-$49 to -$40	0%	0%
-$39 to -$30	1%	0%
-$29 to -$20	1%	1%
-$19 to -$10	1%	2%
-$9 to $0	39%	43%
$1 to $10	46%	44%
$11 to $20	9%	7%
$21 to $30	1%	1%
$31 to $40	1%	1%
$41 to $50	0%	0%
$51 to $60	0%	0%
$61 to $70	0%	0%
$71 to $80	0%	0%
$81 to $90	0%	0%
$91 to $100	0%	0%





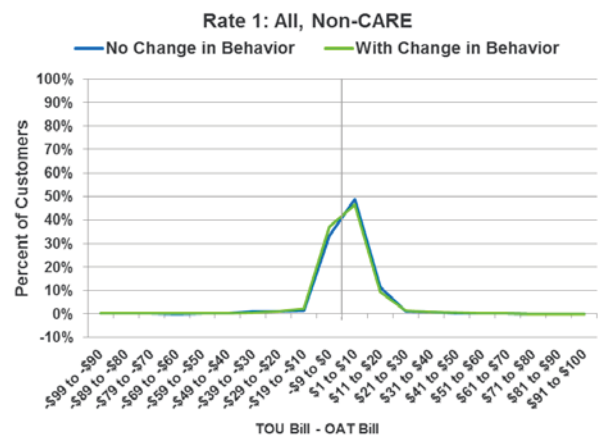
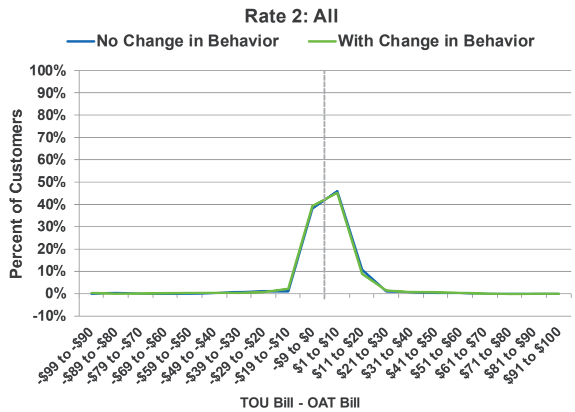
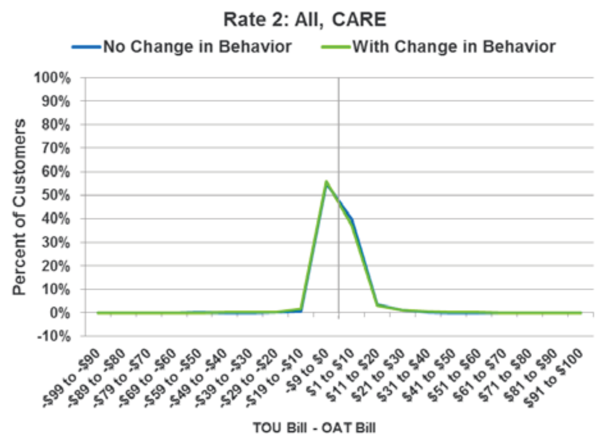


Figure 3.4-23 provides the distribution of bill impacts for all customers and for CARE/FERA and non-CARE/FERA customers on Rate 2. The distributions are nearly identical to that of Rate 1, with about half of customers (46%) experiencing structural losses between $1 and $10. Through behavior change, the distribution shifted toward the $0 to $9 savings bucket. About 55% and 32% of CARE/FERA and non-CARE/FERA customers, respectively, experience structural gains between $0 and $9, and the shift due to behavior change is quite small.

Figure 3.4-23: Rate 2 Change in Distribution of Bill Impacts Due to Behavior Change All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0%	0%
-$89 to -$80	0%	0%
-$79 to -$70	0%	0%
-$69 to -$60	0%	0%
-$59 to -$50	0%	0%
-$49 to -$40	0%	0%
-$39 to -$30	1%	0%
-$29 to -$20	1%	1%
-$19 to -$10	1%	2%
-$9 to $0	38%	39%
$1 to $10	46%	45%
$11 to $20	11%	9%
$21 to $30	1%	2%
$31 to $40	1%	1%
$41 to $50	0%	1%
$51 to $60	0%	0%
$61 to $70	0%	0%
$71 to $80	0%	0%
$81 to $90	0%	0%
$91 to $100	0%	0%





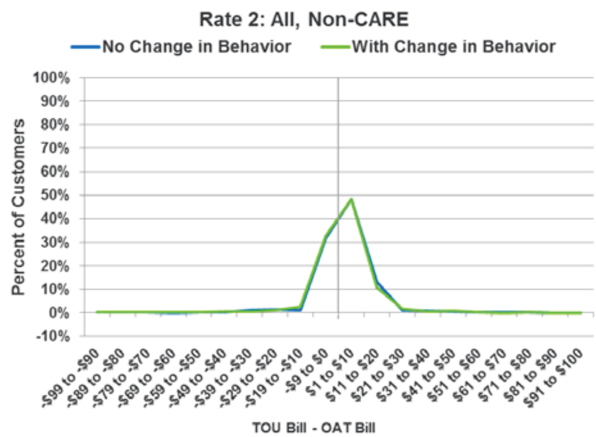
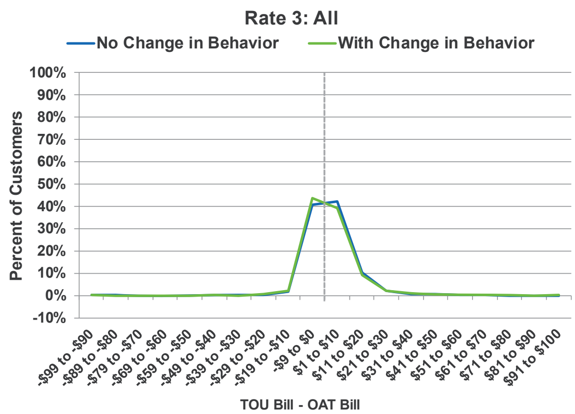
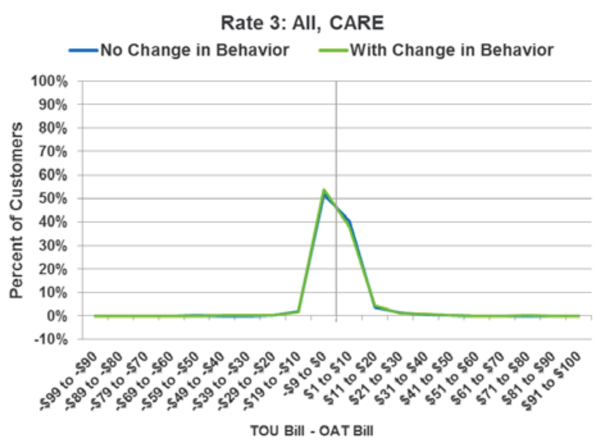


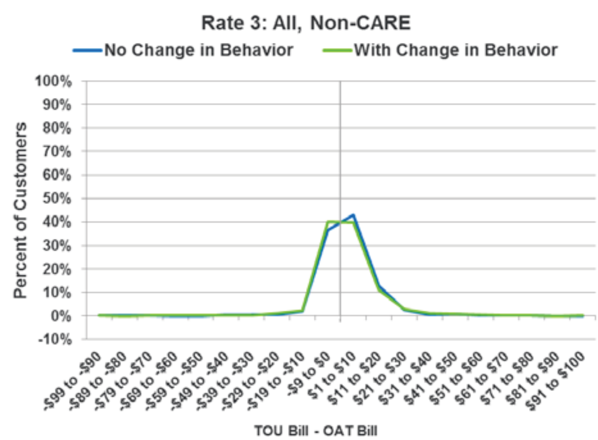
Figure 3.4-24 provides the distributions of bill impacts for all customers and CARE/FERA and non-CARE/FERA customers on Rate 3. Over 40% of customers experienced small structural gains, and another 40% experienced small structural losses. A small portion of customers were able to shift from "benefiter" to "non-benefiter" through changes in behavior, as indicated in the peak of the blue line shifting to the left.

Figure 3.4-24: Rate 3 Change in Distribution of Bill Impacts Due to Behavior Change
All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0%	0%
-$89 to -$80	0%	0%
-$79 to -$70	0%	0%
-$69 to -$60	0%	0%
-$59 to -$50	0%	0%
-$49 to -$40	0%	0%
-$39 to -$30	0%	0%
-$29 to -$20	0%	1%
-$19 to -$10	2%	2%
-$9 to $0	41%	44%
$1 to $10	42%	39%
$11 to $20	10%	9%
$21 to $30	2%	2%
$31 to $40	0%	1%
$41 to $50	1%	1%
$51 to $60	0%	0%
$61 to $70	0%	0%
$71 to $80	0%	0%
$81 to $90	0%	0%
$91 to $100	0%	0%







3.5 Synthesis for PG&E Pilot

This section compares input from the load impact analysis, the bill impact analysis and the survey analysis. The objective of these comparisons, at least in part, is to determine if the information and conclusions observed for individual metrics are supported by findings from other metrics or, alternatively, findings for one metric contradict those for another metric. We also look for clues from the survey findings that might help explain why load or bill impacts for one rate differ from those for other rates. For example, if we find that the load impacts are significantly different across rates or across segments on a specific rate, we could turn to the survey questions concerning the level of understanding of rate features to see if there are significant differences in customer understanding of key rate features that might explain the observed differences across rates and/or customer segments.

When reviewing the synthesis tables and discussion below, it is important to keep in mind, as discussed in the RIA Report, that the statistical analysis of survey questions is “over powered” That is, with the very large sample sizes for each treatment and control group, combined with the high survey responses rate, even very small differences in values across segments can be statistically significant. While any decision regarding whether a statistically significant difference is meaningful from a policy perspective is inherently subjective, it nevertheless is critical. For example, reporting that there is a statistically significant difference in the satisfaction rating of one rate compared to another and concluding or recommending that the rate with the lower satisfaction rating is inferior from a customer engagement perspective would be very misleading if the satisfaction rating for one was 6.2 and the other 6.7 on an 11 point scale.

3.5.1 Synthesis

Table 3.5-1 through Table 3.5-3 summarize some relevant findings from the load impact, bill impact and survey analysis. Before summarizing the results, we provide the following guide to the information in Table 3.5-1 as well as a map to prior tables and figures from which the information was taken for Rate 1, including those contained in the separate RIA Report. This way, readers can easily refer back to those more complete tables and figures.

In each cell in the tables, in addition to the reported values, there is either a colored triangle facing up or down, a (-), N/A, I/S or nothing at all. Cells containing N/A indicate that the specific segment was not included in the analysis, and cells containing I/S indicate the segment was analyzed but didn't have sufficient sample size to warrant reporting the results. If there is a colored triangle in the cell, it means the value in the cell is statistically significantly different relative to the control group. Green triangles symbolize a desirable outcome (e.g., peak period load reductions are good) and red arrows an undesirable outcome (e.g., peak period load increases are not good). If (-) appears, the value is not statistically significant and if there is no symbol at all (as in the column labeled "Understanding TOU Pricing (None Correct)", it means a comparison to the control group is not relevant (in this example, the control group was not on a TOU rate so couldn't respond to questions about rate periods, etc.). N/A indicates that a statistical significance test was not appropriate. The content of each column and the places in the text from which the values were taken is explained below:

- **Summer Peak Period Load Reduction:** The percent reduction in peak period electricity use on average weekdays for the months of July through September 2016. Positive values mean customers reduced use and negative values mean customers increased use during the peak period relative to the control group (e.g., reference load). Reductions are desirable, and therefore indicated by a green triangle, and increases are undesirable, and represented by a red triangle. These values from Rate 1 were carried over from the First Interim Report.
- **Winter Peak Period Load Reduction:** The percent reduction in peak period electricity use on average weekdays for the months of October 2016 through May 2017. Positive values mean customers reduced use and negative values mean customers increased use during the peak period relative to the control group (e.g., reference load). These values for Rate 1 can be found in Table 3.3-1 through Table 3.3-4 in Section 3.3.1.[32]
- **Net Annual kWh Change %:** The percent reduction in annual electricity use for the year starting July 2016 and ending June 2017. Positive values mean customers reduced use and negative values mean customers increased use. These values are also found in
- Figure 3.3-5 through Figure 3.3-7.

[32] Values for Rates 2 and 3 can be found in similar tables in Sections 3.2.2 and 3.2.3, respectively.

- **Annual Total Bill Impact ($ or %):** This is the change in the average customer's bill on Rate 1 due to the impact of both the structural change in the tariff, holding usage constant, and the change in the bill due to changes in usage. These values may be found at the bottom of the table in Figure 3.4-8.
- **Health Index:** The values in this column represent the mean values of the health index for each customer segment on Rate 1. They are taken from Table 3-7 in the RIA Report. Cells with red triangles indicate that the index mean value for the segment is higher than the mean value for the control group and the difference is statistically significant. Cells with green arrows mean that the treatment group index is actually lower than the control group value and the difference is statistically significant.
- **Bill Higher Than Expected:** The values in this column are taken from Table 3-49 in the RIA Report and equal the percent of customers reporting that their bills since December 2016 had been higher than they expected. The values do not represent the difference in the percentage between treatment and control customers. Many control customers also reported that bills were higher than expected, reflecting the usual seasonal variation in bills that occurs due to seasonal changes in rates, higher air conditioning use in the summer and the tiered structure of the rates. Cells with red triangles represent values that are higher than the percentage reported by control group customers and where the difference is statistically significant.
- **Difficulty Paying Bills:** The values in this column are taken from Table 3-26 in the RIA Report and represent the percent of customers reporting having difficulty paying bills since June 2016. Cells with red or green triangles represent values that are higher or lower than control group values, respectively, and where the differences are statistically significant.
- **Economic Index:** The values in this column represent the mean values of the economic index for each customer segment on Rate 1. They are taken from Table 3-6 in the RIA Report. Cells with red triangles indicate that the index mean value for the segment is higher than the mean value for the control group and the difference is statistically significant.
- **Understanding TOU Pricing:** This variable is based on a survey question asking respondents to identify the hours of the day when prices are the highest. The values in the table come from Table 3-52 in the RIA Report and indicate the percent of customers that failed to correctly identify ANY peak period hours associated with the TOU rate. The higher this percentage, the less likely that a group of customers would make significant reductions during the peak period-this is because fewer customers would know when the peak period was.
- **Satisfaction with Rate:** These values represent the average satisfaction rating for the rate plan on an 11 point scale, from 0 to 10, with higher values indicating higher satisfaction. These values are taken from Table 3-39 in the RIA Report. Values with red triangles represent cells where the average rating for the treatment group on the TOU rate is lower than for the control group on the OAT, and the difference is statistically significant.
- **Satisfaction with Utility:** The same 11-point scale as above was used to assess satisfaction with PG&E. The values in the column are also taken from Table 3-39 in the RIA Report. As above, red triangles represent statistically significant differences between average values for the control and treatment groups.

Looking across the various metrics for each customer segment and rate, we did not observe any internal inconsistencies. In fact, quite the opposite—overall, the load impact, bill impact and survey findings typically align quite well. Below is a summary by customer segment.

Non-CARE/FERA Customers

Non-CARE/FERA customers in the hot climate region have the second highest percent reduction in winter peak period energy use among all segments, averaging 3.9% across the three rates[33], and the highest net annual kWh savings, averaging 2.4% across all rates. While they experienced the greatest annual total bill increases of approximately $20 per year due to a large portion of customers being structural non-benefiters, they were able to offset 67% of their approximately $60 annual structural loss through behavior change. Total annual bill increases for non-CARE/FERA customers in the hot climate region ranged from a low of $4 on Rate 1 to a high of $40 on Rate 2. Average annual bills decreased for non-CARE/FERA customers in the moderate and cool climate regions for all three rates

Across all rates and climate regions, population weighted peak period impacts in the winter were approximately one-half the magnitude of the summer, but all were statistically significant. This is an important finding as it shows customers are continuing to respond to the TOU rates. All non-CARE/FERA customer segments across all rates experienced average total bill decreases in the winter. Non-CARE/FERA customers understood the rates better than nearly any other segment (as indicated by the very low percent that failed to identify at least one peak period hour). In many cases, they had statistically significantly lower instances of customers receiving a higher bill than expected compared to the control group—meaning more control group customers were surprised by higher than expected bills than treatment group customers. The non-CARE/FERA customers also had the lowest satisfaction ratings for the rate plan and for PG&E compared with any other segment. However, there were no cases in which the satisfaction levels were significantly lower relative to the control group. In some cases the satisfaction levels for both the rate and for PG&E were actually higher for the treatment group compared to the control group in the moderate climate region. All of these metrics paint an internally consistent picture of a customer segment that understood the timing of the peak period well, worked hard to reduce usage and bills, and ultimately had satisfaction ratings very similar to those of the control group.

CARE/FERA Customers

Across Rates 1 and 2 in all climate regions, CARE/FERA customers had lower reductions in peak period and daily electricity use than non-CARE/FERA customers. Although, as reported in Sections 3.3.1 through 3.3.3, not all of the differences between CARE/FERA and non-CARE/FERA customers were statistically significant. Rate 3 CARE/FERA customers in the hot climate region exhibited the largest winter peak reduction across all rates and climate regions, and also had among the highest annual kWh savings levels. The specific driver for these large winter impacts is unknown, especially given this group provided some of the smallest impacts over the summer. However, some of the survey findings may provide some insights. This group had the highest percent of customers expressing difficultly paying bills, at 74%. While this metric was not statistically significantly different compared to the control group, they also had the highest economic index score of 4.6, which was significantly higher compared to the control group. In the first survey, 22% of these customers were not able to identify any of the TOU pricing periods correctly. In the second survey, this dropped by nearly one-third, to 14%. This group initially

[33] Average based on peak period for each rate and not the common hours.

faced an annual structural loss of approximately $14, and through behavior change was able to reduce their bills by $19, resulting in a net savings of $5 per year.

Table 3.5-1: Load Impacts, Bill Impacts, and Selected Survey Findings for PG&E Rate 1

Climate	Segment	Load Impacts			Bill Impacts		Survey						
		Summer Peak Period Load Reduction %	Winter Peak Period Load Reduction %	Net Annual kWh Change %	Annual Total Bill Impact $	Annual Total Bill Impact %	Health Index (Range 0-10)	Bill Higher than Expected	Difficulty Paying Bills	Economic Index (Range 0-10)	Understanding TOU Pricing (None-Correct)	Satisfaction w/ Rate (11 pt. Scale)	Satisfaction w/ Utility (11 pt. Scale)
Hot	Non-CARE/FERA	8.7% ▼	5.4% ▼	3.1% ▼	$4 -	0% -	2.20 -	31% ▼	25% -	2.4 -	5%	6.2 -	6.8 -
	CARE/FERA	3.2% ▼	2.6% ▼	0.9% ▼	$0 -	0% -	2.90 -	27% ▼	68% -	4.1 -	14%	6.9 -	7.4 -
	Senior	7.0% ▼	4.8% ▼	2.6% ▼	-$8 ▼	-1% ▼	2.80 -	26% ▼	37% -	3.0 -	12%	6.9 ▲	7.4 -
	HH < 100% FPG	-0.4% -	0.8% -	-0.9% ▲	$37 ▲	4% ▲	2.90 -	31% ▼	70% -	4.3 -	13%	7.0 -	7.5 -
	100% FPG < HH < 200% FPG	N/A	N/A	N/A	-$23 ▼	-2% ▼	2.90 -	28% ▼	60% -	3.9 -	11%	6.7 -	7.2 -
Moderate	Non-CARE/FERA	4.7% ▼	3.5% ▼	0.3% ▼	-$20 ▼	-2% ▼	2.40 -	26% ▼	15% ▼	1.9 ▼	5%	6.6 ▲	6.8 -
	CARE/FERA	3.9% ▼	2.5% ▼	1.7% ▼	-$36 ▼	-5.4% ▼	2.90 -	27% ▼	62% -	4.1 -	14%	7.3 -	7.7 -
Cool	Non-CARE/FERA	4.6% ▼	3.3% ▼	0.8% ▼	-$26 ▼	-2.8% ▼	2.10 -	35% -	15% ▼	1.9 -	3%	6.3 -	6.6 -
	CARE/FERA	1.4% ▼	-0.9% -	-2.2% ▲	-$8 ▼	-1.6% ▼	2.80 -	33% -	57% -	3.6 -	16%	7.1 -	7.4 -

Table 3.5-2: Load Impacts, Bill Impacts, and Selected Survey Findings for PG&E Rate 2

Climate	Segment	Load Impacts			Bill Impacts		Survey						
		Summer Peak Period Load Reduction %	Winter Peak Period Load Reduction %	Net Annual kWh Change %	Annual Total Bill Impact $	Annual Total Bill Impact %	Health Index (Range 0-10)	Bill Higher than Expected	Difficulty Paying Bills	Economic Index (Range 0-10)	Understanding TOU Pricing (None-Correct)	Satisfaction w/ Rate (11 pt. Scale)	Satisfaction w/ Utility (11 pt. Scale)
Hot	Non-CARE/FERA	9.0% ▼	3.7% ▼	1.5% ▼	$40 ▲	2.5% ▲	2.40 -	32% -	28% -	2.4 -	11%	6.0 -	6.5 -
	CARE/FERA	2.8% ▼	3.3% ▼	0.5% ▼	$7 ▲	0.8% ▲	2.90 -	25% ▼	68% -	4.3 -	27%	7.1 -	7.6 ▲
Moderate	Non-CARE/FERA	6.8% ▼	4.3% ▼	-0.1% -	-$18 ▼	-1.4% ▼	2.20 -	36% ▼	17% -	2.0 -	10%	6.3 -	6.9 -
	CARE/FERA	2.8% ▼	5.0% ▼	1.9% ▼	-$31 ▼	-5.0% ▼	3.10 -	30% -	60% -	3.9 -	24%	7.3 -	7.6 -
Cool	Non-CARE/FERA	4.7% ▼	2.5% ▼	0.3% ▼	-$16 ▼	-1.8% ▼	2.20 -	33% -	18% -	2.0 -	11%	6.3 -	6.9 -
	CARE/FERA	0.3% -	0.0% -	-2.4% ▲	-$4 ▼	-0.8% ▼	2.90 -	36% -	53% -	3.7 -	22%	7.2 -	7.5 -

Table 3.5-3: Load Impacts, Bill Impacts, and Selected Survey Findings for PG&E Rate 3

Climate	Segment	Load Impacts			Bill Impacts		Survey						
		Summer Peak Period Load Reduction %	Winter Peak Period Load Reduction %	Net Annual kWh Change %	Annual Total Bill Impact $	Annual Total Bill Impact %	Health Index (Range 0-10)	Bill Higher than Expected	Difficulty Paying Bills	Economic Index (Range 0-10)	Understanding TOU Pricing (None-Correct)	Satisfaction w/ Rate (11 pt. Scale)	Satisfaction w/ Utility (11 pt. Scale)
Hot	Non-CARE/FERA	9.5% ▼	2.6% ▼	2.6% ▼	$21 ▲	1% ▲	2.20 -	28% ▼	25% -	2.5 -	6%	6.2 -	6.7 -
	CARE/FERA	1.9% ▼	7.3% ▼	2.3% ▼	-$5 ▼	-1% ▼	2.70 -	25% ▼	74% -	4.6 ▲	14%	7.3 ▲	7.6 ▲
Moderate	Non-CARE/FERA	4.1% ▼	3.7% ▼	0.5% ▼	-$8 ▼	-1% ▼	2.10 -	32% ▼	15% ▼	2.1 -	3%	6.6 ▲	7.0 ▲
	CARE/FERA	3.2% ▼	1.8% ▼	0.8% ▼	-$28 ▼	-4% ▼	2.90 -	26% ▼	60% -	3.9 -	11%	7.4 -	7.7 -
Cool	Non-CARE/FERA	3.1% ▼	2.0% ▼	0.4% ▼	-$24 ▼	-3% ▼	2.50 -	32% -	20% -	2.1 -	7%	6.4 -	6.8 -
	CARE/FERA	2.3% ▼	0.8% -	-0.1% -	-$22 ▼	-4% ▼	2.70 ▼	31% -	57% -	3.7 -	13%	7.3 -	7.5 -

This group had significant economic challenges, and was successful in adjusting their energy consumption, at least in the winter period, in order to ultimately lower their bills. It should also be noted that these customers had some of the highest satisfaction scores with both the rate and with PG&E, with scores from both satisfaction metrics being significantly higher compared to the control group for customers in the hot climate region on Rate 3, and no worse compared to the control group for any rates across any climate regions.

Turning to other metrics of interest, there was essentially no change in total annual bills in the hot climate region for CARE/FERA customers averaged across the three tariffs. These customers were able to offset 80% of their annual structural bill increase of around $9. While on an annual basis the difference is negligible, customers did experience higher bills in the summer that were ultimately offset by lower bills in the winter. CARE/FERA customers in the moderate and cool climate regions both had structural bill decreases of around $20 (3-4%) on an annual basis. Between 53% and 74% of CARE/FERA customers reported having difficulty paying bills, which was three times higher on average than for non-CARE/FERA customers, but this was also true for control customers. The economic index for CARE/FERA customers was roughly twice as high as for non-CARE/FERA customers in all climate regions and for all rate options, including the control group. In short, CARE/FERA customers had higher economic index scores compared with non-CARE/FERA customers, but the increase in the economic index scores moving from the OAT to TOU rates is not statistically significant except for the Rate 3 hot climate regions customer noted above.

CARE/FERA customers did have higher satisfaction ratings for the TOU rates than non-CARE/FERA customers for all rates and climate regions. This is consistent with findings from many other surveys of this customer class which in general tends to have higher satisfaction ratings overall for all IOU programs. In all climate regions, none of the satisfaction ratings for CARE/FERA customers were statistically significantly lower than the control group ratings—in fact, they were higher for the Rate 3 hot climate regions customers. CARE/FERA customers also had higher ratings for satisfaction with PG&E than non-CARE/FERA customers in all climate regions for all rates.

Senior Households

Senior households in the hot climate region had load reductions in the peak period for the average weekday that were comparable to average reductions for the overall population in the hot region, as reported for Rate 1 in Section 3.3.1. The average peak period load impact of 4.8% is in between the slightly larger load impacts of the non-CARE/FERA group of 5.4% and the smaller impacts from the CARE/FERA group with 2.6%. This reflects the combination of non-CARE/FERA and CARE/FERA customers comprising the Senior household population. The net annual kWh change of 2.6% was also between the values for non-CARE/FERA and CARE/FERA, suggesting the Senior population responds to price signals in a manner consistent with the general population.

Total bill impacts and reductions in bill impacts due to behavior change were also very similar for senior households and the hot general population, reflecting the split between non-CARE/FERA and CARE/FERA customers. On Rate 1, 26% of seniors, along with around a third of the customers from other segments, indicated that their bills were higher than expected. However, this percentage was actually statistically significantly lower for the customers on TOU rates compared to the OAT. There was no statistically significant difference in the percent of seniors reporting difficulty in paying bills, or in the economic index, compared with the control group.

Senior households appear to have a higher percentage of participants that could not identify any peak period hours compared with the population as a whole in the hot region. Weighted average values for CARE/FERA and non-CARE/FERA customers for this variable for Rate 1 is 8.5% compared to 12% for seniors. Though it should be noted this is an improvement over the first survey where 18% of seniors couldn't identify any of the peak periods.

In addition, about 56% of combined CARE/FERA and non-CARE/FERA customers selected over half of the correct peak hours compared to 50% of seniors (see Table 3-52 in the RIA Report). This was also an improvement, up from 42% in the first survey.

Finally, satisfaction ratings by seniors for the rate plan (6.9) and for PG&E (7.4) were somewhat higher than the ratings for the hot climate zone population as a whole (as calculated by a weighted average for CARE/FERA and non-CARE/FERA households, whose ratings were 6.5 and 7.0 respectively). Seniors on TOU rates also had a statistically different higher average satisfaction ratings for the rate plan compared with the control group, but did not have statistically significantly different ratings for satisfaction with PG&E.

Households with Incomes Below 100% of FPG

Households with incomes below 100% of FPG on Rate 1 in the hot climate region did not have statistically significant peak period load reductions in the winter—nor did they have any in the first summer. This group actually had a statistically significant increase in net annual kWh electricity use equal to almost 1% in the hot climate region. Consistent with these changes, bill impacts due to behavior change actually led to higher bills over and above the structural bill impact for Rate 1. The average annual cost increase for this segment was $37 or 4%.

This segment was tied for the highest percentage on the health index compared to other segments on Rate 1.[34] However, the percentage was not statistically different for the treatment group compared to the control group on this index.

70% of customers with incomes below 100% of FPG reported that they had difficulty paying bills and this segment had the highest economic index score (4.3) of any segment. However, the difference in the economic index for TOU customers compared with the control group was not statistically significant for customers on Rate 1. The percentage of customers reporting difficulty paying bills was also not statistically different from the percent of control customers reporting difficulty. 31% of customers with incomes below 100% of FPG stated they received bills higher than expected. However, this was statistically significantly lower than the control group, and was a general trend across Rate 1 customer segments in the hot and moderate climate regions.

Customers in this segment were among the highest percent of participants who could not identify any peak period hours among all segments on Rate 1. For Rate 1, this segment did not have statistically

[34] This metric is not reported for Rates 2 or 3.

different levels of satisfaction with the rate or with PG&E. Satisfaction was not measured for this segment on Rates 2 or 3.

3.5.2 Key Findings

Key findings pertaining to load impacts from the PG&E pilots include:

1. Customers can and will respond to TOU rates with peak periods that extend well into the evening hours during the winter – peak period load reductions averaged roughly 3.6% for all three pilot rates across the service territory as a whole.
2. The average winter impact of 3.6% is slightly more than half the size of the load impact from the first summer of approximately 6%. However, there was significant variation in the relationship between summer and winter impacts across rates and customer segments.
3. For Rate 2, which has the same prices in effect on weekends as on weekdays, the pattern of load impacts across rate periods was very similar on weekends and weekdays – that is, customers can and will reduce loads on weekends in the winter.
4. There was a statistically significant reduction in net annual electricity use for all three rates – for Rates 1 and 3 the average reduction was 1.4%, while for Rate 2 it was 0.6%. These savings are comparable with those of normative comparison home energy reports.
5. Winter load impacts, in both absolute and percentage terms, were largest in the hot climate region, second largest in the moderate region, and lowest in the cool region for Rates 1 and 3 (although the differences were not always statistically significant). Load impacts were slightly larger in the moderate climate region than the hot region for Rate 2, though the difference is not statistically significant.
6. CARE/FERA customers had significantly lower peak period load reductions compared with non-CARE/FERA customers.
7. Senior households on Rate 1 in the hot climate region had load impacts very similar to the hot climate region population as a whole – in fact, Senior household impacts (4.8%) were slightly higher than the non-CARE/FERA and CARE/FERA population weighted average at 4.2%.
8. Households with incomes below 100% of FPG on Rate 1 in the hot climate region had no statistically significant reduction in peak period, and a small statistically significant increase in net annual electricity use.

Key findings pertaining to bill impacts include:

1. Average monthly winter bills were lower under TOU rates than under the OAT for all customer segments and all climate regions – the average monthly bill decrease ranged from a low of $3.18 for CARE/FERA customers in the cool climate region on Rate 3 to a high of $11.35 for non-CARE/FERA customers on Rate 2 in the moderate climate region. This is driven in part by the fact that the TOU rates are seasonally differentiated (prices are lower in the winter than in the summer), whereas PG&E's standard rate is not.
2. Average annual total bill impacts varied by rate and climate region. The average customer on Rate 1 and Rate 3 experienced slight decreases on an annual basis of $13 and $6, respectively. Average customers on Rate 2 experienced no net change in annual bills. However, the distribution of annual bill impacts varied significantly by climate region. The average customer from the moderate or cool climate regions across all rates experienced net annual total cost

decreases of between $4 and $36. Non-CARE/FERA customers in the hot climate region on all rates experienced annual net cost increases of $4 on Rate 1, $40 on Rate 2, and $21 on Rate 3. Households below 100% of FPG on Rate 1 and CARE/FERA customers on Rate 2 in the hot climate region also experienced net annual cost increases.

Key findings from the survey research include the following:

1. **Economic Hardship:** Rate 3 CARE/FERA customers in the hot region had a higher economic index score, or greater economic hardship, when compared to the Control group. This increase in economic index scores is equivalent to a customer noting difficulty paying one additional bill during the previous six months. In contrast, Rate 1 non-CARE/FERA customers in the moderate region had a lower economic index score, or lower economic hardship, compared to the Control group. Corroborating this finding, non-CARE/FERA customers in the moderate region also reported less difficulty paying their bills than control customers.
2. **Health Hardship:** None of the Rate segment customers had a higher health index score, or greater health hardship, compared to the Control Group. Rate 3 customers participating in or eligible for CARE/FERA in the hot region and Rate 3 CARE/FERA customers in the cool region had a lower health index score, or lower health hardship, compared to the Control groups. Additionally, lower percentages of Rate 1 Below 100% FPG customers in the hot region reported needing medical attention due to excessive heat or cold in their home compared to the Control group.
3. **Satisfaction:** Across most groups, particularly CARE/FERA groups, satisfaction with their rate and PG&E was higher for TOU customers when compared to control group customers, which is a reversal of findings from the first survey. These differences are substantively small. For example, hot region CARE/FERA Rate 3 customers' average rating with their rate plan was 7.3, while control group customers' average rating was 6.8, a difference of 0.5 (Table 4.5.20). On average, satisfaction ratings are slightly higher or the same for Rate group customers, and are slightly lower for Control group customers, compared to results from the first survey.
4. **Bill protection, understanding of rates, and actions taken**:
   - About half of customers reported receiving a letter from PG&E mentioning their bill protection and knowing when their bill protection ends. When customers were asked to select what bill protection means from a list of three possible meanings, 28% to 59% selected the correct meaning and 25% to 51% reported they did not know.
   - Though average levels of agreement for "rate is easy to understand" were somewhat high (generally between 7.0 and 7.5), customer's understanding of their rates indicate a disconnect between customer's rating of understandability and actual understanding (with 3% to 27% of customers unable to identify peak hours). This is especially true for CARE/FERA customers where the percent of customers who could not identify peak hours was much higher than for non-CARE/FERA customers. However, the percentage of customers who selected over 50% of the correct peak hours improved compared to results from the first survey, and about one-third to two-thirds of customers selected the correct answer when asked if their rate is higher, lower, or the same in the summer vs. in the winter.
   - When asked if customers agreed that peak and off-peak times were easy to remember, Rate 1 customers provided slightly higher agreement ratings than rate 2 and 3 customers. Partially corroborating this finding, Rate 2 customers were the most likely to

select "no correct" answers to the rate understanding question, but Rate 1 and 3 customers showed little difference in rate understanding.[35]

- Customers on TOU rates were more likely to take time-specific actions than customers in the control condition. For example, while a similar proportion of customers from control and rate groups indicated that they turned off their lights to conserve energy, a larger proportion of treatment customers indicated they shifted doing laundry, running the dishwasher, and running their pool/spa pump during peak hours, and were more likely to pre-cool their homes. These findings suggest that while fewer treatment customers understood the nuances of their rates, they did know and take actions that helped them shift use.

Overall findings and conclusions include:

- Customers continued to respond to the TOU price signals at the end of a full year. As expected, the load impacts were lower during the winter compared to the first summer. Load impact persistence will be examined in the final report once data from the second summer becomes available.
- The majority of customers across all three rates experienced slight net annual total bill decreases. However, customers in the hot climate regions were more likely to experience net annual bill increases, especially non-CARE/FERA customers.
- Evidence continues to suggest that the more complex, three-period TOU rate (Rate 2) was harder for all customers to fully understand and this was especially true for low income customers. While peak period reductions are roughly the same for all three rates, the reduction in net annual electricity use for Rate 2 was significantly less than for Rates 1 and 3. There is no evidence that Rate 2 has other advantages to offset the disadvantages summarized above although it may be possible with better education and outreach to overcome some of these shortcomings.
- After a year, there is no evidence indicating that senior households as a group in PG&E's service territory fare better or worse than the general population as a whole. Generally speaking, metrics such as load and bill impacts, and the scores on nearly all survey questions—including those related to hardship—were in between the scores for CARE/FERA and non-CARE/FERA customers in the same climate region, and is reflective of the composition of CARE/FERA and non-CARE/FERA customers within the Senior Segment.
- For households with incomes below 100% of FPG, there was no statistically significant increase in economic or health index scores after a full year on Rate 1 (the only rate where measurements are reported for this segment).
- Evidence from the second survey continues to suggest that the education and outreach to low income customers (CARE/FERA and households with incomes below 100% of FPG) did not generate the same level of understanding of TOU rates as it did for non-low income customers. This could partly result from the fact that more CARE/FERA customers have English as a second language but there may be other reasons. There were improvements in the level of understanding of CARE/FERA households between the first and second survey, but it remains

[35] These survey items were coded much like a test with partial credit; customers would get 50% right if they could identify half of the peak hours for their test rate.

below the general population's level of understanding. This issue should be carefully addressed and studied further in the upcoming default pilots, where there is a much greater emphasis on and opportunity to test ME&O alternatives for all segments.

4 SCE Evaluation

This report section summarizes the attrition, load impacts, and bill impacts for the first year of SCE's pilot, with specific attention to the winter months and annual findings. Load and bill impacts from the first summer season can be found in the First Interim Report.

4.1 Summary of Pilot Treatments

Figure 4.1-1 through Figure 4.1-3 summarize the three tariffs that are being tested in the SCE service territory. All three tariffs have peak periods that include the prime evening hours from 5 to 8 PM. The rates have changed since the launch of the pilot, and the figures represent the tariffs that were in effect in January 2017 and do not reflect the baseline credit of 9.1 ¢/kWh. Appendix B shows the prices that were in effect in each rate period for each tariff, including the OAT. Two sets of prices are shown in the appendix, one covering the period from pilot start through December 2016, and the other beginning on January 1, 2017. While several minor rate changes occurred over the course of the pilot, the rate adjustment that occurred on January 1, 2017 was more significant and, as such, it was factored into the estimation of bill impacts summarized in Section 4.4 below.

Figure 4.1-1: SCE Pilot Rate 1 (January 2017)[36]

Tariff	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Super Off-Peak (23.2¢)								Off-Peak (27.8¢)						Peak (34.8¢)									
	Winter	Super Off-Peak (22.7¢)								Off-Peak (22.7¢)						Peak (27.3¢)									
Weekend	Summer	Super Off-Peak (23.2¢)								Off Peak (27.8¢)															
	Winter	Super Off-Peak (22.7¢)								Off Peak (22.7¢)															

Figure 4.1-2: SCE Pilot Rate 2 (January 2017)

Tariff	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Super Off-Peak (17.6¢)								Off-Peak (29.1¢)									Peak (55.2¢)						
	Winter	Super Off-Peak (17.7¢)								Off-Peak (25.5¢)									Peak (27.6¢)						
Weekend	Summer	Super Off-Peak (17.6¢)								Off-Peak (29.1¢)															
	Winter	Super Off-Peak (17.7¢)								Off-Peak (25.5¢)															

Figure 4.1-3: SCE Pilot Rate 3 (January 2017)

Tariff	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Off Peak (16.3¢)											Peak (22.6¢)					Super On-Peak (37.0¢)							
	Winter	Off Peak (18.3¢)																Mid Peak (21.1¢)							
	Spring	Off Peak (18.3¢)											Super Off Peak (10.0¢)					Peak (25.0¢)							
Weekend	Summer	Off Peak (16.3¢)																Mid Peak (18.7¢)							
	Winter	Off Peak (18.3¢)											Super Off Peak (10.39¢)					Mid Peak (21.1¢)							
	Spring	Off Peak (18.3¢)											Super Off Peak (10.0¢)					Mid Peak (21.1¢)							

36 See Appendix B for comparison of tariffs.

The prices shown in the above figures for Rates 1 and 2 do not reflect the credit of 9.1¢/kWh for usage below the baseline quantity in each climate zone. This credit significantly reduces average prices, especially for lower usage customers. Rate 3 does not include a baseline credit. Given this difference in baseline credits between Rates 1 and 2 and Rate 3, it is not possible to directly compare prices in each rate period from the above figures.

Rate 1 has three rate periods on summer weekdays and two on winter weekdays. The peak period on Rate 1 is the same all year long and runs from 2 to 8 PM. The peak to super-off-peak price ratio[9] (ignoring the baseline credit) is 1.2 to 1 in winter and 1.5 to 1 in the summer. Customers on SCE's Rate 1 pay off-peak prices on weekends in the winter. In summer, off-peak prices are in effect on weekends from 8 AM to 10 PM, which is the time period covered by the combination of peak and off-peak prices on weekdays.

SCE's Rate 2 has three rate periods on weekdays all year long. Compared with Rate 1, it has a much shorter peak period but a similar peak price in the winter months (27.6 ¢/kWh). The peak period runs from 5 to 8 PM. Rate 2 also features a super off-peak price of roughly 17.7 ¢/kWh between 10 PM and 8 AM on weekdays all year long. The ratio of peak to super-off-peak prices in the summer is roughly 3 to 1. In winter, the peak-to-super off-peak price ratio is roughly 1.6 to 1. On weekends, customers pay the off-peak price between 8 AM and 10 PM and the super off-peak price during the same overnight hours as on weekdays, from 10 PM to 8 AM.

Rate 3 has a peak-period length of five hours, which is in between the peak-period length for Rates 1 and 2. In addition, the peak period starts later in the day compared with Rate 1, and extends further into the evening (until 9 PM) than either of the other pilot rates. The weekday peak-to-super-off-peak price ratio in the winter on Rate 3 is roughly 2.1 to 1. Another difference between Rate 3 and the other rates is the presence of super off-peak pricing between 11 AM and 4 PM in spring, when excess supply conditions may exist in California. On weekends, Rate 3 has two rate periods in summer and three in spring and winter. The peak period on weekends shown in Figure 4.1-3 has a different color compared with weekday peak periods because the prices on weekends don't match any of the prices during peak, partial, off-peak, or super-off-peak periods on weekdays. Finally, as mentioned above, a very important difference is the lack of a baseline credit in Rate 3.

Figure 4.1-4 presents the seasons for each rate. For all three rates, the summer season covers the months of June through September. The winter season is October through May for Rates 1 and 2, and October through February for Rate 3. The spring period for Rate 3 is March through May.

Figure 4.1-4 Seasons by Rate

<table>
<tr><th>Month</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td>Rate 1</td><td colspan="5">Winter</td><td colspan="4">Summer</td><td colspan="3">Winter</td></tr>
<tr><td>Rate 2</td><td colspan="5">Winter</td><td colspan="4">Summer</td><td colspan="3">Winter</td></tr>
<tr><td>Rate 3</td><td colspan="2">Winter</td><td colspan="3">Spring</td><td colspan="4">Summer</td><td colspan="3">Winter</td></tr>
</table>

In addition to assessing the rate treatments summarized above based on customers recruited from the general, eligible residential population, SCE also recruited customers who were known to have purchased and installed a smart thermostat. The objective of this treatment group was to estimate load impacts for smart thermostat owners on TOU rates. The pilot plan called for SCE to partner with a smart thermostat vendor (in this case, Nest) to recruit smart thermostat owners into the study using the same "pay-to-play" recruitment strategy as was used for the general population. However, because Nest does not know the names or addresses of Nest thermostat owners, recruitment was done via email only (the same communication channel that Nest uses to send out monthly reports to each online Nest owner summarizing equipment run time and other behavioral information) rather than through the direct mail solicitation that was employed for the rate treatment groups. Target enrollment for the technology treatment was 3,750 customers and participants were to be randomly assigned to Rates 1 and 3 or to the control condition. In reality, enrollment fell well short of this target and those who enrolled were randomly assigned only to Rate 1 and to the control group.

SCE also varied the education and outreach provided to participants who were on the three TOU rates. The majority of customers (75%) on each of the three TOU rates received what SCE describes as enhanced education and outreach while the remainder received fewer contacts during the post enrollment phase.

The next section, Section 4.2, is a discussion of customer attrition over the first year of the pilot. Section 4.3 presents the load impact estimates for the winter period for each rate and Section 4.4 summarizes the bill impacts for the winter months and on an annual basis.

4.2 Customer Attrition

Figure 4.2-1 through Figure 4.2-3 show the cumulative opt-out rates over time for each test cell and climate region. The cumulative number of opt-outs is highest in the hot region, second highest in the moderate region and lowest in the cool region. The number of control customers dropping out is very low in all climate regions. The cumulative opt-out rate in the moderate region is below 6% and the cumulative opt-out rate in the cool regions is below 4% for all rates and for both CARE/FERA and non-CARE/FERA customers. The opt-out rates in the hot climate zones increase between July and August for Rates 1 and 2, and a bit later for Rate 3. This is likely due to the fact that enrollment in Rate 3 occurred later than it did for the other two rates. CARE/FERA customers in the hot climate region on Rate 3 had the greatest opt-out rate, reaching over 12% by the end of the first year of the pilot (June 2017). This is more than twice the opt-out rate for hot-CARE/FERA customers on Rate 2 and roughly four times larger than for Rate 1. The opt-out rates generally level off after the summer season, except for Rate 3 where the cumulative opt outs steadily increase over time.

Figure 4.2-1: Cumulative SCE Opt Outs by Month – Hot Climate Region

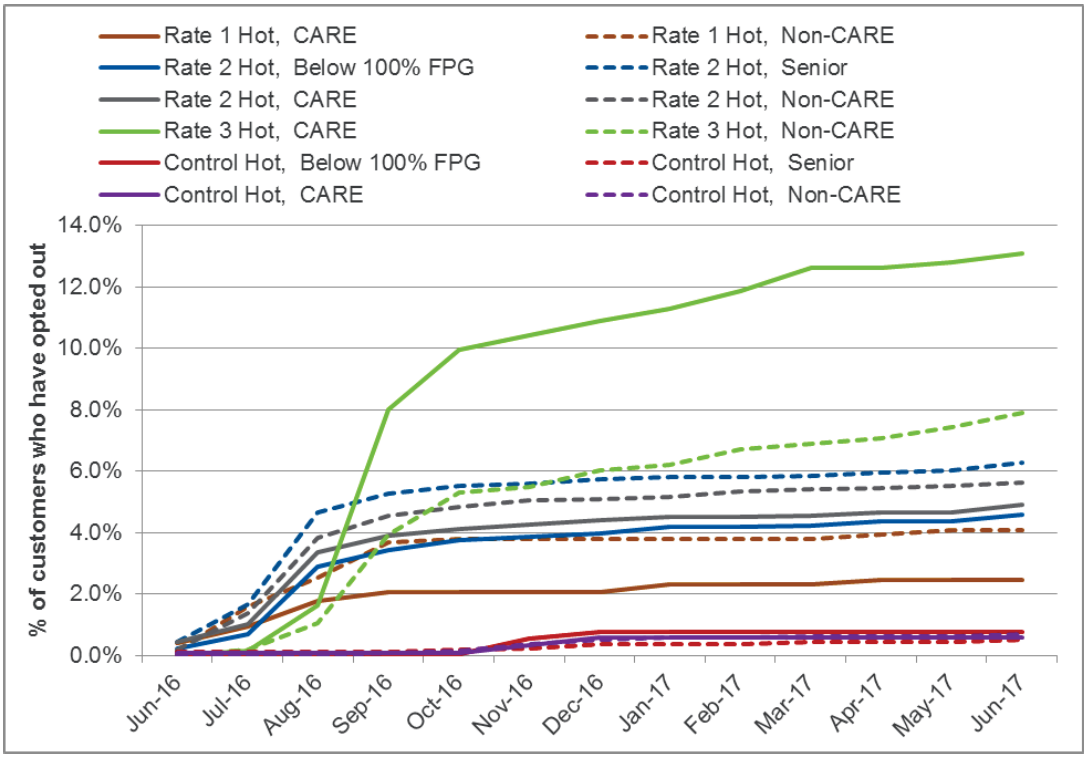


Figure 4.2-2: Cumulative SCE Opt Outs by Month – Moderate Climate Region

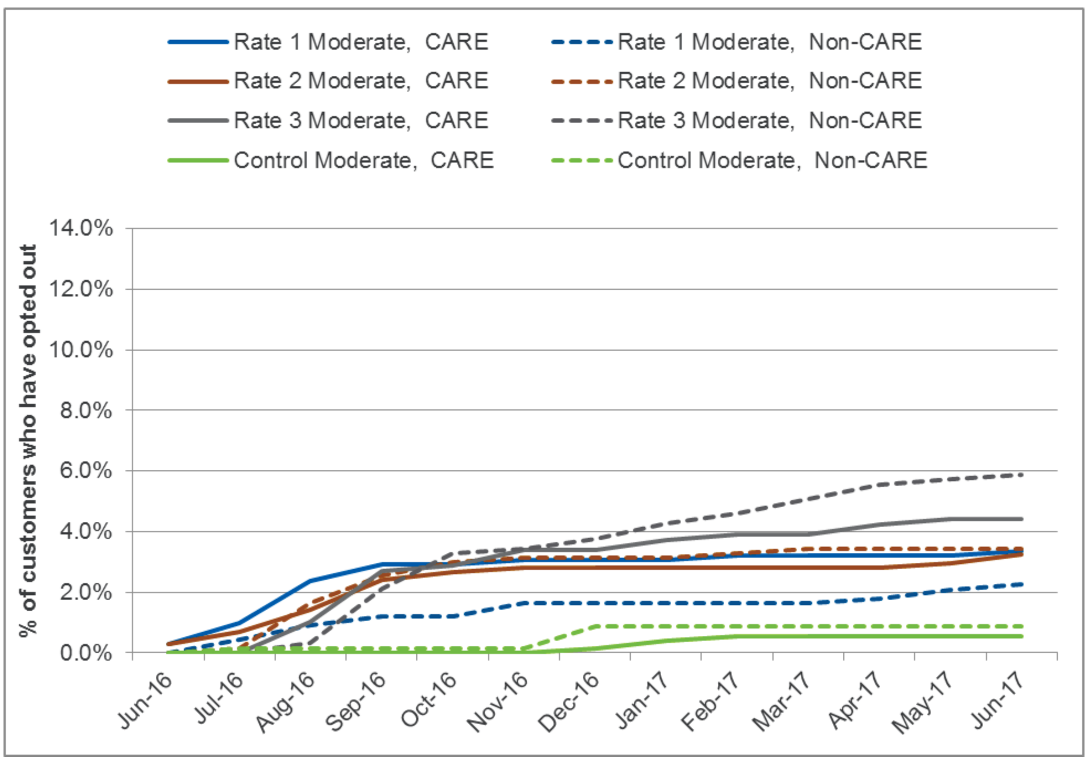


Figure 4.2-3: Cumulative SCE Opt Outs by Month – Cool Climate Region

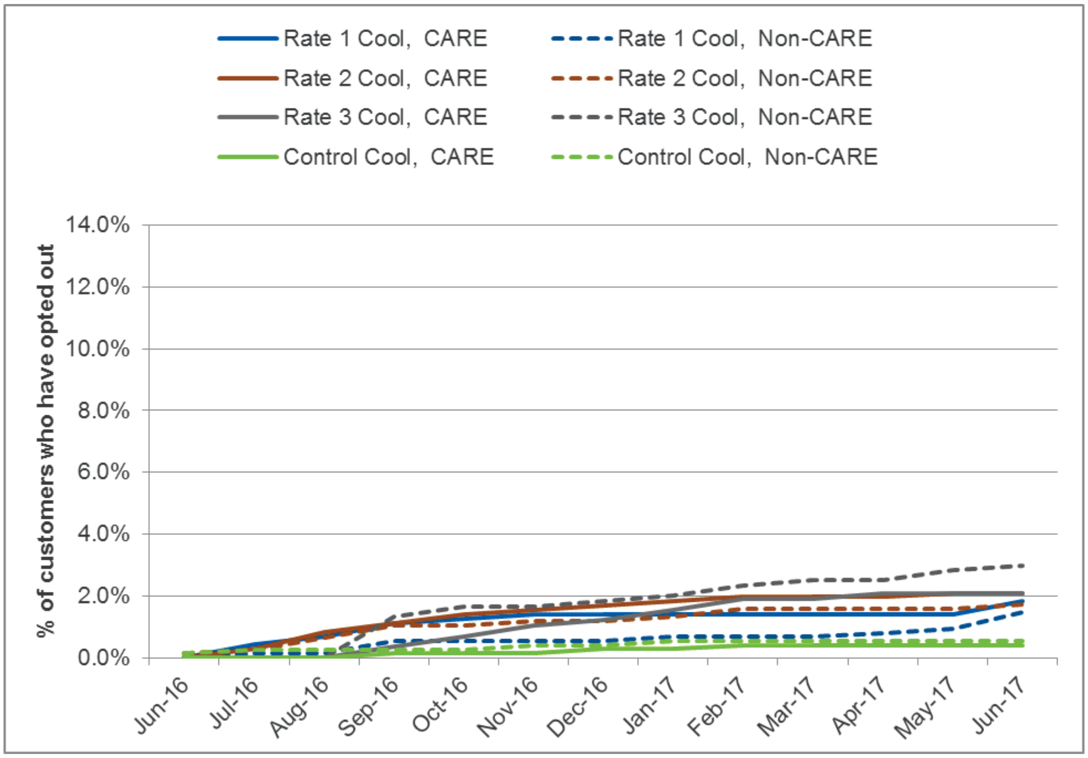


Figure 4.2-4 shows the cumulative percent of customers that opted out of each tariff for the CARE/FERA, non-CARE/FERA segments and for the total population across SCE's service territory as a whole. As seen, the cumulative percent of customers opting out was quite low for all rates and segments. The lowest cumulative percent opt out was for non-CARE/FERA customers on Rate 1 and the highest was for CARE/FERA customers on Rate 3. The opt-out percentage was highest for Rate 3 for both CARE/FERA and non-CARE/FERA customers and for the population as a whole. Recall that this is the rate with no baseline credit. The cumulative opt-out rate for each group showed a very rapid increase once bills began to be issued and the opt-out rates leveled off for Rate 1 and Rate 2. For all three rates, the cumulative opt out percentage over the entire period was only roughly 4.5%.

Figure 4.2-4: Cumulative Opt Outs by Rate and Customer Segment for the SCE Service Territory

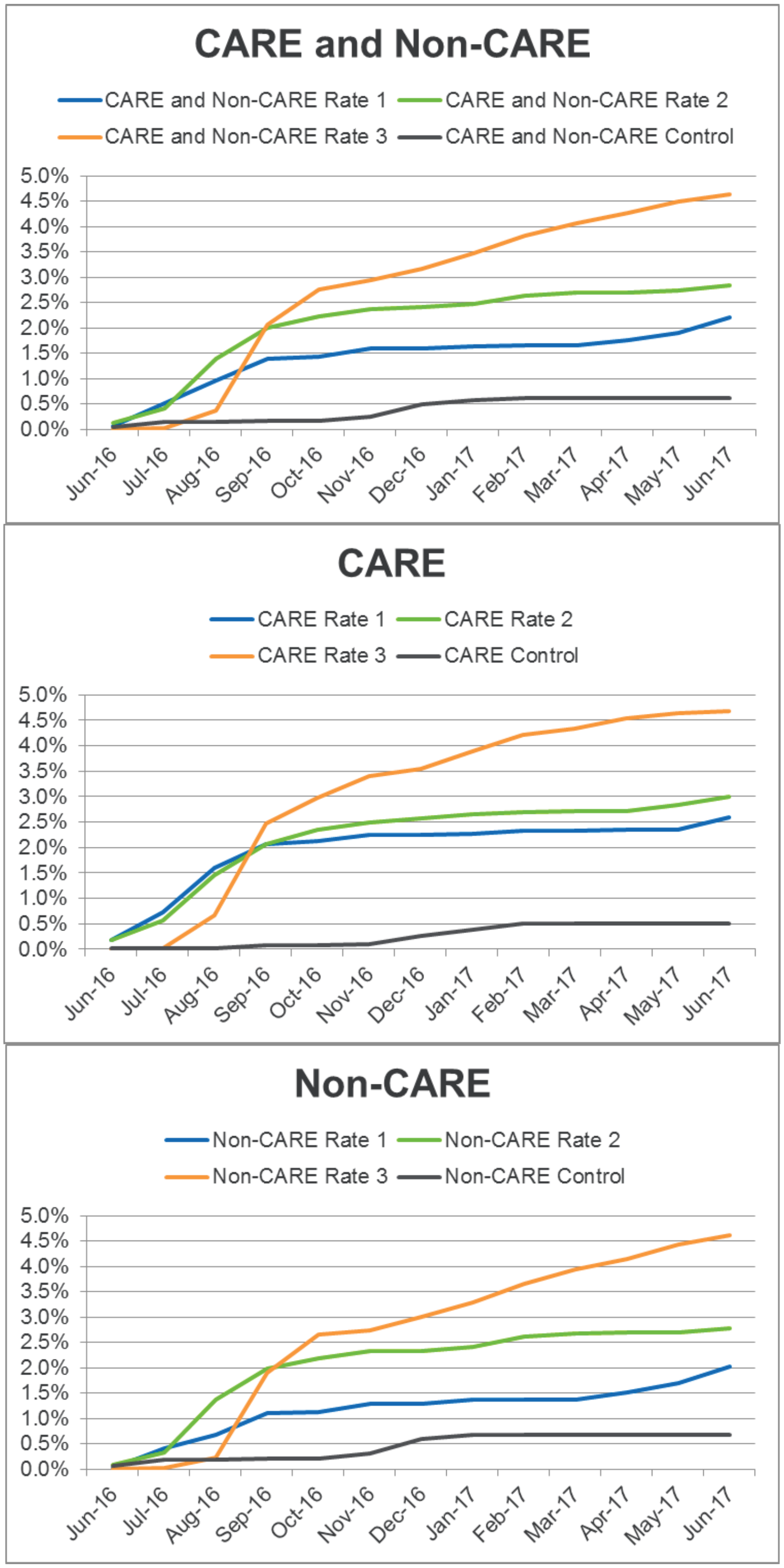


Figure 4.2-5 through Figure 4.2-7 show the overall attrition rate over time for each climate region, customer segment, and TOU rate. As seen in the figures, the cumulative attrition rate is quite constant over time in the moderate and cool climate regions, but not in the hot climate region. Much of the attrition among CARE/FERA Rate 3 customers in the hot climate region is attributable to opt-outs, and overall attrition rates for this group reached nearly 35% by the end of the first year of the pilot. Customers in the hot climate zone had a slight increase in attrition between March and April 2017 due to customers joining CCAs. Overall attrition rates are below 25% for the moderate climate region and below 20% for the cool climate region.

Figure 4.2-5: Cumulative SCE Attrition by Month – Hot Climate Region

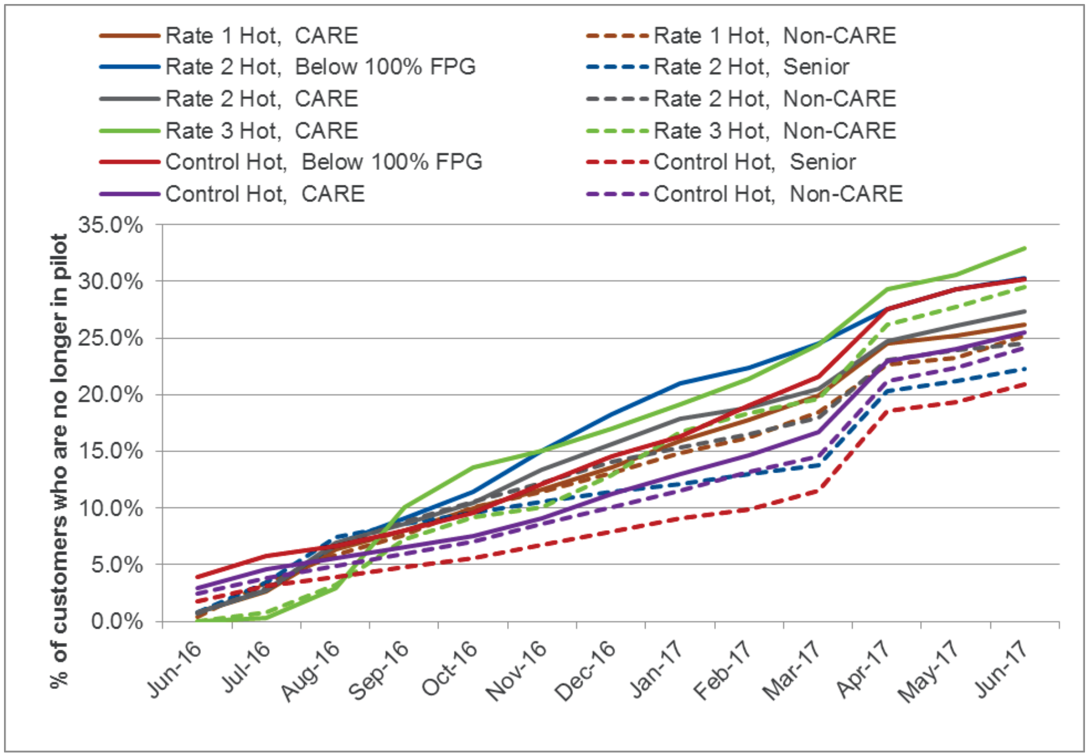


Figure 4.2-6: Cumulative SCE Attrition by Month – Moderate Climate Region

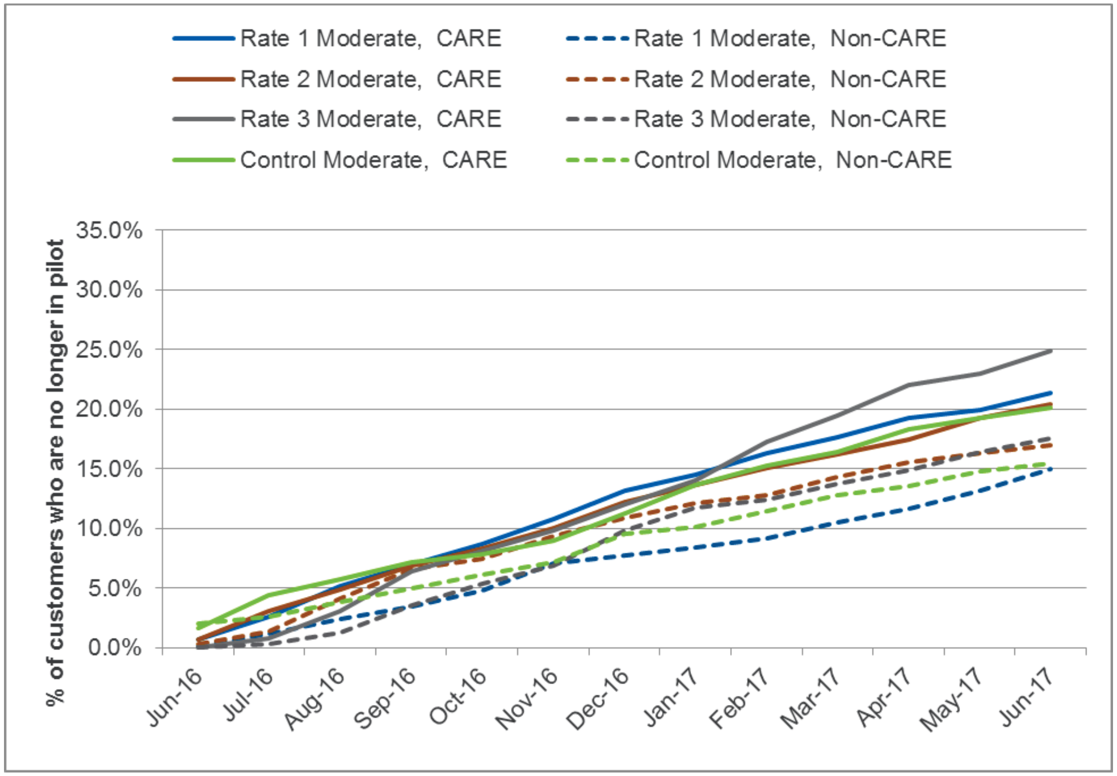
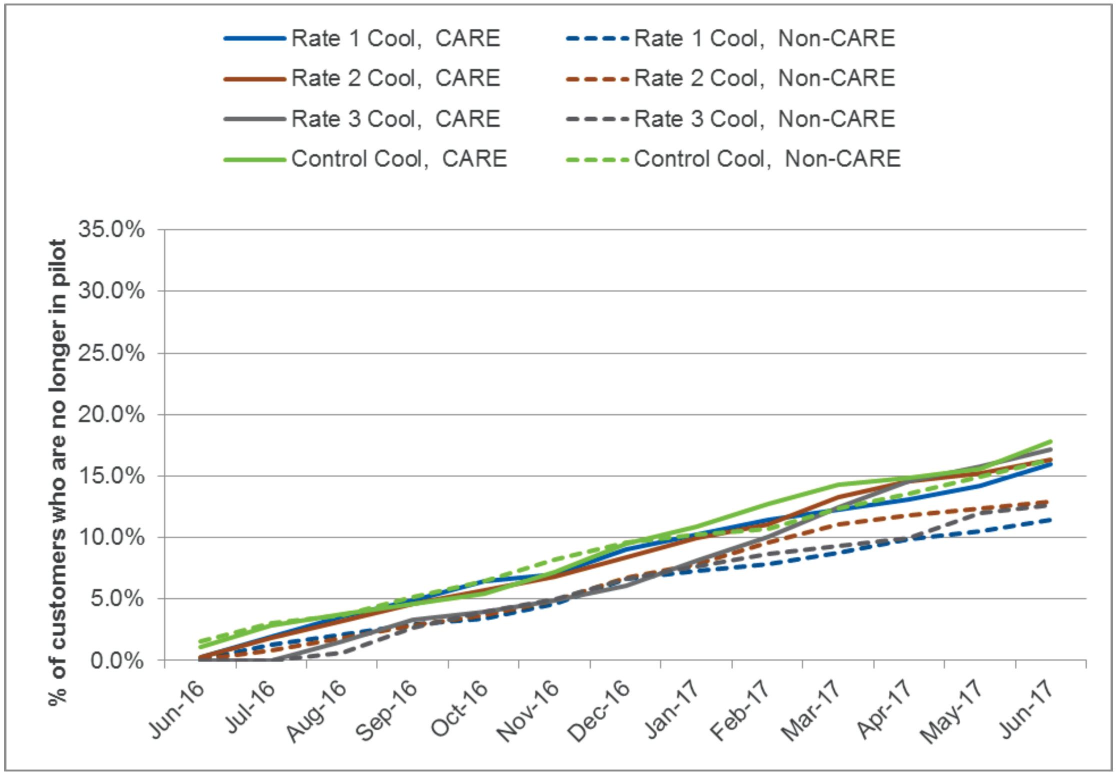


Figure 4.2-7: Cumulative SCE Attrition by Month – Cool Climate Region



4.3 Load Impacts

This section summarizes the load impact estimates for the three rate treatments tested by SCE. The CPUC resolution approving SCE's pilot requires that load impacts be estimated for the peak and off-peak periods and for daily energy use for the following rates, customer segments, and climate regions:

- Seniors, CARE/FERA customers, non-CARE/FERA customers and households with incomes below 100% of FPG in SCE's hot climate region for Rate 2;
- For all three rates for all customers in SCE's service territory as a whole and for all customers in SCE's hot and moderate climate regions; and
- For CARE/FERA and non-CARE/FERA customers on each rate across SCE's service territory as a whole.

In addition to these required segments, Nexant estimated load impacts for CARE/FERA and non-CARE/FERA customers for each rate for each climate region. Load impacts are reported here for each rate period for the average weekday, average weekend and for the average monthly peak day for the winter months of October through May for Rate 1 and Rate 2 and October through February for Rate 3 and for the spring months of March through May for Rate 3. Impacts are reported for each rate, climate zone and customer segment summarized above. Underlying the values presented in the report are electronic tables that contain estimates for each hour of the day for each day type, segment and climate zone and for each month separately. These values are contained in Excel spreadsheets that are available upon request through the CPUC.

Figure 4.3-1 shows an example of the content of these tables for SCE Rate 1 for all eligible customers in the service territory. Pull down menus in the upper left hand cover allow users to select different customer segments, climate regions, day types (e.g., weekdays, weekends, monthly peak day) and time period (individual months or the average of October through May).

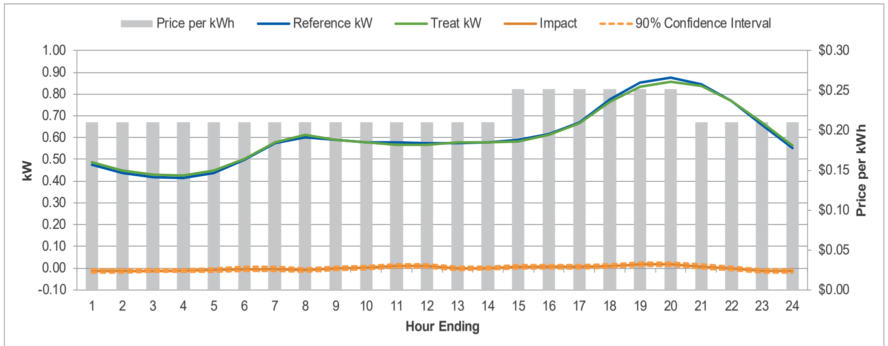
The remainder of this section is organized by rate treatment—load impacts are presented for each relevant customer segment and climate region for each of the three rates. Following the summary for each rate, load impacts are compared across rates. This comparison is made only for the hours within each peak period that are common across all three rates (5 to 8 PM) and during the overlapping winter period (October through February). Because the rates differ with respect to the length and timing of peak and off-peak periods, differences in load impacts across rates for any particular rate period may be due not only to differences in prices within the rate period but also due to differences in the length or timing of the rate periods.

As discussed in Section 5 in the First Interim Report, in addition to the three rate treatments, SCE also recruited customers who were known to have purchased and installed a smart thermostat. The objective of this treatment group was to estimate load impacts for smart thermostat owners on TOU rates. Those who enrolled were randomly assigned only to Rate 1 and to the control group. Load impacts for these customers are presented in Section 4.3.1.

Figure 4.3-1: Example of Content of Electronic Tables Underlying Load Impacts Summarized in this Report (SCE Rate 1, Average Winter Weekday, All Customers)

Segment	All
Rate	Rate 1
Month	Winter 2016 2017 - Rate 1 or 2
Day Type	Average Weekday
Treated Customers	3,997

Period	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval	
Super On Peak	N/A	N/A	N/A	N/A	N/A	N/A
Peak	0.73	0.72	0.01	1.4%	0.01	0.01
Mid Peak	N/A	N/A	N/A	N/A	N/A	N/A
Off Peak	0.64	0.63	0.00	0.4%	0.00	0.01
Super Off Peak	0.51	0.52	-0.01	-2.0%	-0.01	-0.01
Daily kWh	14.53	14.54	-0.02	-0.1%	-0.05	0.02



Hour Ending	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval		Price	Period
1	0.48	0.49	-0.01	-2.6%	-0.02	0.00	$0.21	Super Off Peak
2	0.44	0.45	-0.01	-2.6%	-0.02	0.00	$0.21	Super Off Peak
3	0.42	0.43	-0.01	-2.7%	-0.02	0.00	$0.21	Super Off Peak
4	0.42	0.43	-0.01	-2.7%	-0.02	0.00	$0.21	Super Off Peak
5	0.44	0.45	-0.01	-2.4%	-0.02	0.00	$0.21	Super Off Peak
6	0.50	0.50	0.00	-0.7%	-0.01	0.00	$0.21	Super Off Peak
7	0.57	0.58	0.00	-0.6%	-0.01	0.00	$0.21	Super Off Peak
8	0.60	0.61	-0.01	-1.7%	-0.02	0.00	$0.21	Super Off Peak
9	0.59	0.59	0.00	-0.3%	-0.01	0.01	$0.21	Off Peak
10	0.58	0.58	0.00	0.1%	-0.01	0.01	$0.21	Off Peak
11	0.58	0.57	0.01	1.6%	0.00	0.02	$0.21	Off Peak
12	0.57	0.57	0.01	1.5%	0.00	0.02	$0.21	Off Peak
13	0.58	0.58	0.00	-0.4%	-0.01	0.01	$0.21	Off Peak
14	0.58	0.58	0.00	0.0%	-0.01	0.01	$0.21	Off Peak
15	0.59	0.58	0.01	1.1%	0.00	0.01	$0.25	Peak
16	0.62	0.61	0.01	0.9%	0.00	0.01	$0.25	Peak
17	0.67	0.67	0.01	0.9%	0.00	0.01	$0.25	Peak
18	0.78	0.77	0.01	1.4%	0.00	0.02	$0.25	Peak
19	0.85	0.83	0.02	2.0%	0.01	0.03	$0.25	Peak
20	0.87	0.86	0.02	1.9%	0.01	0.02	$0.25	Peak
21	0.84	0.84	0.01	0.9%	0.00	0.02	$0.21	Off Peak
22	0.77	0.77	0.00	-0.2%	-0.01	0.01	$0.21	Off Peak
23	0.66	0.67	-0.01	-2.0%	-0.02	0.00	$0.21	Super Off Peak
24	0.55	0.56	-0.01	-2.4%	-0.02	0.00	$0.21	Super Off Peak
Daily kWh	**14.53**	**14.54**	**-0.02**	**-0.1%**	**-0.05**	**0.02**	**N/A**	**N/A**

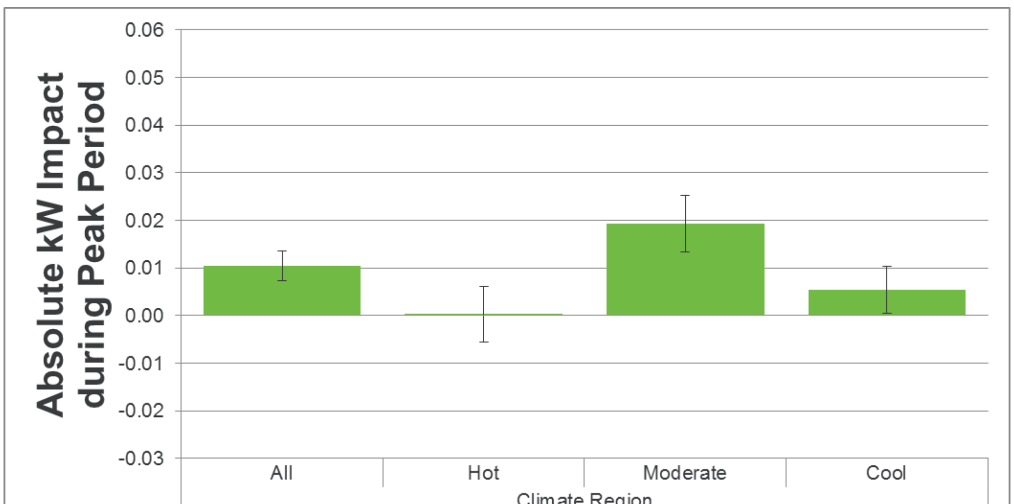
4.3.1 Rate 1

SCE's Rate 1 is a three-period rate on weekdays with a peak-period from 2 to 8 PM, an off-peak period from 9 AM to 2 PM and 8 PM to 10 PM and the remaining hours designated as super off peak. In winter, for electricity usage above the baseline quantity, prices equal roughly 27.5 ¢/kWh[37] in the peak period and 22.9 ¢/kWh in the off-peak period. Usage on the weekends is priced at the off-peak price all day. For usage below the baseline quantify, a credit of 9.9 ¢/kWh is applied.

Winter Load Impacts

Figure 4.3-2 shows the average peak period load reduction in absolute terms for Rate 1 for SCE's service territory as a whole and for each climate region. The lines bisecting the top of each bar in the figures show the 90% confidence band for each estimate. If the confidence band includes 0, it means that the estimated load impacts are not statistically different from 0 at the 90% level of confidence. If the confidence bands for two bars do not overlap, it means that the observed difference in the load impacts is statistically significant. If they do overlap, it does not necessarily mean that the difference is not statistically significant.[38] In these cases, t-tests were calculated to determine whether the difference is statistically significant.[39]

Figure 4.3-2: Average Load Impacts for Peak Period for SCE Rate 1[40]
(Positive values represent load reductions)



	All	Hot	Moderate	Cool
Percent Impact	1.4%	0.0%	2.5%	0.8%
kW Impact	0.01	0.00	0.02	0.01

[37] Prices reflect tariffs in effect at the launch of the pilot through the end of December 2016. As indicated above and shown in Appendix B, rates changed on January 1, 2017.

[38] For further discussion of this topic, see https://www.cscu.cornell.edu/news/statnews/stnews73.pdf.

[39] The test was applied at the 90% confidence level which means that a t-value exceeding 1.65 indicates statistical significance.

[40] SCE Rate 1 winter impacts represent October 2016 through May 2017.

As seen in the figure, the average peak-period load impacts for the service territory as a whole and for the cool and moderate climate regions are statistically significant at the 90% level of confidence. On average, pilot participants across SCE's service territory on Rate 1 reduced peak-period electricity use by 1.4%, or 0.01 kW, across the six-hour peak period from 2 to 8 PM. The average peak-period load reduction ranges from a high of 2.5% and 0.02 kW in the moderate climate region to a low of 0.0% and 0.00 kW in the hot climate region. In other words, customers in the hot climate region did not make significant changes in their energy use during the peak period. In the cool climate region, the load reduction equals 0.8% or 0.01 kW.

There is a very significant difference in the pattern of load reductions across climate regions in SCE's service territory compared with PG&E's service territory. This was also true in the summer period as reported in the First Interim Report. As discussed in Section 3.3, both the percentage and absolute impacts are significantly greater for customers in PG&E's hot climate region than in the moderate and cool regions for Rate 1 and Rate 3. SCE's peak period load reductions in the hot region are not significant, while PG&E's reduction equals 4.4% for Rate 1. The difference in absolute impacts between the moderate and cool regions is also large and statistically significant. In many cases, SCE's hottest climate regions in the summer are also the coldest in the winter.

Table 4.3-1 shows the average percent and absolute load impacts for each rate period for weekdays and weekends and for the average monthly system peak day for the SCE service territory as a whole and for the participant population in each climate region. The percent reduction equals the load impact in absolute terms (kW) divided by the reference load. Shaded cells in the table contain load impact estimates that are not statistically significant at the 90% confidence level. The percentage and absolute values in the first row of Table 4.3-1, which represent the load impacts in the peak period on the average weekday, equal the values shown in Figure 4.3-2, discussed above.

The reference loads shown in Table 4.3-1 represent estimates of what customers on the TOU rate would have used if they had not responded to the price signals contained in the TOU tariff. As seen in the table, average hourly usage during the peak period is roughly 0.73 kW for the service territory as a whole, and around 0.61 kW over the 24 hour average weekday. In the hot climate region, average usage in the peak period is slightly larger at 0.85 kW. Average usage in the moderate climate region is 0.77 kW and in the cool region it is 0.67 kW.

As discussed in Section 3.3.1, when examining the change in usage across rate periods, it is important to keep in mind that a change in any period could be the result of an overall decrease or increase in end-use consumption or due to shifting usage from one rate period to another (or both). As seen in Table 4.3-1, on the average weekday, there were small but statistically significant load increases in the super off-peak period in the service territory as a whole and in the individual climate regions. The moderate climate region saw statistically significant demand reductions in the off-peak period during all three day types.

A reduction in daily electricity use (depicted by positive values in the row labeled Day in the table) means that the combination of changes in use across all rate periods resulted in less electricity use for the day as a whole. As seen in Table 4.3-1, for the service territory as a whole, there was an insignificant increase in daily electricity use on the average weekday. In the moderate climate region, the conservation effect was 0.7% on the average weekday. However, loads increased overall in the hot and cool climate regions.

The monthly system peak day estimates represent the average across the eight weekdays, one in each winter month, when SCE's system peaked in 2016 and 2017. Peak period reference loads are higher on these days than on the average weekday, although differences in daily reference loads across average weekdays and system peak days are small. For the service territory as a whole, the percent reduction in peak period loads, 2.1%, is greater than that on the average weekday (1.4%) and the absolute load reduction, 0.02, kW is greater than on the average weekday (0.01 kW). Customers had small but statistically significant daily usage increases on the average weekend, most of which was concentrated in the super off-peak period. During this period, customers increased their usage by 2.1% or 0.01 kWh.

Table 4.3-1: Rate 1 Load Impacts by Period and Day Type *
(Positive values represent load reductions, negative values represent load increases)

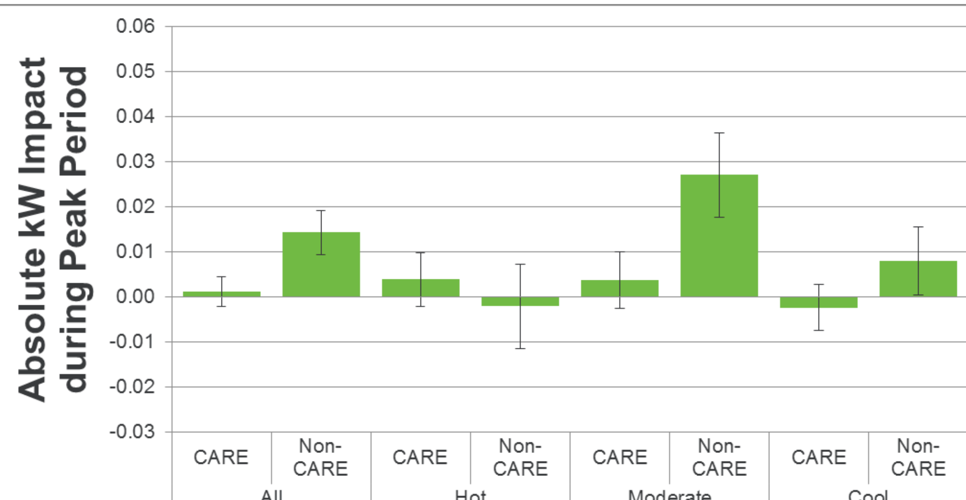
Day Type	Period	Hours	Rate 1 All Ref. kW	All Impact kW	All % Impact	Hot Ref. kW	Hot Impact kW	Hot % Impact	Moderate Ref. kW	Moderate Impact kW	Moderate % Impact	Cool Ref. kW	Cool Impact kW	Cool % Impact
Average Weekday	Peak	2 PM to 8 PM	0.73	0.01	1.4%	0.85	0.00	0.0%	0.77	0.02	2.5%	0.67	0.01	0.8%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	0.64	0.00	0.4%	0.72	-0.01	-1.6%	0.66	0.01	1.1%	0.59	0.00	0.3%
	Super Off Peak	10 PM to 8 AM	0.51	-0.01	-2.0%	0.57	-0.02	-3.3%	0.54	-0.01	-1.2%	0.46	-0.01	-2.3%
	Day	All Hours	0.61	0.00	-0.1%	0.69	-0.01	-1.7%	0.64	0.00	0.7%	0.56	0.00	-0.5%
Average Weekend	Off Peak	8 AM to 10 PM	0.74	0.00	0.5%	0.83	-0.01	-1.2%	0.77	0.01	1.4%	0.68	0.00	0.1%
	Super Off Peak	10 PM to 8 AM	0.50	-0.01	-2.1%	0.57	-0.02	-3.2%	0.54	-0.01	-1.8%	0.46	-0.01	-2.0%
	Day	All Hours	0.64	0.00	-0.3%	0.72	-0.01	-1.9%	0.68	0.00	0.4%	0.59	0.00	-0.6%
Monthly System Peak Day	Peak	2 PM to 8 PM	0.88	0.02	2.1%	0.97	-0.01	-1.1%	0.98	0.03	3.1%	0.77	0.02	2.0%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	0.70	0.01	1.2%	0.78	-0.01	-1.8%	0.75	0.01	1.7%	0.64	0.01	1.6%
	Super Off Peak	10 PM to 8 AM	0.52	-0.01	-1.6%	0.58	-0.02	-3.6%	0.56	0.00	-0.3%	0.47	-0.01	-2.3%
	Day	All Hours	0.67	0.00	0.6%	0.74	-0.02	-2.2%	0.72	0.01	1.6%	0.60	0.00	0.4%

* A shaded cell indicates estimate is not statistically significant

Figure 4.3-3 shows the absolute peak period load impacts for Rate 1 for CARE/FERA and non-CARE/FERA customers for the service territory as a whole and for each climate region. In the moderate and cool climate regions, and the service territory as a whole, both the percent and absolute load impacts in the peak period are greater for non-CARE/FERA customers than for CARE/FERA customers. For example, in the cool climate region, the average weekday peak period reduction is 1.1% and 0.01 kW for non-CARE/FERA customers whereas for CARE/FERA customers, there is no statistically significant change in peak period electricity use. Load reductions in the hot climate region do not follow the same pattern and are not statistically significant for either segment. Once again, this finding is quite different from what was seen in PG&E's service territory, where the contrast in load reductions between CARE/FERA and non-CARE/FERA customers was greatest in the hot and cool climate regions.

Figure 4.3-3: Average Load Impacts for Peak Period for SCE Rate 1 for CARE/FERA and non-CARE/FERA Customers

(Positive values represent load reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	0.2%	1.9%	0.5%	-0.2%	0.6%	3.3%	-0.4%	1.1%
Absolute Impact	0.00	0.01	0.00	0.00	0.00	0.03	0.00	0.01

Table 4.3-2 shows the estimated load impacts for each rate period and day type by climate zone and for the service territory as a whole for non-CARE/FERA customers and Table 4.3-3 shows the estimated values for CARE/FERA customers. For the service territory as a whole, non-CARE/FERA customers have average peak period loads that are larger than CARE/FERA customers (0.78 kW for non-CARE/FERA and 0.62 kW for CARE/FERA). This pattern is consistent across all three climate regions and for daily electricity usage on average summer weekdays.

For the service territory as a whole, CARE/FERA customers increased average daily usage on weekdays by 1.3% or 0.01 kW, whereas non-CARE/FERA customers showed no statistically significant change. On the monthly system peak days, non-CARE/FERA customers reduced electricity use by 1.1%, but CARE/FERA increased their overall usage by 1.0%. CARE/FERA customers in the cool climate region increased their daily demand on all three day types.

Table 4.3-2: Rate 1 Load Impacts by Rate Period and Day Type – Non-CARE/FERA Customers*
(Positive values represent load reductions, negative values represent load increases

Rate 1														
Day Type	Period	Hours	All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	2 PM to 8 PM	0.78	0.01	1.9%	0.91	0.00	-0.2%	0.83	0.03	3.3%	0.71	0.01	1.1%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	0.68	0.01	0.9%	0.79	-0.02	-2.0%	0.73	0.01	2.0%	0.63	0.00	0.7%
	Super Off Peak	10 PM to 8 AM	0.54	-0.01	-1.7%	0.61	-0.03	-4.4%	0.58	0.00	-0.3%	0.49	-0.01	-2.2%
	Day	All Hours	0.65	0.00	0.3%	0.74	-0.02	-2.3%	0.69	0.01	1.6%	0.59	0.00	-0.2%
Average Weekend	Off Peak	8 AM to 10 PM	0.80	0.01	0.7%	0.91	-0.02	-1.7%	0.85	0.02	1.9%	0.73	0.00	0.4%
	Super Off Peak	10 PM to 8 AM	0.53	-0.01	-1.8%	0.61	-0.03	-4.5%	0.58	-0.01	-1.3%	0.48	-0.01	-1.5%
	Day	All Hours	0.69	0.00	-0.1%	0.78	-0.02	-2.6%	0.73	0.01	0.8%	0.63	0.00	-0.2%
Monthly System Peak Day	Peak	2 PM to 8 PM	0.93	0.02	2.2%	1.04	-0.02	-1.7%	1.06	0.03	3.3%	0.82	0.02	2.1%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	0.75	0.01	1.9%	0.85	-0.02	-2.0%	0.81	0.02	2.8%	0.68	0.01	2.1%
	Super Off Peak	10 PM to 8 AM	0.55	0.00	-0.8%	0.62	-0.03	-4.9%	0.60	0.01	1.4%	0.50	-0.01	-1.9%
	Day	All Hours	0.71	0.01	1.1%	0.80	-0.02	-2.8%	0.79	0.02	2.5%	0.64	0.01	0.8%

* A shaded cell indicates estimate is not statistically significant

Table 4.3-3: Rate 1 Load Impacts by Rate Period and Day Type – CARE/FERA Customers*
(Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 1											
			All, CARE			Hot, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	2 PM to 8 PM	0.62	0.00	0.2%	0.74	0.00	0.5%	0.65	0.00	0.6%	0.55	0.00	-0.4%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	0.53	-0.01	-1.1%	0.62	0.00	-0.6%	0.54	-0.01	-1.2%	0.48	-0.01	-1.1%
	Super Off Peak	10 PM to 8 AM	0.44	-0.01	-2.8%	0.51	-0.01	-1.4%	0.45	-0.02	-3.5%	0.39	-0.01	-2.7%
	Day	All Hours	0.51	-0.01	-1.3%	0.60	0.00	-0.5%	0.53	-0.01	-1.5%	0.46	-0.01	-1.5%
Average Weekend	Off Peak	8 AM to 10 PM	0.61	0.00	-0.2%	0.71	0.00	-0.2%	0.63	0.00	0.3%	0.54	0.00	-0.8%
	Super Off Peak	10 PM to 8 AM	0.44	-0.01	-2.9%	0.51	0.00	-0.6%	0.46	-0.01	-3.1%	0.39	-0.01	-3.7%
	Day	All Hours	0.54	-0.01	-1.1%	0.63	0.00	-0.3%	0.56	0.00	-0.9%	0.48	-0.01	-1.8%
Monthly System Peak Day	Peak	2 PM to 8 PM	0.74	0.01	1.9%	0.85	0.00	0.0%	0.82	0.02	2.8%	0.63	0.01	1.6%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	0.58	-0.01	-0.9%	0.67	-0.01	-1.4%	0.61	-0.01	-1.0%	0.51	0.00	-0.4%
	Super Off Peak	10 PM to 8 AM	0.44	-0.02	-4.0%	0.52	-0.01	-1.3%	0.46	-0.02	-4.9%	0.40	-0.02	-4.0%
	Day	All Hours	0.56	-0.01	-1.0%	0.65	-0.01	-0.9%	0.60	-0.01	-1.0%	0.49	0.00	-1.0%

* A shaded cell indicates estimate is not statistically significant

Table 4.3-4 shows the estimated load impacts for smart thermostat customers who were enrolled on Rate 1. As a reminder, these load reductions represent the total reduction for customers who had previously purchased smart thermostats and are on Rate 1 relative to a control group of smart thermostat owners who are on the OAT. The impacts are not the incremental load impact of a smart thermostat for customers on a TOU rate relative to customers on a TOU rate who do not have a smart thermostat. These customers are distributed throughout the service territory and the vast majority are non-CARE/FERA customers. The average weekday peak-period reference load for these households (1.03 kW) is more than 40% higher than the average for households in the service territory as a whole (0.73 kW). The average load reduction for smart thermostat households during the peak period, 4.7% or 0.05 kW, was much larger than the average for all households in the service territory (1.4% or 0.01 kW). This result is in contrast to what was found in the first summer, as reported in the First Interim Report, where smart thermostat households had reductions similar to those of the general population. Smart thermostat households reduced average daily use by 2.7%, or 0.02 kW, and had comparable reductions in daily usage on weekends. Peak period load reductions on the monthly system peak day were less than half the size of the impacts on weekends and weekdays and were not statistically significant.

Table 4.3-4: Rate 1 Load Impacts by Rate Period and Day Type – Technology Customers*
(Positive values represent load reductions, negative values represent load increases)

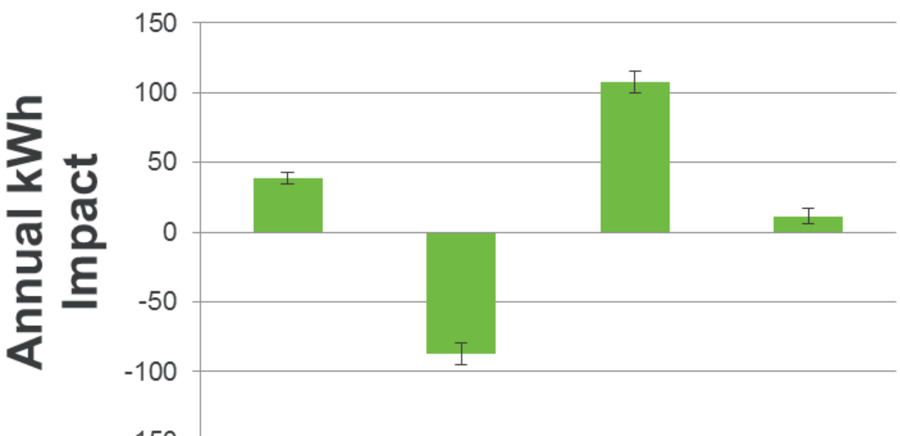
Day Type	Period	Hours	Technology		
			Ref. kW	Impact kW	% Impact
Average Weekday	Peak	2 PM to 8 PM	1.03	0.05	4.7%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	0.87	0.02	2.5%
	Super Off Peak	10 PM to 8 AM	0.69	0.01	1.0%
	Day	All Hours	0.84	0.02	2.7%
Average Weekend	Off Peak	8 AM to 10 PM	1.03	0.04	3.7%
	Super Off Peak	10 PM to 8 AM	0.69	0.01	1.6%
	Day	All Hours	0.89	0.03	3.0%
Monthly System Peak Day	Peak	2 PM to 8 PM	1.30	0.02	1.5%
	Off Peak	8 AM to 2 PM, 8 PM to 10 PM	0.97	0.03	3.0%
	Super Off Peak	10 PM to 8 AM	0.71	0.00	0.0%
	Day	All Hours	0.95	0.01	1.5%

* A shaded cell indicates estimate is not statistically significant

Annual Conservation Effect

Figure 4.3-4 shows the annual conservation effect for customers on SCE's Rate 1. The impacts here are quite different from those for PG&E. Most notably, customers in PG&E's hot climate region saved the most energy during the first year of the pilot. In contrast, customers in SCE's hot climate region had a statistically significant increase in daily electricity use of 1.1%. This group had the largest energy usage increase in SCE's service territory. Customers in the moderate climate region saw the greatest conservation effect of 107.6 kWh, or about 1.6%. Overall, customers in SCE's service territory saved about 0.6% or 38.7 kWh per customer over the course of the year.

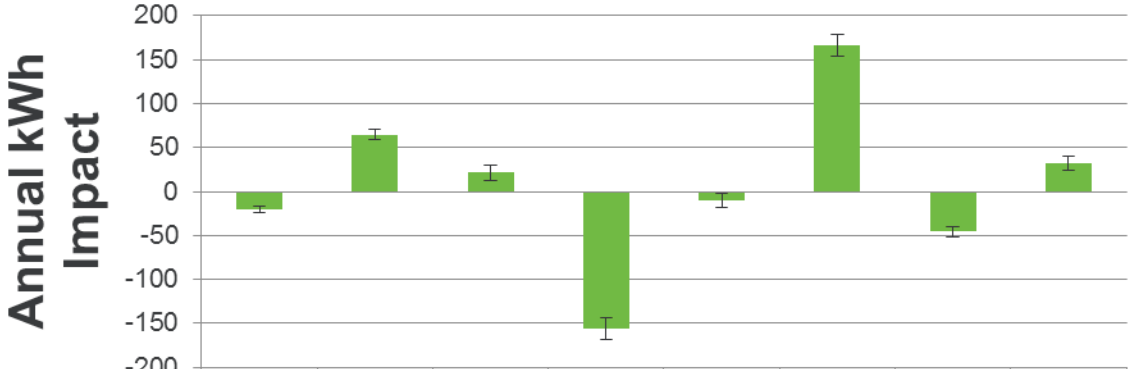
Figure 4.3-4: Average Annual Conservation Effect for SCE Rate 1 (Positive values represent usage reductions)



	All	Hot	Moderate	Cool
Percent Impact	0.6%	-1.1%	1.6%	0.2%
kWh Impact	38.7	-87.5	107.6	11.6

Figure 4.3-5 shows the annual conservation effect for CARE/FERA and non-CARE/FERA customers. The difference between customer segments is not consistent across climate regions. Non-CARE/FERA customers in the moderate climate region saved the most energy, about 2.2% or 166.4 kWh during the first year of the pilot. This is not surprising, as this group had the greatest winter peak period impacts and was the only segment to save energy on the average winter weekday. CARE/FERA customers in the moderate and cool climate regions and non-CARE/FERA customers in the hot climate region increased their electricity use over the course of the year.

Figure 4.3-5: Average Annual Conservation Effect for SCE Rate 1 for CARE/FERA and Non-CARE/FERA Customers
(Positive values represent usage reductions)



	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	-0.4%	1.0%	0.3%	-1.8%	-0.2%	2.2%	-1.1%	0.6%
kWh Impact	-20.4	64.8	21.7	-155.9	-10.1	166.4	-45.8	32.4

4.3.2 Rate 2

SCE's Rate 2 like Rate 1, is a three-period rate in the winter on weekdays. The primary difference between Rate 1 and Rate 2 is that Rate 2 has a much shorter peak period, from 5 to 8 PM (and corresponding longer shoulder period) compared with six hour peak period for Rate 1. The Rate 2 peak period price is 27.9 ¢/kWh, which is similar to Rate 1 peak price of 27.5 ¢/kWh.[41] The super off-peak period, which is in effect on weekends and weekdays, has a price of 17.4 ¢/kWh and covers the hours from 10 PM to 8 AM. For usage below the baseline quantify, a credit of 9.9 ¢/kWh is applied in both cases.

Winter Load Impacts

Figure 4.3-6 shows the percent and absolute load impacts for the weekday peak period for Rate 2 for SCE's service territory as a whole and for each climate region. Percent and absolute impacts for the service territory as a whole, 2.0% and 0.02 kW, are greater than those for Rate 1 (1.4% and 0.01 kW). The average weekday peak-period load reduction for customers in the hot climate region on Rate 2, 1.4% and 0.01 kW, are very different from the impacts for Rate 1, which were not statistically significant. Customers in the moderate and cool climate regions reduced their electricity usage by about the same amount as their counterparts on Rate 1.

[41] Prices reflect tariffs in effect at the launch of the pilot through the end of December 2016. As indicated above and shown in Appendix B, rates changed on January 1, 2017.

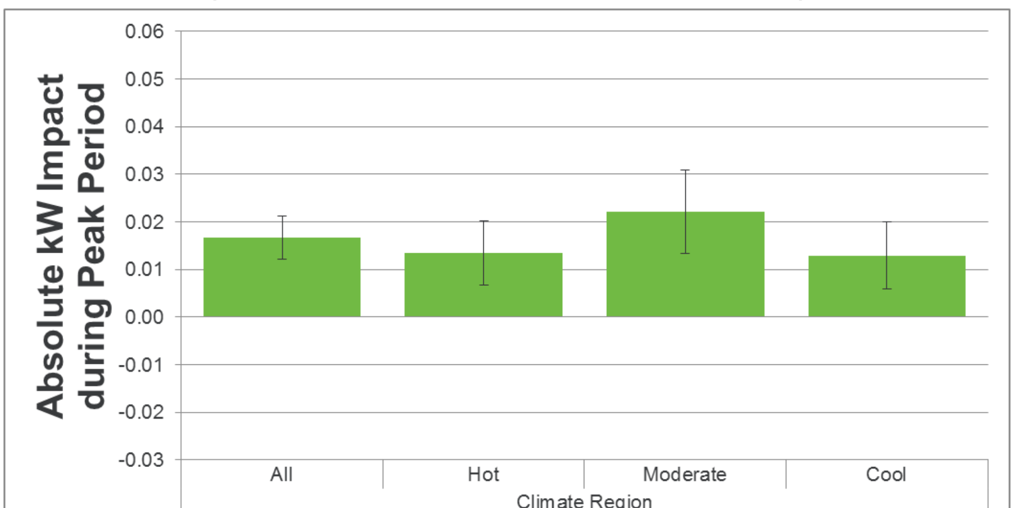
Looking at the pattern of load impacts across climate regions for customers on Rate 2, the difference in impacts between the hot and moderate regions is not statistically significant. None of the other pairwise comparisons are statistically different either.

Table 4.3-5 contains load impact estimates for each rate period and day type for Rate 2. For the service territory as a whole, daily electricity usage was similar on average winter weekdays and weekends, 0.61 kW and 0.64 kW. Reductions in daily electricity use were also quite similar on weekdays and weekends, although quite small in both percentage and absolute terms. Electricity use and impacts were the largest on monthly system peak days, with load reductions of about 3.3% or 0.03 kW.

When the daily reduction in electricity use for Rate 2 is spread over 24 hours each day, the average reduction in electricity use on weekdays equals roughly 0.06 kWh. Over eight months, this adds up to about 15 kWh per customer. This is slightly less than the PG&E estimate of roughly 17 kWh per household for the winter season for its Rate 1. If this average conservation effect was provided under default conditions and, say, 90% of the eligible population of roughly 3.3 million customers in SCE's service territory remained on the rate, the total reduction in electricity use over the eight month period would equal more than 48 GWh.

Customers in every climate region provided statistically significant peak and off-peak demand reductions for Rate 2 during all three day types. Customers in each climate region increased their electricity use during the super off-peak period on weekdays and weekends, which could indicate load shifting or increased consumption of selected end uses during the lower priced period.

Figure 4.3-6: Average Load Impacts for Peak Period for SCE Rate 2[42]
(Positive values represent load reductions)



	All	Hot	Moderate	Cool
Percent Impact	2.0%	1.4%	2.5%	1.7%
kW Impact	0.02	0.01	0.02	0.01

[42] SCE Rate 2 winter impacts represent October 2016 through May 2017.

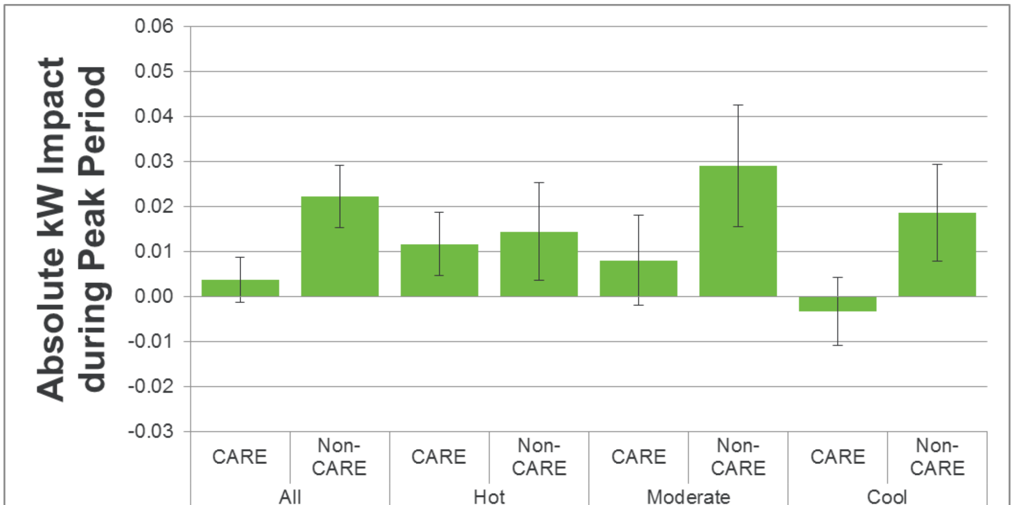
Table 4.3-5: Rate 2 Load Impacts by Rate Period and Day Type*
(Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 2											
			All			Hot			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	5 PM to 8 PM	0.83	0.02	2.0%	0.93	0.01	1.4%	0.87	0.02	2.5%	0.78	0.01	1.7%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	0.63	0.01	1.5%	0.73	0.01	1.7%	0.67	0.01	2.2%	0.58	0.00	0.7%
	Super Off Peak	10 PM to 8 AM	0.51	-0.01	-1.8%	0.57	-0.01	-1.7%	0.54	-0.01	-2.4%	0.46	-0.01	-1.2%
	Day	All Hours	0.61	0.00	0.4%	0.69	0.00	0.5%	0.64	0.00	0.6%	0.56	0.00	0.2%
Average Weekend	Off Peak	8 AM to 10 PM	0.74	0.01	1.6%	0.83	0.01	1.6%	0.77	0.02	2.2%	0.68	0.01	1.1%
	Super Off Peak	10 PM to 8 AM	0.50	-0.01	-2.0%	0.57	-0.01	-1.8%	0.54	-0.01	-2.4%	0.46	-0.01	-1.7%
	Day	All Hours	0.64	0.00	0.4%	0.72	0.00	0.5%	0.68	0.00	0.6%	0.59	0.00	0.2%
Monthly System Peak Day	Peak	5 PM to 8 PM	0.97	0.03	3.3%	1.04	0.02	1.7%	1.06	0.03	3.2%	0.87	0.03	4.0%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	0.72	0.02	2.3%	0.81	0.01	0.9%	0.79	0.02	2.8%	0.64	0.01	2.1%
	Super Off Peak	10 PM to 8 AM	0.52	-0.01	-1.1%	0.58	-0.01	-2.1%	0.56	-0.01	-1.6%	0.47	0.00	-0.3%
	Day	All Hours	0.67	0.01	1.4%	0.74	0.00	0.1%	0.72	0.01	1.5%	0.60	0.01	1.7%

* A shaded cell indicates estimate is not statistically significant

Figure 4.3-7 shows the estimated peak period load impacts for Rate 2 for CARE/FERA and non-CARE/FERA households for the service territory as a whole and for each climate region. Except in the hot climate region, there were significant differences in load reductions between CARE/FERA and non-CARE/FERA customers. In the moderate climate region, non-CARE/FERA customers had the greatest reduction in peak-period energy use at 3.1% and 0.03 kW.

Figure 4.3-7: Average Load Impacts for Peak Period for SCE Rate 2 for CARE/FERA and non-CARE/FERA Customers
(Positive values represent load reductions)



	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
	All		Hot		Moderate		Cool	
Percent Impact	0.6%	2.5%	1.4%	1.5%	1.1%	3.1%	-0.5%	2.2%
Absolute Impact	0.00	0.02	0.01	0.01	0.01	0.03	0.00	0.02

Table 4.3-6 and Table 4.3-7show the load impacts for non-CARE/FERA and CARE/FERA customers, respectively, for each rate period and day-type. Once again, the values in the first row of each table are the same as those found in Figure 4.3-7. For the service territory as a whole, non-CARE/FERA customers have higher peak period usage, 0.89 kW, than CARE/FERA customers, 0.70 kW. Daily consumption is also greater for non-CARE/FERA customers than for CARE/FERA customers on Rate 2. Only the non-CARE/FERA group was able to reduce their average daily energy use by about 0.7% or more on weekends and weekdays. At the service territory level, both groups increased usage during the super off-peak period.

Table 4.3-6: Rate 2 Load Impacts by Rate Period and Day Type – Non-CARE/FERA Customers*
(Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 2											
			All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	5 PM to 8 PM	0.89	0.02	2.5%	1.00	0.01	1.5%	0.95	0.03	3.1%	0.83	0.02	2.2%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	0.68	0.01	2.0%	0.80	0.02	2.1%	0.72	0.02	2.6%	0.62	0.01	1.5%
	Super Off Peak	10 PM to 8 AM	0.54	-0.01	-1.8%	0.61	-0.02	-2.5%	0.58	-0.02	-3.0%	0.49	0.00	-0.5%
	Day	All Hours	0.65	0.01	0.8%	0.74	0.00	0.4%	0.69	0.00	0.7%	0.59	0.01	1.0%
Average Weekend	Off Peak	8 AM to 10 PM	0.80	0.02	2.0%	0.91	0.02	1.8%	0.85	0.02	2.4%	0.73	0.01	1.8%
	Super Off Peak	10 PM to 8 AM	0.53	-0.01	-2.0%	0.61	-0.02	-2.6%	0.58	-0.02	-3.2%	0.48	0.00	-0.8%
	Day	All Hours	0.69	0.00	0.7%	0.78	0.00	0.4%	0.73	0.00	0.5%	0.63	0.01	0.9%
Monthly System Peak Day	Peak	5 PM to 8 PM	1.04	0.04	3.6%	1.11	0.02	2.1%	1.16	0.04	3.1%	0.93	0.04	4.5%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	0.77	0.02	2.9%	0.88	0.01	1.0%	0.85	0.02	2.9%	0.69	0.02	3.3%
	Super Off Peak	10 PM to 8 AM	0.55	0.00	-0.5%	0.62	-0.02	-3.6%	0.60	-0.01	-1.1%	0.50	0.00	0.8%
	Day	All Hours	0.71	0.01	1.9%	0.80	0.00	-0.3%	0.79	0.01	1.7%	0.64	0.02	2.7%

* A shaded cell indicates estimate is not statistically significant

Table 4.3-7: Rate 2 Load Impacts by Rate Period and Day Type – CARE/FERA Customers*
(Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	All, CARE Ref. kW	All, CARE Impact kW	All, CARE % Impact	Hot, CARE Ref. kW	Hot, CARE Impact kW	Hot, CARE % Impact	Moderate, CARE Ref. kW	Moderate, CARE Impact kW	Moderate, CARE % Impact	Cool, CARE Ref. kW	Cool, CARE Impact kW	Cool, CARE % Impact
Average Weekday	Peak	5 PM to 8 PM	0.70	0.00	0.6%	0.82	0.01	1.4%	0.72	0.01	1.1%	0.63	0.00	-0.5%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	0.53	0.00	-0.1%	0.63	0.01	1.0%	0.55	0.01	1.3%	0.47	-0.01	-2.3%
	Super Off Peak	10 PM to 8 AM	0.44	-0.01	-1.9%	0.51	0.00	-0.2%	0.45	0.00	-0.9%	0.39	-0.01	-3.8%
	Day	All Hours	0.51	0.00	-0.6%	0.60	0.00	0.6%	0.53	0.00	0.5%	0.46	-0.01	-2.5%
Average Weekend	Off Peak	8 AM to 10 PM	0.61	0.00	0.4%	0.71	0.01	1.3%	0.63	0.01	1.7%	0.54	-0.01	-1.5%
	Super Off Peak	10 PM to 8 AM	0.44	-0.01	-2.0%	0.51	0.00	-0.3%	0.46	0.00	-0.5%	0.39	-0.02	-4.7%
	Day	All Hours	0.54	0.00	-0.4%	0.63	0.00	0.8%	0.56	0.01	0.9%	0.48	-0.01	-2.5%
Monthly System Peak Day	Peak	5 PM to 8 PM	0.81	0.02	2.5%	0.91	0.01	0.7%	0.87	0.03	3.3%	0.70	0.02	2.2%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	0.61	0.00	0.6%	0.70	0.01	0.8%	0.65	0.02	2.6%	0.52	-0.01	-2.0%
	Super Off Peak	10 PM to 8 AM	0.44	-0.01	-2.7%	0.52	0.00	0.6%	0.46	-0.01	-2.8%	0.40	-0.02	-4.1%
	Day	All Hours	0.56	0.00	-0.2%	0.65	0.00	0.7%	0.60	0.01	1.0%	0.49	-0.01	-2.0%

* A shaded cell indicates estimate is not statistically significant

Figure 4.3-8 shows the load impacts in absolute terms for senior households and households with incomes below 100% of FPG. Table 4.3-8 shows the estimated values for other rate periods and day types for each segment.

The reduction in peak-period electricity use was greater for customers with incomes below 100% FPG (2.7% or 0.02 kW) than they were for senior households (1.1% or 0.01 kW), although the difference was not statistically significant. Load impacts for senior households were similar to those for the hot climate region population as a whole, 1.4% or 0.01 kW. It is worth noting in Table 4.3-8 that senior households had average peak period usage of 0.91 kW, which is nearly identical to the average usage for the population as a whole in the hot climate region (0.93 kW as seen in Table 4.3-5). Households with incomes below 100% FPG had peak period average usage of 0.81 kW.

Senior households have average daily demand (0.68 kW) on weekdays compared to customers with incomes below 100% of FPG (0.61 kW). Households with incomes below 100% of FPG were able to reduce daily weekday energy consumption by over 2%. Load reductions were also significant in the off-peak periods on average weekdays for both groups. On the average weekend, senior households did not significantly reduce their daily energy consumption due to their increased demand in the super off-peak period.

Figure 4.3-8: Average Load Impacts for Peak Period for SCE Rate 2 for Senior Households and Households with Incomes Below 100% of FPG in the Hot Climate Region (Positive values represent load reductions)

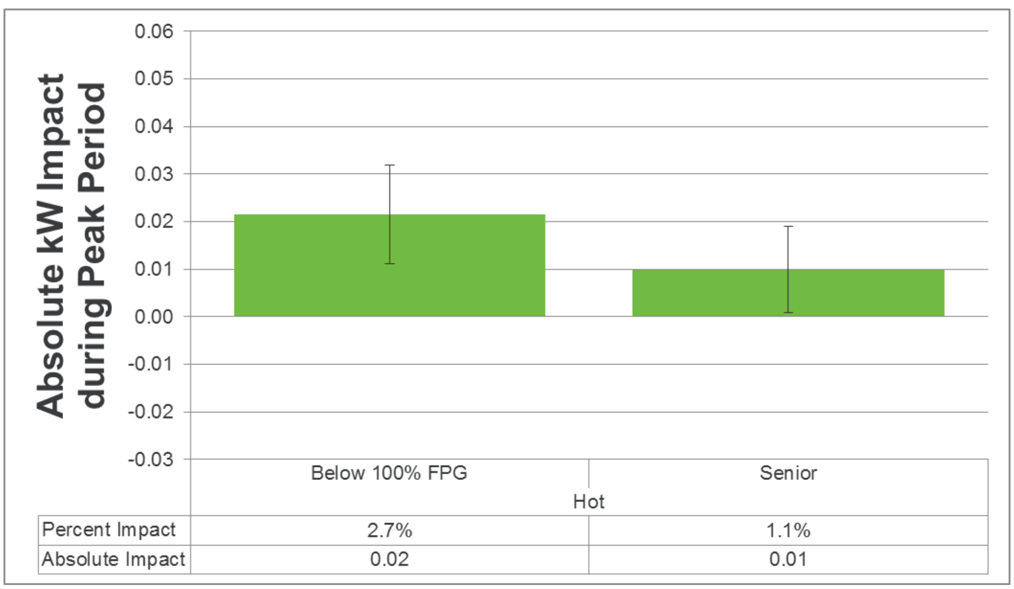


Table 4.3-8: Rate 2 Load Impacts by Rate Period and Day Type for Senior Households and Households with Incomes Below 100% of FPG in the Hot Climate Region*

(Positive values represent load reductions, negative values represent load increases)

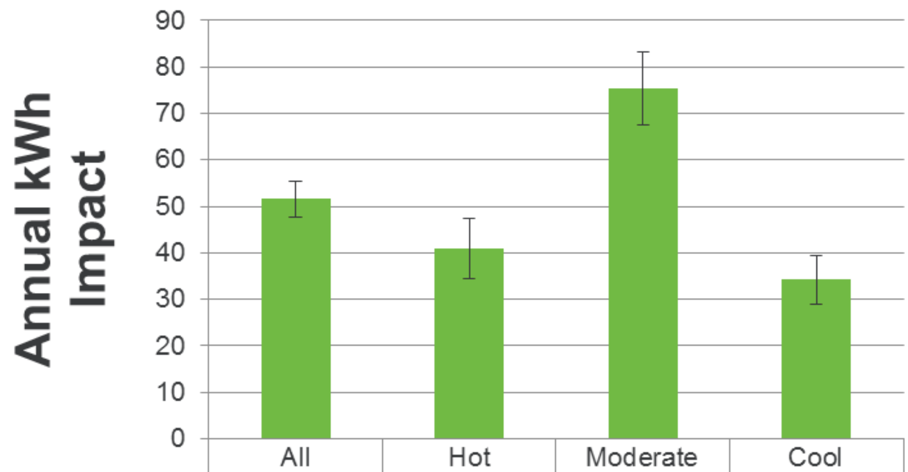
Rate 2								
Day Type	Period	Hours	Hot, Below 100% FPG			Hot, Senior		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	5 PM to 8 PM	0.81	0.02	2.7%	0.91	0.01	1.1%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	0.64	0.02	3.1%	0.74	0.01	0.9%
	Super Off Peak	10 PM to 8 AM	0.52	0.00	0.4%	0.54	-0.02	-2.8%
	Day	All Hours	0.61	0.01	2.1%	0.68	0.00	-0.3%
Average Weekend	Off Peak	8 AM to 10 PM	0.71	0.02	2.9%	0.81	0.01	1.1%
	Super Off Peak	10 PM to 8 AM	0.52	0.00	0.7%	0.54	-0.02	-3.0%
	Day	All Hours	0.63	0.01	2.1%	0.70	0.00	-0.2%
Monthly System Peak Day	Peak	5 PM to 8 PM	0.91	0.04	4.8%	1.02	0.01	1.3%
	Off Peak	8 AM to 5 PM, 8 PM to 10 PM	0.71	0.03	3.8%	0.83	0.00	-0.2%
	Super Off Peak	10 PM to 8 AM	0.53	0.01	2.0%	0.55	-0.01	-2.7%
	Day	All Hours	0.66	0.02	3.4%	0.74	-0.01	-0.7%

* A shaded cell indicates estimate is not statistically significant

Annual Conservation Effect

Figure 4.3-9 shows the annual conservation effect for SCE's service territory as a whole and for each climate region. The impacts for customers on Rate 2 are quite different compared to those on Rate 1, especially in the hot and cool climate regions. Customers in the hot climate region on Rate 1 increased their energy consumption during the first year of the pilot, while those on Rate 2 reduced their consumption by 0.5% or 41.0 kWh. Similar to Rate 1, customers in the moderate climate region provided the greatest reductions of 1.1% or 75.4 kWh. Customers in the cool climate regions had the smallest conservation effect of 0.7% or 34.2 kWh.

Figure 4.3-9: Average Annual Conservation Effect for SCE Rate 2
(Positive values represent usage reductions)

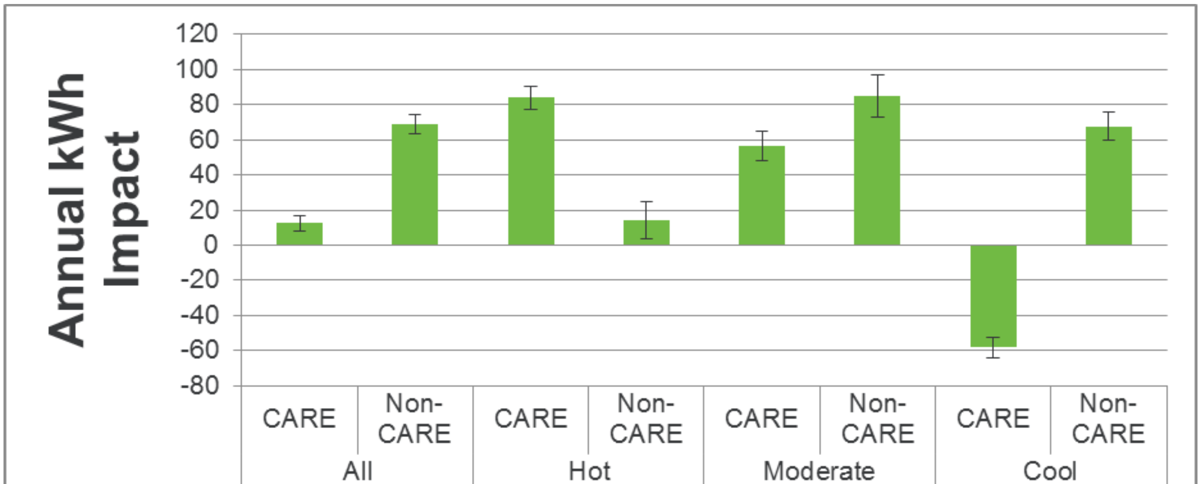


	All	Hot	Moderate	Cool
Percent Impact	0.8%	0.5%	1.1%	0.7%
kWh Impact	51.5	41.0	75.4	34.2

Figure 4.3-10 shows the energy savings during the first year of the pilot for CARE/FERA and non-CARE/FERA customers. Each group reduced their energy consumption with the exception of CARE/FERA customers in the cool climate region. This is not surprising, as this group did not reduce their demand during the peak period. For the service territory as a whole, non-CARE/FERA customers saved more energy than their CARE/FERA counterparts, with savings of 1.0% and 0.2%, respectively.

Figure 4.3-10: Average Annual Conservation Effect for SCE Rate 2 for CARE/FERA and Non-CARE/FERA Customers

(Positive values represent usage reductions)

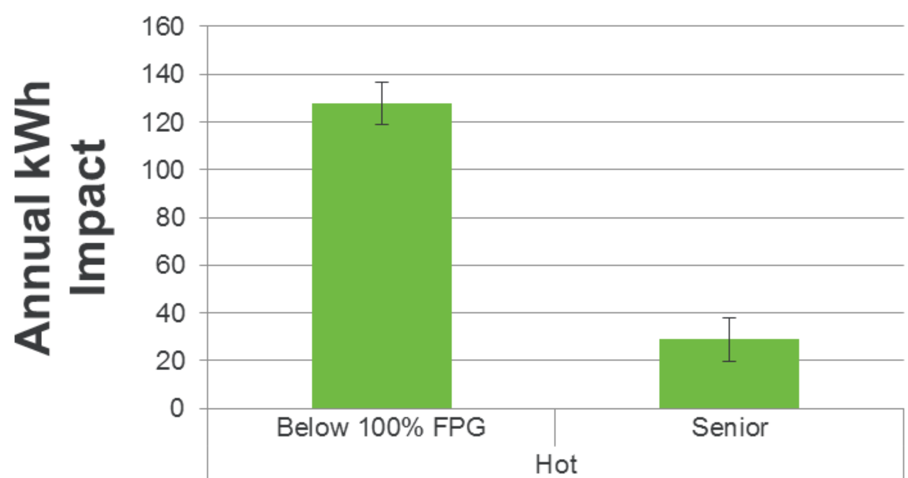


	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	0.2%	1.0%	1.2%	0.2%	1.0%	1.1%	-1.4%	1.2%
kWh Impact	12.4	68.9	83.9	14.1	56.4	84.9	-58.3	67.7

Figure 4.3-11 shows the annual conservation effect for senior households and households with incomes below 100% FPG in SCE's hot climate region. Customers with incomes below 100% FPG reduced their energy use by 1.9% or 127.9 kWh, which is quite different from similar customers on PG&E's Rate 1. Senior households saved energy as well, but only about 0.4% or 29.0 kWh over the course of the year.

Figure 4.3-11: Average Annual Conservation Effect for SCE Rate 2 for Senior Households and Households with Incomes Below 100% FPG

(Positive values represent usage reductions)



	Below 100% FPG	Senior
Percent Impact	1.9%	0.4%
kWh Impact	127.9	29.0

4.3.3 Rate 3

SCE's Rate 3 has two rate periods on winter weekdays, a mid-peak period (21.0 ¢/kWh from 4 to 9 PM) and an off peak-period (18.2 ¢/kWh for all other hours).[43] On weekends, a super off-peak period is in effect from 11 AM to 4 PM and the price is 10.4 ¢/kWh. During the spring months, Rate 3 is a three-period rate on weekends and weekdays, with a weekday peak period price of 24.9 ¢/kWh, a super-off peak price of 9.9 ¢/kWh, and an off peak price of 18.2 ¢/kWh. Rate 3 differs from Rates 1 and 2 in that it does not offer customers a baseline credit.

Winter Load Impacts

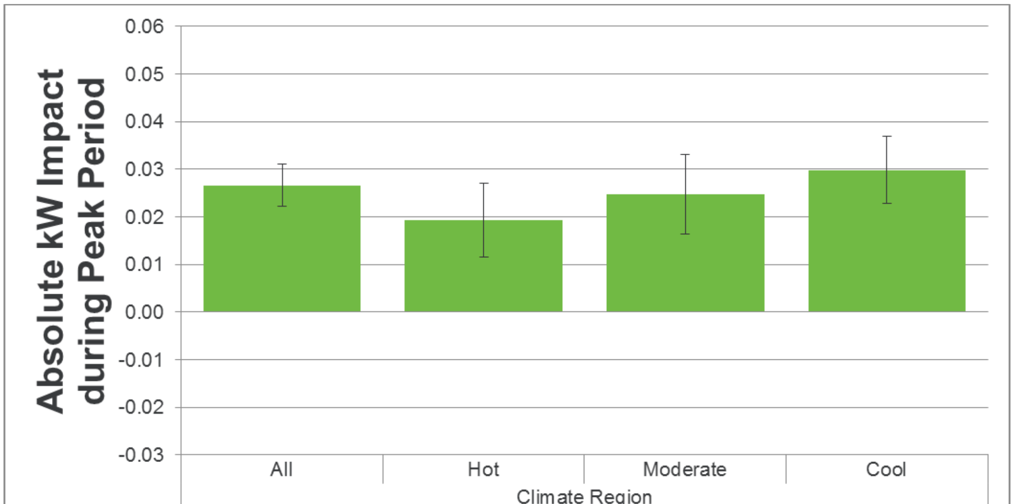
Figure 4.3-12 shows the mid peak period load reductions on average weekdays for Rate 3. The load reductions for the SCE territory as a whole, 3.2% or 0.03 kW, are greater than they were for Rate 1 or Rate 2 even though average demand during the peak period was similar across the three rates (between 0.73 and 0.83 kW). Load impacts for customers in the hot and moderate climate regions were identical in absolute terms (0.02 kW), but reductions in the moderate region were larger than they were in the hot region in percentage terms (2.8% versus 2.2%). Load reductions were greatest among customers in the cool climate region, with impacts of 3.8% or 0.03 kW. The differences in the absolute load impacts in the mid peak period between the climate regions were not statistically significant.

[43] Prices reflect tariffs in effect at the launch of the pilot through the end of December 2016. As indicated above and shown in Appendix B, rates changed on January 1, 2017.

Table 4.3-9 contains estimates of load impacts for all relevant rate periods and day types. Mid peak demand was the smallest among customers in the cool climate region at 0.79 kW, but percent impacts were the greatest. On the average weekend, customers in the moderate climate region had the greatest percent impacts at 2.9% (0.03 kW). Customers did not increase electricity use during the super off peak period which only occurred on weekends.

On weekdays, the average reduction in daily electricity use was statistically significant overall and in the hot and cool climate regions, ranging from a low of 1.0% in the hot climate region to a high of 1.5% in the cool region.

Figure 4.3-12: Average Load Impacts for Mid Peak Period for SCE Rate 3[44] (Positive values represent load reductions)



	All	Hot	Moderate	Cool
Percent Impact	3.2%	2.2%	2.8%	3.8%
kW Impact	0.03	0.02	0.02	0.03

[44] SCE Rate 3 winter impacts represent October 2016 through February 2017.

Table 4.3-9: Rate 3 Load Impacts by Rate Period and Day Type*
(Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	All			Hot			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Mid Peak	4 PM to 9 PM	0.84	0.03	3.2%	0.89	0.02	2.2%	0.88	0.02	2.8%	0.79	0.03	3.8%
	Off Peak	9 PM to 4 PM	0.58	0.00	0.1%	0.64	0.00	0.6%	0.61	0.00	-0.6%	0.53	0.00	0.7%
	Day	All Hours	0.63	0.01	1.0%	0.69	0.01	1.0%	0.66	0.00	0.3%	0.59	0.01	1.5%
Average Weekend	Mid Peak	4 PM to 9 PM	0.87	0.02	2.7%	0.92	0.02	2.7%	0.91	0.03	2.9%	0.81	0.02	2.5%
	Off Peak	9 PM to 11 PM	0.59	0.00	-0.6%	0.65	0.00	0.7%	0.62	-0.01	-1.0%	0.54	0.00	-0.5%
	Super Off Peak	11 PM to 4 PM	0.70	0.00	0.3%	0.78	0.01	0.7%	0.74	0.01	1.2%	0.65	0.00	-0.6%
	Day	All Hours	0.67	0.00	0.5%	0.74	0.01	1.2%	0.71	0.00	0.5%	0.62	0.00	0.3%
Monthly System Peak Day	Mid Peak	4 PM to 9 PM	0.95	0.05	4.7%	0.93	0.02	2.0%	1.02	0.04	3.8%	0.90	0.06	6.3%
	Off Peak	11 AM to 4 PM, 9 PM to 11 PM	0.61	0.01	1.3%	0.66	0.00	0.5%	0.65	0.00	0.2%	0.57	0.02	2.7%
	Day	All Hours	0.68	0.02	2.3%	0.71	0.01	0.9%	0.73	0.01	1.2%	0.64	0.02	3.8%

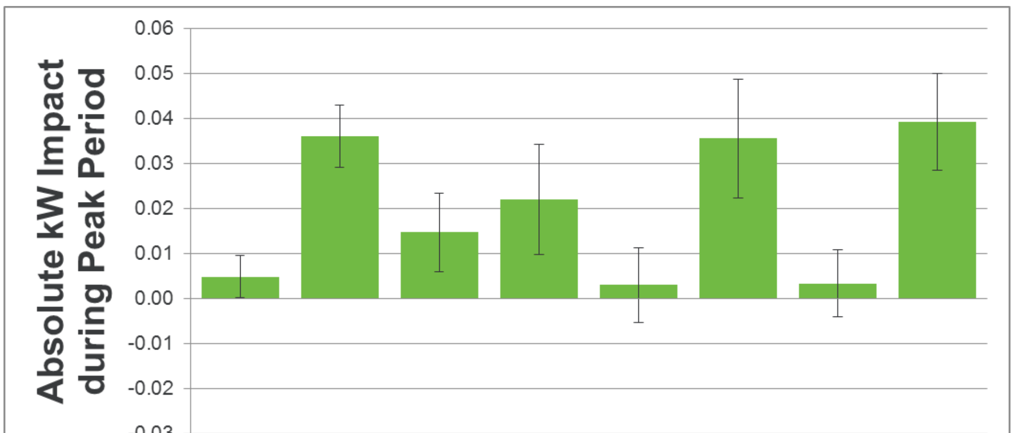
* A shaded cell indicates estimate is not statistically significant

Figure 4.3-13 shows the mid peak period load reductions on weekdays for non-CARE/FERA and CARE/FERA customers, and Table 4.3-10 and Table 4.3-11 show the load impacts for each rate period and day type for the two segments. Load reductions were statistically significant for all customer segments and climate regions except for CARE/FERA customers in the moderate and cool climate regions. The differences in absolute impacts between CARE/FERA and non-CARE/FERA customers were statistically significant for the service territory as a whole as well as in the moderate and cool climate regions.

As seen in Table 4.3-10 and Table 4.3-11, there are significant average weekday load reductions for non-CARE/FERA customers in the SCE territory as a whole. Load reductions were also significant, and over 1%, for non-CARE/FERA customers on average weekends and monthly system peak days.

Figure 4.3-13: Average Load Impacts for Mid Peak Period for SCE Rate 3 for CARE/FERA and Non-CARE/FERA Customers

(Positive values represent load reductions)



	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
	All		Hot		Moderate		Cool	
Percent Impact	0.7%	4.0%	1.9%	2.3%	0.4%	3.8%	0.5%	4.7%
Absolute Impact	0.00	0.04	0.01	0.02	0.00	0.04	0.00	0.04

Table 4.3-10: Rate 3 Load Impacts by Rate Period and Day Type – Non-CARE/FERA Customers*
(Positive values represent load reductions, negative values represent load increases)

Rate 3														
Day Type	Period	Hours	All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Mid Peak	4 PM to 9 PM	0.90	0.04	4.0%	0.95	0.02	2.3%	0.95	0.04	3.8%	0.84	0.04	4.7%
	Off Peak	9 PM to 4 PM	0.61	0.00	0.2%	0.69	0.00	0.6%	0.66	-0.01	-1.1%	0.56	0.01	1.1%
	Day	All Hours	0.67	0.01	1.2%	0.74	0.01	1.0%	0.72	0.00	0.3%	0.62	0.01	2.1%
Average Weekend	Mid Peak	4 PM to 9 PM	0.93	0.03	3.0%	0.99	0.03	2.8%	0.99	0.03	3.2%	0.87	0.03	3.0%
	Off Peak	9 PM to 11 PM	0.62	0.00	-0.6%	0.70	0.01	0.8%	0.67	-0.01	-1.7%	0.57	0.00	-0.1%
	Super Off Peak	11 PM to 4 PM	0.76	0.00	0.4%	0.85	0.00	0.1%	0.81	0.01	1.0%	0.70	0.00	0.1%
	Day	All Hours	0.72	0.00	0.6%	0.79	0.01	1.2%	0.77	0.00	0.2%	0.66	0.01	0.8%
Monthly System Peak Day	Mid Peak	4 PM to 9 PM	1.02	0.06	5.8%	0.99	0.03	3.1%	1.10	0.06	5.4%	0.96	0.06	6.8%
	Off Peak	11 AM to 4 PM, 9 PM to 11 PM	0.65	0.01	1.9%	0.70	0.01	1.1%	0.71	0.00	0.2%	0.60	0.02	3.6%
	Day	All Hours	0.73	0.02	3.0%	0.76	0.01	1.6%	0.79	0.01	1.7%	0.68	0.03	4.5%

* A shaded cell indicates estimate is not statistically significant

Table 4.3-11: Rate 3 Load Impacts by Rate Period and Day Type –CARE/FERA Customers*
(Positive values represent load reductions, negative values represent load increases)

Rate 3														
Day Type	Period	Hours	All, CARE			Hot, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Mid Peak	4 PM to 9 PM	0.70	0.00	0.7%	0.80	0.01	1.9%	0.73	0.00	0.4%	0.64	0.00	0.5%
	Off Peak	9 PM to 4 PM	0.49	0.00	-0.1%	0.57	0.00	0.6%	0.51	0.00	0.4%	0.45	0.00	-1.0%
	Day	All Hours	0.54	0.00	0.1%	0.62	0.01	1.0%	0.55	0.00	0.4%	0.49	0.00	-0.6%
Average Weekend	Mid Peak	4 PM to 9 PM	0.71	0.01	1.5%	0.81	0.02	2.3%	0.74	0.01	2.0%	0.65	0.00	0.7%
	Off Peak	9 PM to 11 PM	0.50	0.00	-0.3%	0.58	0.00	0.5%	0.52	0.00	0.5%	0.46	-0.01	-1.7%
	Super Off Peak	11 PM to 4 PM	0.58	0.00	0.0%	0.67	0.01	2.1%	0.61	0.01	1.7%	0.52	-0.02	-3.0%
	Day	All Hours	0.56	0.00	0.2%	0.65	0.01	1.3%	0.59	0.01	1.2%	0.51	-0.01	-1.4%
Monthly System Peak Day	Mid Peak	4 PM to 9 PM	0.80	0.01	1.6%	0.84	0.00	-0.1%	0.85	0.00	-0.2%	0.73	0.03	4.5%
	Off Peak	11 AM to 4 PM, 9 PM to 11 PM	0.52	0.00	-0.3%	0.58	0.00	-0.8%	0.55	0.00	0.0%	0.48	0.00	-0.4%
	Day	All Hours	0.58	0.00	0.3%	0.63	0.00	-0.6%	0.61	0.00	0.0%	0.53	0.01	1.0%

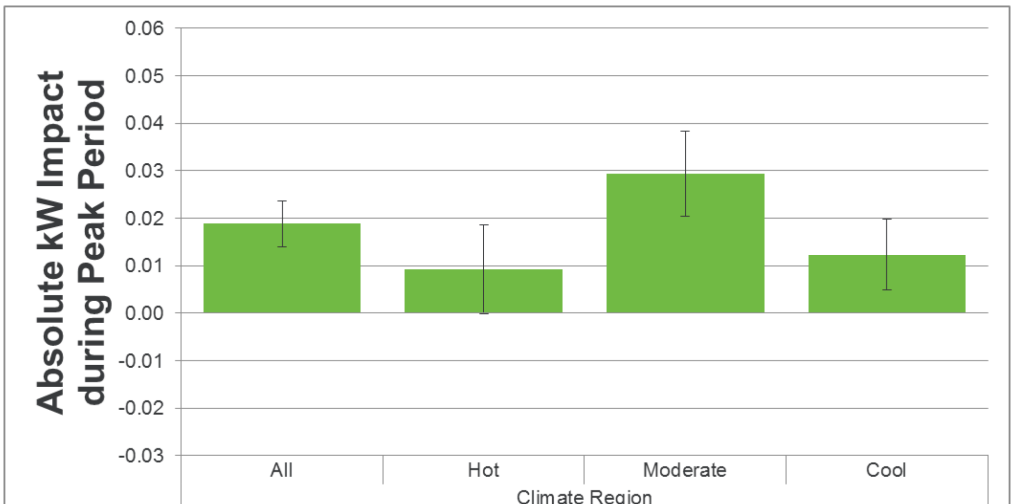
* A shaded cell indicates estimate is not statistically significant

Spring Load Impacts

Figure 4.3-14 shows peak period load reductions on average weekdays during the spring period, which includes March, April, and May. Load reductions are significant in the moderate and cool climate zones, with percent impacts of 3.7% and 1.8%, respectively. For the service territory as a whole, customers reduced their peak period energy use by 2.5% or 0.02 kW. Spring impacts for each climate region in SCE's territory were smaller than those for PG&E's Rate 1, except in the moderate climate region where they were nearly identical (3.7% and 0.03 kW).

Table 4.3-12 contains estimates of load impacts for all relevant rate periods and day types. Peak demand was the greatest among customers in the hot climate region at 0.90 kW, but impacts were not statistically significant. On the average weekend, customers in SCE's territory had percent impacts equal to 1.4% or 0.01 kW during the mid peak period. Customers increased electricity use during the super off peak period on weekends but not weekdays. On weekdays, the average reduction in daily electricity use was statistically significant in only the hot climate regions.

Figure 4.3-14: Average Load Impacts for Peak Period for SCE Rate 3[45]
(Positive values represent load reductions)



	All	Hot	Moderate	Cool
Percent Impact	2.5%	1.0%	3.7%	1.8%
kW Impact	0.02	0.01	0.03	0.01

[45] SCE Rate 3 spring impacts represent March 2017 through May 2017.

Table 4.3-12: Rate 3 Load Impacts by Rate Period and Day Type*
(Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 3											
			All			Hot			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.75	0.02	2.5%	0.90	0.01	1.0%	0.79	0.03	3.7%	0.67	0.01	1.8%
	Off Peak	9 PM to 11 AM	0.49	-0.01	-1.0%	0.57	0.00	0.6%	0.52	-0.01	-2.7%	0.45	0.00	0.0%
	Super Off Peak	11 AM to 4 PM	0.58	0.00	0.3%	0.77	0.01	0.9%	0.61	0.00	0.0%	0.50	0.00	0.5%
	Day	All Hours	0.56	0.00	0.2%	0.68	0.01	0.8%	0.59	0.00	-0.3%	0.51	0.00	0.6%
Average Weekend	Mid Peak	4 PM to 9 PM	0.76	0.01	1.4%	0.91	0.01	0.8%	0.81	0.02	2.8%	0.69	0.00	0.3%
	Off Peak	9 PM to 11 PM	0.50	-0.01	-1.1%	0.58	0.00	0.5%	0.52	-0.01	-1.9%	0.46	0.00	-0.7%
	Super Off Peak	11 PM to 4 PM	0.66	-0.01	-2.0%	0.84	-0.01	-1.2%	0.71	-0.01	-1.6%	0.58	-0.02	-2.7%
	Day	All Hours	0.59	0.00	-0.6%	0.70	0.00	0.1%	0.62	0.00	-0.6%	0.53	0.00	-0.9%
Monthly System Peak Day	Peak	4 PM to 9 PM	0.91	0.03	3.4%	1.15	-0.01	-0.8%	1.06	0.04	3.8%	0.73	0.03	4.7%
	Off Peak	9 PM to 11 AM	0.51	0.00	0.1%	0.61	0.01	1.7%	0.55	-0.01	-1.8%	0.45	0.01	1.5%
	Super Off Peak	11 AM to 4 PM	0.71	0.01	1.8%	0.98	-0.02	-1.8%	0.82	0.02	2.6%	0.56	0.01	2.5%
	Day	All Hours	0.64	0.01	1.5%	0.80	0.00	0.1%	0.71	0.01	1.0%	0.53	0.01	2.6%

* A shaded cell indicates estimate is not statistically significant

Figure 4.3-15 shows the peak period load reductions on weekdays for non-CARE/FERA and CARE/FERA customers in the spring period. Table 4.3-13 and Table 4.3-14 show the load impacts for each rate period and day type for the two segments. Load reductions were not statistically significant for non-CARE/FERA customers in the hot climate region and CARE/FERA customers in the cool climate region. There was a statistically significant difference in absolute impacts between CARE/FERA and non-CARE/FERA customers in the moderate and cool climate regions and in the territory as a whole.

As seen in Table 4.3-13 and Table 4.3-14, there are significant average weekday load reductions for CARE/FERA customers in the SCE territory as a whole and in the hot and moderate climate regions.

Figure 4.3-15: Average Load Impacts for Peak Period for SCE Rate 3 for CARE/FERA and Non-CARE/FERA Customers (Positive values represent load reductions)

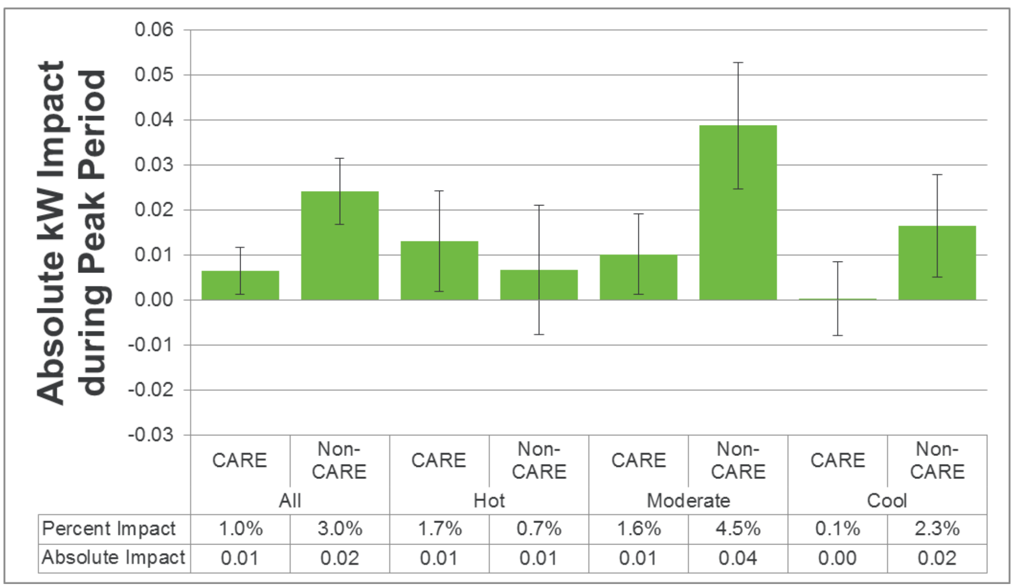


Table 4.3-13: Rate 3 Load Impacts by Rate Period and Day Type – Non-CARE/FERA Customers*
(Positive values represent load reductions, negative values represent load increases)

Day Type	Period	Hours	Rate 3											
			All, Non-CARE			Hot, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.80	0.02	3.0%	0.98	0.01	0.7%	0.86	0.04	4.5%	0.72	0.02	2.3%
	Off Peak	9 PM to 11 AM	0.53	-0.01	-1.4%	0.62	0.00	0.5%	0.56	-0.02	-3.9%	0.49	0.00	0.2%
	Super Off Peak	11 AM to 4 PM	0.61	0.00	0.0%	0.84	0.00	0.4%	0.66	-0.01	-1.0%	0.53	0.00	0.9%
	Day	All Hours	0.60	0.00	0.1%	0.74	0.00	0.5%	0.64	-0.01	-1.0%	0.54	0.01	1.0%
Average Weekend	Mid Peak	4 PM to 9 PM	0.82	0.01	1.3%	1.00	0.00	-0.2%	0.89	0.03	3.0%	0.74	0.00	0.2%
	Off Peak	9 PM to 11 PM	0.54	-0.01	-1.4%	0.63	0.00	0.6%	0.57	-0.02	-2.9%	0.49	0.00	-0.6%
	Super Off Peak	11 PM to 4 PM	0.71	-0.02	-2.8%	0.93	-0.01	-1.1%	0.77	-0.02	-2.6%	0.63	-0.02	-3.5%
	Day	All Hours	0.63	-0.01	-1.0%	0.77	0.00	0.0%	0.68	-0.01	-1.3%	0.57	-0.01	-1.0%
Monthly System Peak Day	Peak	4 PM to 9 PM	0.98	0.04	4.1%	1.25	0.00	-0.1%	1.16	0.05	4.2%	0.79	0.04	5.5%
	Off Peak	9 PM to 11 AM	0.55	0.00	0.2%	0.67	0.01	2.1%	0.60	-0.02	-2.7%	0.49	0.01	2.3%
	Super Off Peak	11 AM to 4 PM	0.76	0.01	1.6%	1.07	-0.03	-2.4%	0.89	0.01	1.4%	0.59	0.02	3.4%
	Day	All Hours	0.68	0.01	1.7%	0.87	0.00	0.3%	0.78	0.00	0.4%	0.57	0.02	3.5%

* A shaded cell indicates estimate is not statistically significant

Table 4.3-14: Rate 3 Load Impacts by Rate Period and Day Type –CARE/FERA Customers*
(Positive values represent load reductions, negative values represent load increases)

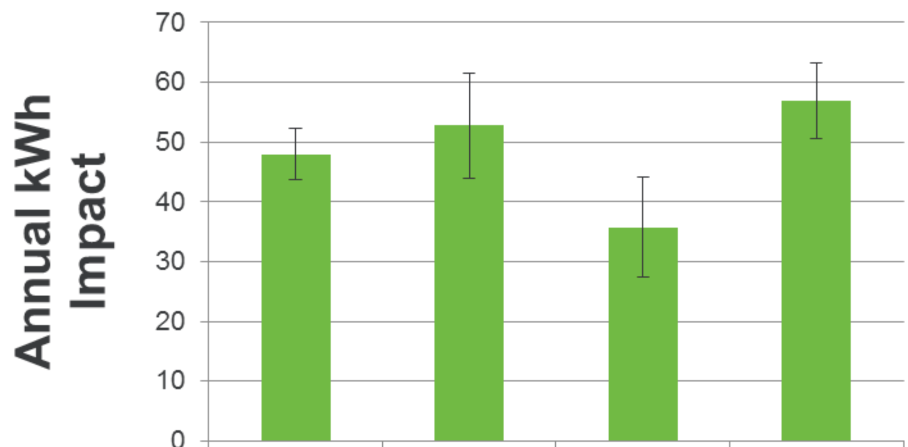
			Rate 3											
Day Type	Period	Hours	All, CARE			Hot, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.63	0.01	1.0%	0.78	0.01	1.7%	0.65	0.01	1.6%	0.55	0.00	0.1%
	Off Peak	9 PM to 11 AM	0.41	0.00	0.2%	0.49	0.00	0.7%	0.42	0.00	0.7%	0.36	0.00	-0.7%
	Super Off Peak	11 AM to 4 PM	0.49	0.01	1.1%	0.65	0.01	1.9%	0.52	0.01	2.5%	0.41	0.00	-1.2%
	Day	All Hours	0.47	0.00	0.6%	0.59	0.01	1.3%	0.49	0.01	1.3%	0.41	0.00	-0.6%
Average Weekend	Mid Peak	4 PM to 9 PM	0.63	0.01	1.8%	0.77	0.02	2.7%	0.66	0.01	2.3%	0.55	0.00	0.8%
	Off Peak	9 PM to 11 PM	0.41	0.00	-0.1%	0.50	0.00	0.2%	0.43	0.00	0.7%	0.37	0.00	-1.1%
	Super Off Peak	11 PM to 4 PM	0.55	0.00	0.4%	0.69	-0.01	-1.4%	0.58	0.01	1.1%	0.47	0.00	0.5%
	Day	All Hours	0.49	0.00	0.6%	0.60	0.00	0.5%	0.51	0.01	1.2%	0.43	0.00	-0.2%
Monthly System Peak Day	Peak	4 PM to 9 PM	0.77	0.01	1.4%	0.99	-0.02	-2.3%	0.87	0.02	2.6%	0.59	0.01	1.8%
	Off Peak	9 PM to 11 AM	0.42	0.00	-0.1%	0.53	0.01	1.0%	0.45	0.00	0.5%	0.36	0.00	-1.4%
	Super Off Peak	11 AM to 4 PM	0.61	0.01	2.4%	0.84	0.00	-0.5%	0.69	0.04	5.7%	0.45	0.00	-1.1%
	Day	All Hours	0.54	0.01	1.0%	0.69	0.00	-0.4%	0.59	0.01	2.4%	0.43	0.00	-0.4%

* A shaded cell indicates estimate is not statistically significant

Annual Conservation Effect

Figure 4.3-16 shows the annual conservation effect of customers on SCE's Rate 3. Because of Rate 3's late start, the estimates shown below do not include savings for the month of July. Energy savings were similar between climate regions, but customers in the cool climate region saved the most (1.2% or 56.9 kWh). In the service territory as a whole, customers reduced their consumption by 0.9% or 47.9 kWh.

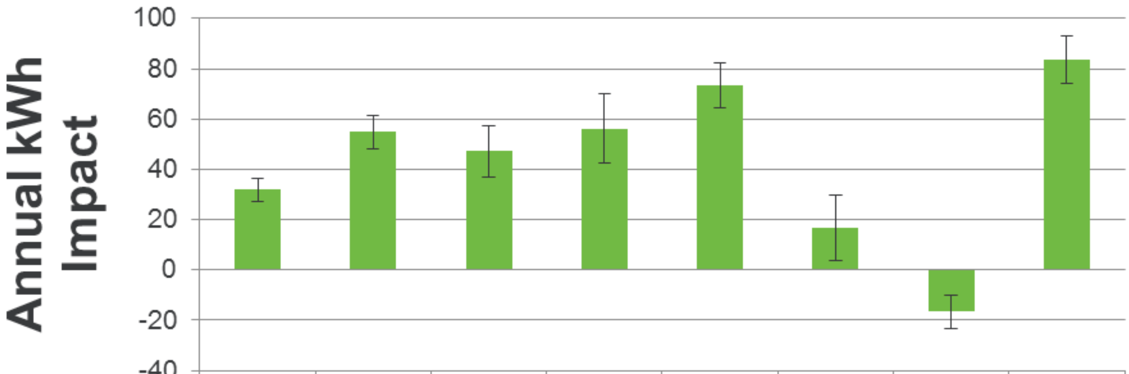
Figure 4.3-16: Average Annual Conservation Effect for SCE Rate 3 (Positive values represent usage reductions)



	All	Hot	Moderate	Cool
Percent Impact	0.9%	0.8%	0.6%	1.2%
kWh Impact	47.9	52.7	35.7	56.9

Figure 4.3-17 presents the annual conservation effect for CARE/FERA customers and non-CARE/FERA customers. These estimates are similar to those for Rate 2 in that all customer segments saved energy with the exception of CARE/FERA customers in the cool climate region. Their non-CARE/FERA counterparts saved the most, however, with a conservation effect of 1.7% or 83.5 kWh. CARE/FERA customers and non-CARE/FERA customers in the hot climate region both reduced their energy use by 0.8%.

Figure 4.3-17: Average Annual Conservation Effect for SCE Rate 3 for CARE/FERA and Non-CARE/FERA Customers
(Positive values represent usage reductions)



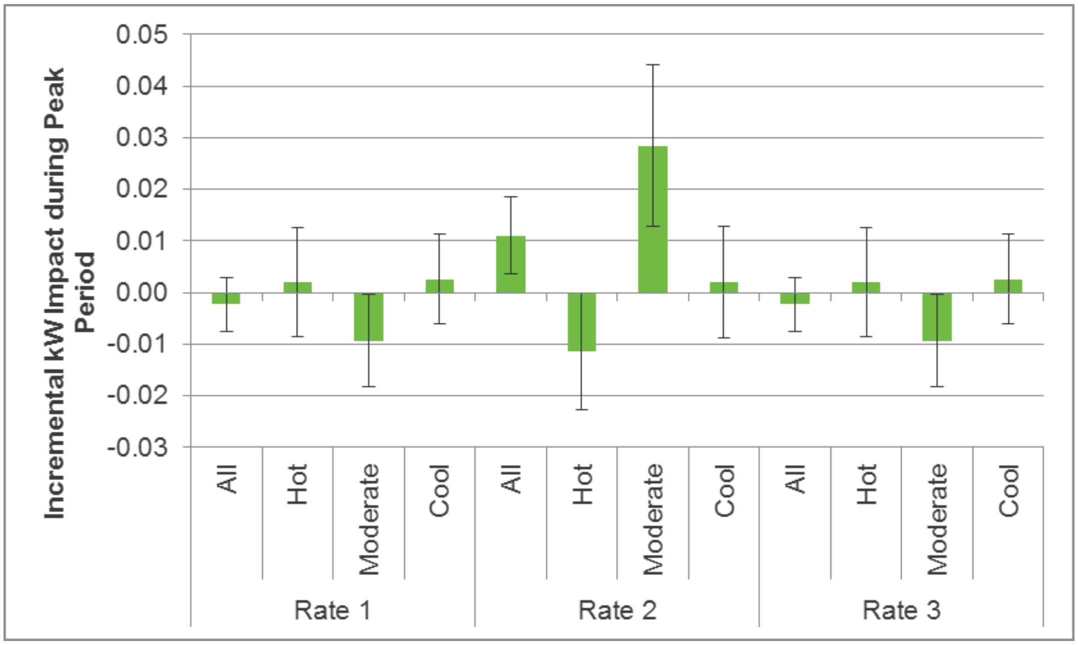
	All		Hot		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	0.7%	0.9%	0.8%	0.8%	1.5%	0.3%	-0.4%	1.7%
kWh Impact	31.9	55.0	47.3	56.1	73.4	16.9	-16.6	83.5

4.3.4 Advanced ME&O

SCE varied the education and outreach provided to participants who were on the three TOU rates. The majority of customers (75%) on each of the three TOU rates received what SCE describes as enhanced education and outreach while the remainder received fewer contacts during the post enrollment phase. The customers chosen at random to receive the enhanced education treatment for each rate received a postcard at the end of August containing tips and reminders about their rate. Starting in Late September, the roughly 19% of participants in the enhanced education group who indicated at the time of enrollment that they were willing to receive information via text messages were sent additional reminders and tips via text message.

Figure 4.3-18 shows the average incremental impact attributable to the enhanced education and outreach for each climate region and rate, as well as for the territory as a whole. In general, customers receiving the enhanced treatment did not have statistically significantly greater impacts than those who did not. The one exception was customers in the moderate climate region on Rate 2.

Figure 4.3-18: Incremental Impacts among Customers Receiving Advanced ME&O



4.3.5 Comparison Across Rates

Figure 4.3-19 compares the load impacts for the three rates tested by SCE for the common set of peak-period hours from 5 to 8 PM for the entire winter. Using a common set of hours reduces differences in impacts across rates that might be due to differences in the number of hours included in the peak period or the timing of those hours. The hours from 5 to 8 PM define the peak period for Rate 2, which is a two period rate in the winter. Rates 1 and 3 are two period rates with the same peak period, from 2 to 8 PM. During the winter period, the peak-to-off-peak ratio[46] is similar for all three rates, so we would expect to see similar impacts during the common peak periods. Generally, impacts were not statistically significantly different between rates, with the exception of the hot climate region. Customers on SCE's Rate 1 in the hot climate region increased their demand between 5 and 8 PM during the winter period, while customers on the other two rates had statistically significant load reductions.

Figure 4.3-20 presents the average daily kWh impacts for each rate during the winter period. Daily impacts vary across rates and climate regions with no clear pattern.

[46] The peak-to-off-peak price ratio is equal to the peak price divided by the off-peak price as defined in Figures 4.1-1 through 4.1-3

Figure 4.3-19: Average Impacts from 5 to 8 PM Across Rates

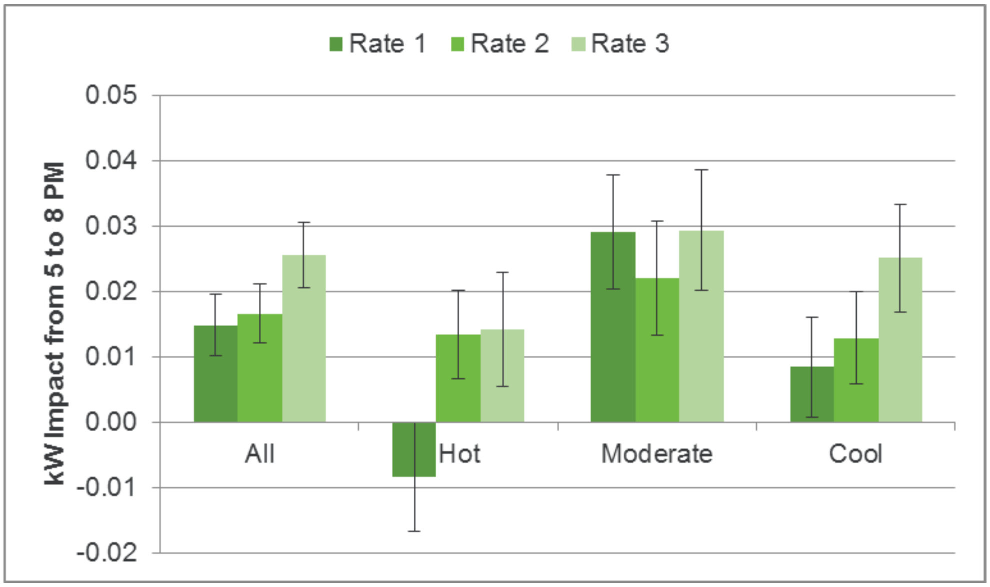
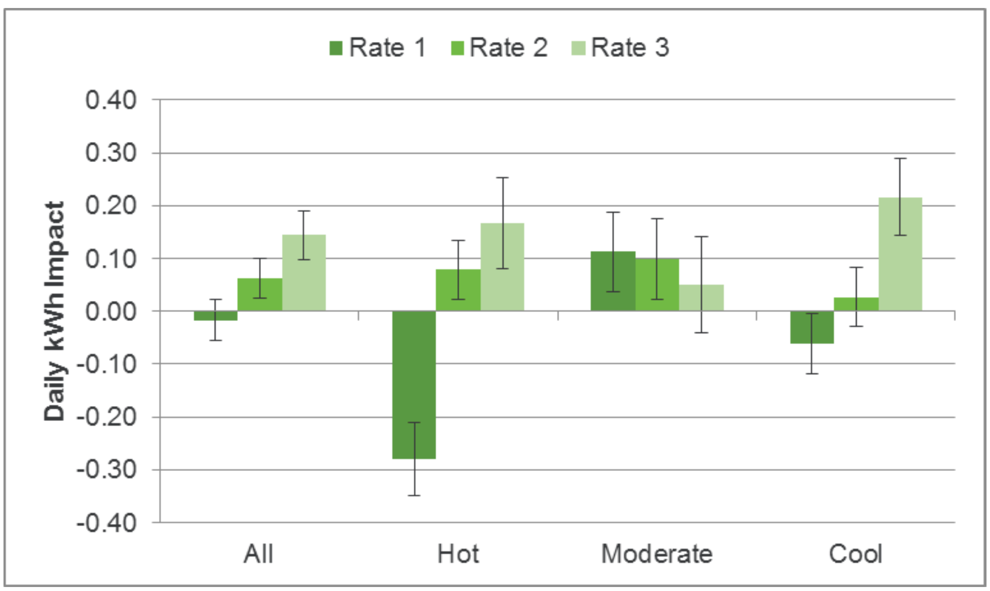


Figure 4.3-20: Average Daily kWh Impacts Across Rates



4.4 Bill Impacts

This section summarizes the bill impact estimates for the three rate treatments tested by SCE. The CPUC resolution approving SCE's pilot requires that bill impacts be estimated for the following rates, customer segments, and climate regions:

- **For Rate 2-** Seniors, CARE/FERA customers, non-CARE/FERA customers, households with incomes below 100% of FPG, and households with incomes between 100% and 200% of FPG in SCE's hot climate region; and
- **For all rates-** For CARE/FERA and non-CARE/FERA customers on each rate across SCE's service territory as a whole and for each climate region.

In addition to these required segments, Nexant estimated bill impacts for seniors, households with incomes below 100% of FPG, and households with incomes between 100% and 200% of FPG in SCE's hot climate region for Rate 1 and Rate 3. Bill impacts are reported as the average monthly impact for the winter months of October, November, December, January, February, March, April, and May[47] and for the first full year of the pilot. Three analyses that were conducted for the First Interim Report were conducted again for this report:

- **Structural benefiter/non-benefiter analysis based on pretreatment usage-** Displaying the proportions of structural benefiters and non-benefiters for each rate and relevant customer segment based on pretreatment data on an annual and seasonal (winter and spring) season basis;
- **Estimation of the total bill impact due to both the difference in the tariffs and behavior change[25]-** Displaying the bill impact for each rate and relevant customer segment due to structural differences in the rate mitigated by changes in behavior; and
- **Change in the distribution of bill impacts due to behavior change-** Displaying the distribution curves of bill impacts (percentage of customers with bill impacts within $10 incremental bins) with and without behavior change in the same graph to illustrate if the distribution for participants shifted to the left or changed shape compared with the distribution for control customers without behavior change.

A more detailed explanation of each type of analysis and how the analysis was conducted is contained in Section 3.7 of the First Interim Report. The remainder of this section is organized according to the three analysis types summarized above—that is, bill impacts are presented for each rate, relevant customer segment, and climate region for each of the three analyses.

Unlike the First Interim Report which relied on only one tariff per pilot rate and OAT, the impacts presented in this report are based on two SCE tariffs. All monthly bills from July 2016 through December 2016 (and their corresponding pretreatment months) are based on the tariffs that were in effect at the start of the pilot. Estimated bills for January 2017 through June 2017 (and their corresponding pretreatment months) are based on the January 2017 tariff. The reason for incorporating a second tariff was a significant change in the structure of SCE's OAT. At the start of the pilot, the OAT was a three-tiered rate. In January 2017, the rate transitioned to a two-tiered structure (with a surcharge for high

[47] The winter period for Rate 3 ends in February. The spring period is March, April, and May. July 2016 is not included in the analysis for Rate 3 due to the late start in enrollment.

usage). To better reflect the conditions customers actually experienced, Nexant chose to include this new rate in the analysis. Because of this change, the annual structural benefiter analysis was updated for this report.

4.4.1 Structural Benefiter/Non-Benefiter Analysis Based on Pretreatment Usage

As with PG&E, the structural benefiter analysis was conducted for the winter, spring, and annual time periods using pretreatment usage data for the treatment group for each rate and relevant customer segment. Annual impacts were based on hourly load data from May 2015 through April 2016[48]. Winter impacts were based on May 2015 and October 2015 through April 2016 for Rate 1 and Rate 2 and October 2015 through February 2016 for Rate 3. For Rate 3 only, spring impacts were based on May 2015[49], March 2016, and April 2016. Monthly bills were estimated for each treatment group customer on the OAT and TOU rate using the hourly load data. The difference in bills based on the TOU rate and the OAT determines if a customer is a structural benefiter, a structural non-benefiter, or falls in a neutral range defined as having a structural bill impact between ±$3.

Final results from the structural benefiter / non-benefiter analysis are presented in column graphs, and shown as percentages for the winter season and on an annual basis. For each rate and relevant segment, the percentage of customers who are non-benefiters, neutral (+/- $3), or benefiters based on their average monthly bills for the time period of interest are shown as individual columns. The three columns within each rate and segment combination total to 100%, thus showing the distribution of structural benefiters and non-benefiters for each rate and segment of interest.

Figure 4.4-1 presents the outcome of the structural benefiter analysis for Rate 1 at the aggregate level across climate regions for all customers as well as for CARE/FERA and non-CARE/FERA. The graph on the left presents the analysis on an annual basis, and the graph on the right presents the findings for the winter period. Nearly all non-CARE/FERA customers are structural benefiters in the winter season. However, nearly half of CARE/FERA customers are in the neutral category in the winter months. Even though most of these customers have a structural gain on the winter rates, their structural gains are smaller than $3 – putting them in the neutral category.

[48] Customers were aware of the pilot in May 2016; May 2015 was used instead.

[49] Customers were aware of the pilot in May 2016; May 2015 was used instead.

Figure 4.4-1: Rate 1 Structural Benefiter / Non-Benefiter Analysis
All | CARE/FERA | Non-CARE/FERA

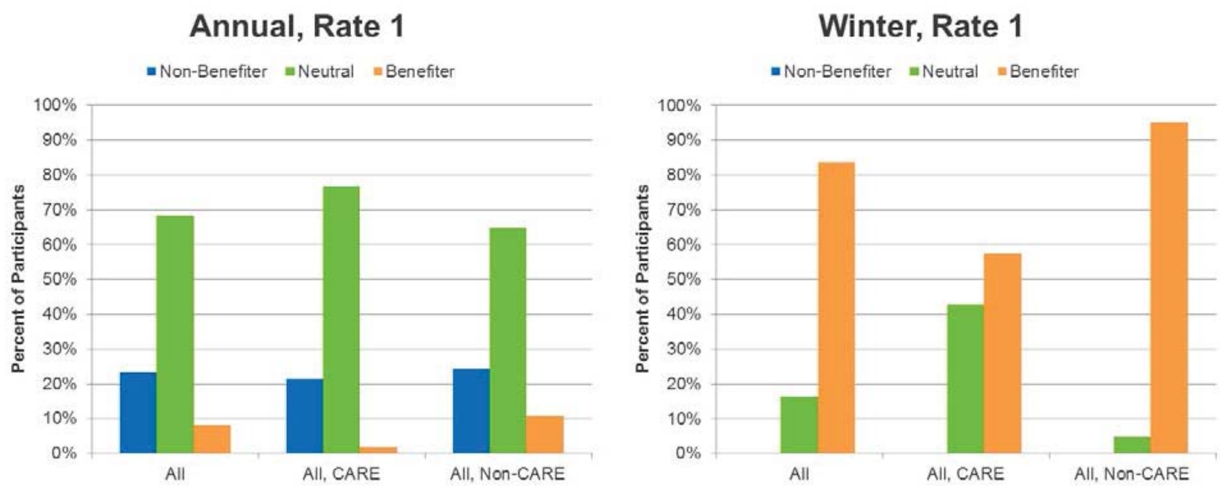


Figure 4.4-2 presents the outcome of the structural benefiter analysis for Rate 1 at the detailed segment level by climate region. The findings at the aggregate level still hold, with a majority of customers being structural benefiters in the winter season. The non-CARE/FERA segments in all three climate regions have a greater proportion of benefiters than the CARE/FERA segments on an annual basis. About half of non-CARE/FERA and CARE/FERA customers in the hot climate regions are structural non-benefiters on an annual basis.

Figure 4.4-2: Rate 1 Structural Benefiter / Non-Benefiter Analysis
Detailed Segments by Climate Region

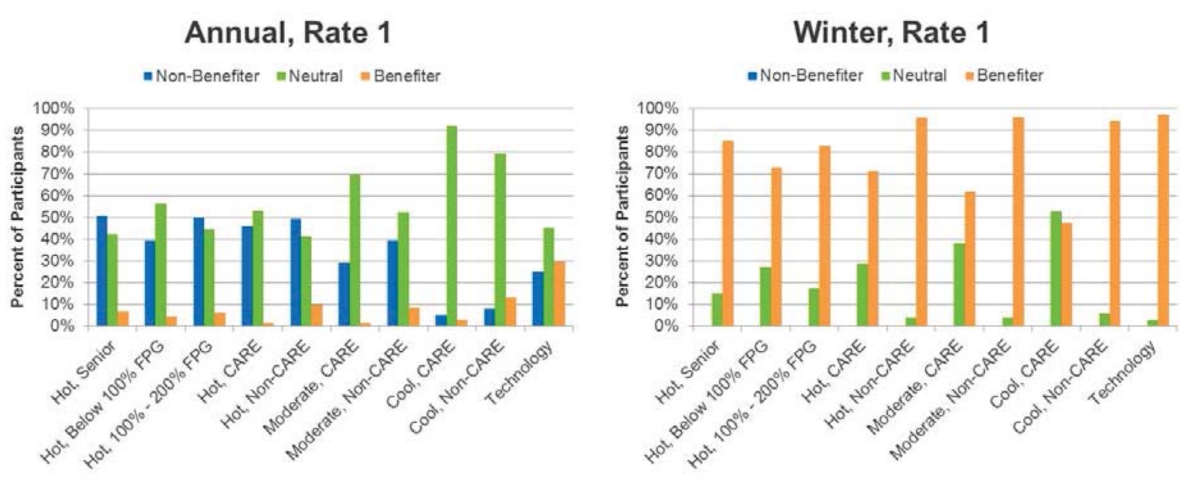


Figure 4.4-3 presents the outcome of the structural benefiter analysis for Rate 2 at the aggregate level across climate regions. SCE's Rate 2 differs from Rate 1 in several important ways. Both rates have three rate periods on winter weekdays; however the Rate 2 peak period is only three hours, from 5 to 8 PM,

compared to six hours on Rate 1. Overall, the general pattern of structural benefiters, non-benefiters, and neutrals is similar between Rate 1 and Rate 2, however Rate 2 has a smaller proportion of customers in the neutral category and a greater proportion of customers are benefiters.

Figure 4.4-3: Rate 2 Structural Benefiter / Non-Benefiter Analysis All | CARE/FERA | Non-CARE/FERA

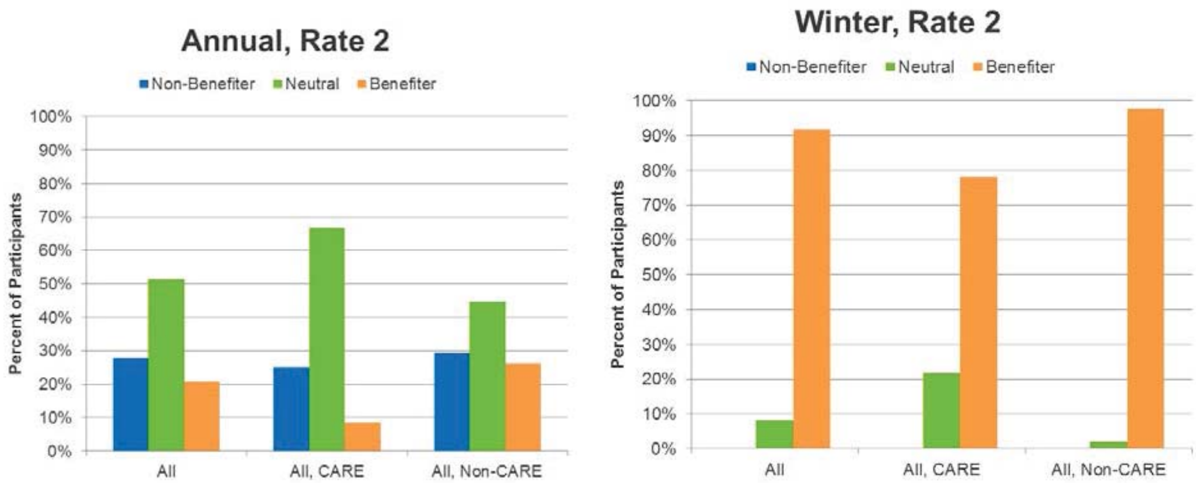


Figure 4.4-4 presents the outcome of the structural benefiter analysis for Rate 2 at the detailed segment level by climate region. On an annual and winter basis, more customers are benefiters when compared to Rate 1. This is especially noticeable in the winter months among CARE/FERA customers in the cool climate region where 97% of customers are benefiters on Rate 2 but only 47% are benefiters on Rate 1.

Figure 4.4-4: Rate 2 Structural Benefiter / Non-Benefiter Analysis Detailed Segments by Climate Region

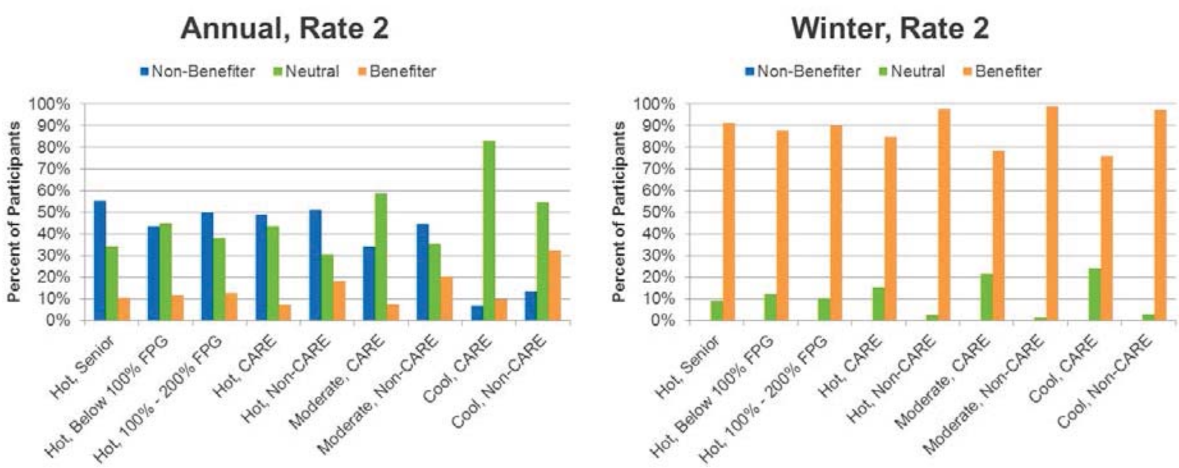


Figure 4.4-5 presents the distribution of structural benefiters, non-benefiters, and neutral customers for Rate 3 at the aggregate level across climate regions on an annual, winter, and spring basis. During the

winter months, the distribution of customers is very different from those for the previous two rates. While most customers are structural benefiters in the winter months on Rate 1 and Rate 2, nearly half of customers are non-benefiters on Rate 3. While a majority of customers may experience structural losses, there is a small number of customers who face very large structural gains, which will be discussed in more detail in the following two sections of this report.

In the spring period (March through April), about one third of customers fall into each category for the service territory as a whole. CARE/FERA customers are more likely to be in the neutral category than non-CARE/FERA customers.

Figure 4.4-5: Rate 3 Structural Benefiter / Non-Benefiter Analysis
All | CARE/FERA | Non-CARE/FERA

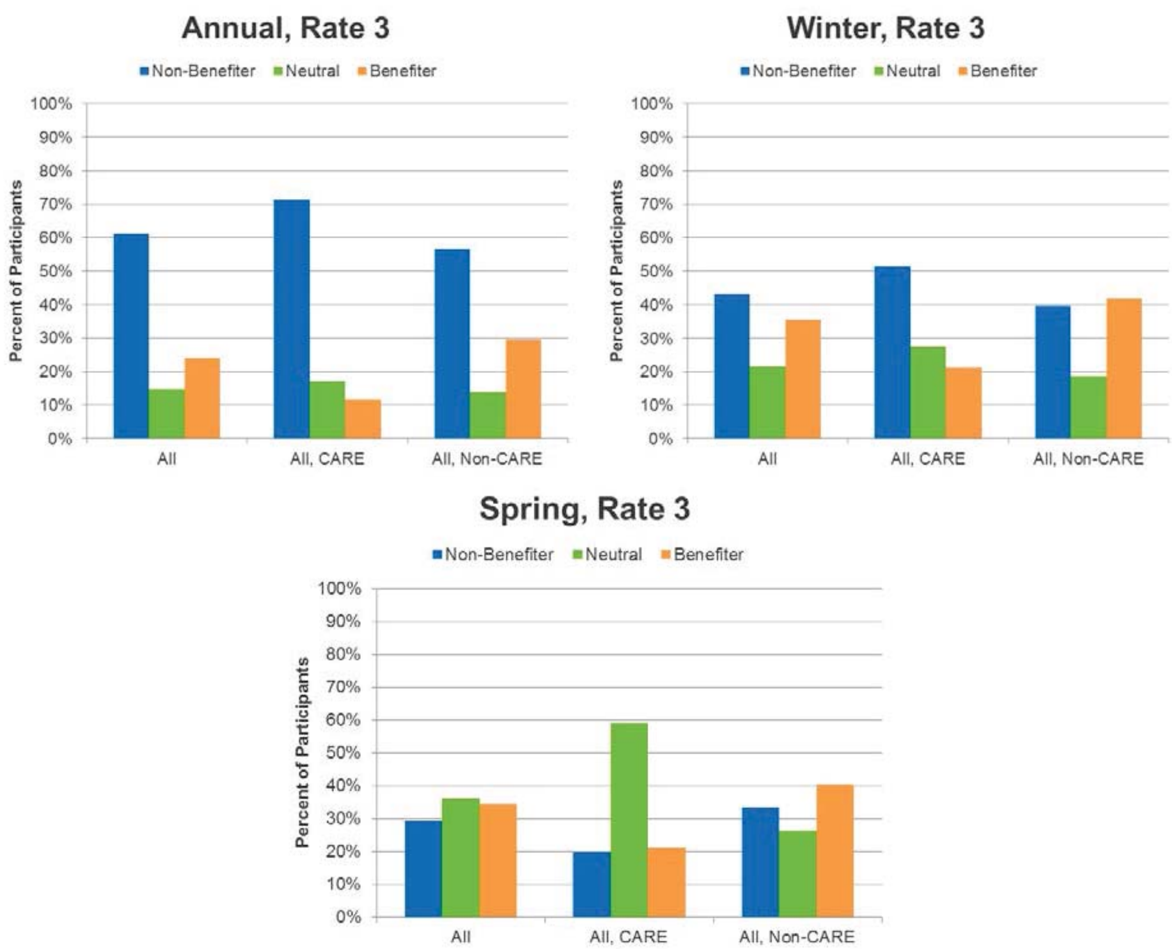


Figure 4.4-6 presents the outcome of the structural benefiter analysis for Rate 3 at the detailed segment level by climate region. In the winter period, the customers who are most likely to be structural benefiters are seniors in the hot climate region, and non-CARE/FERA customers in the hot, moderate, and cool regions. Again, this pattern is quite different from those for Rates 1 and 2. In the spring, nearly

half of non-CARE/FERA customers in the hot climate region are structural benefiters, while their CARE/FERA counterparts fall mostly in the neutral category.

Figure 4.4-6: Rate 3 Structural Benefiter / Non-Benefiter Analysis Detailed Segments by Climate Region

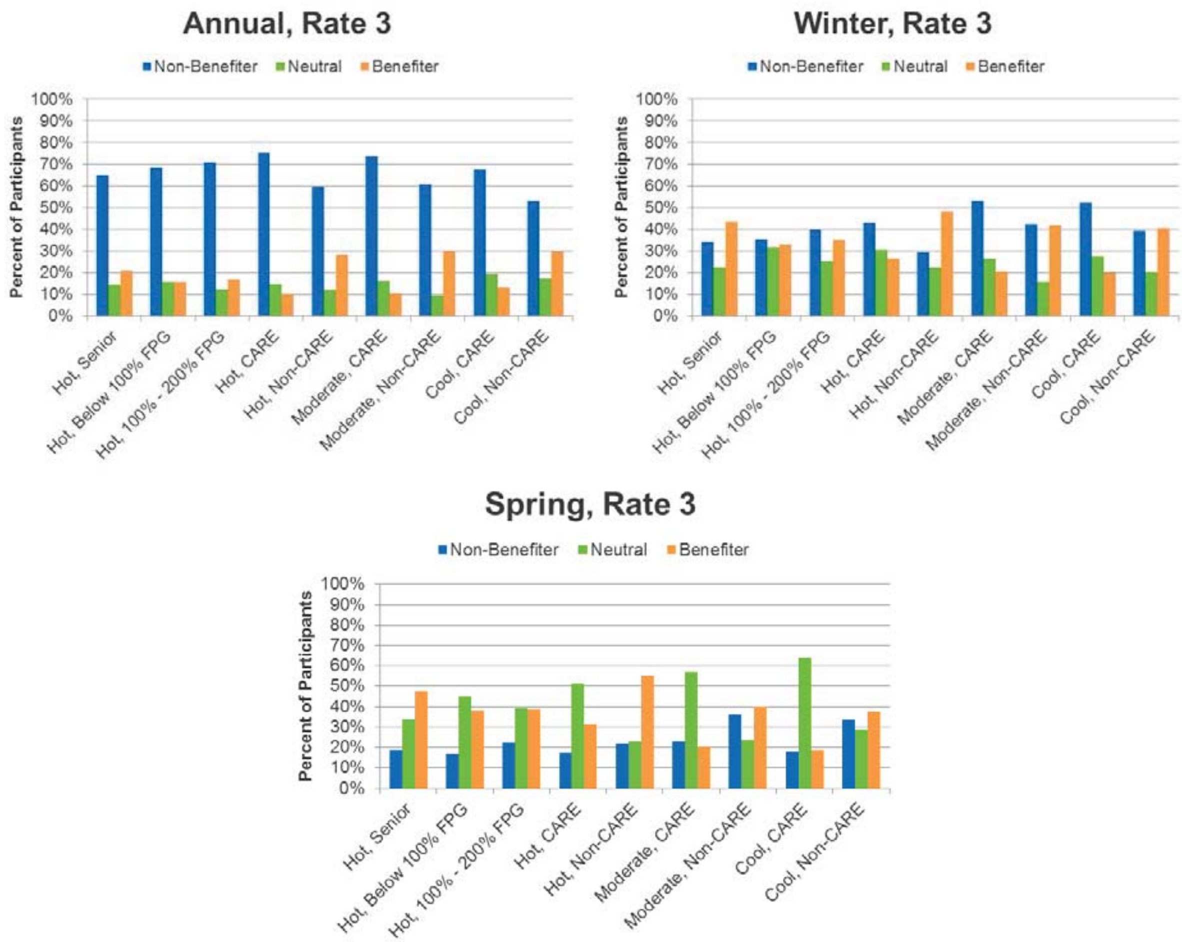
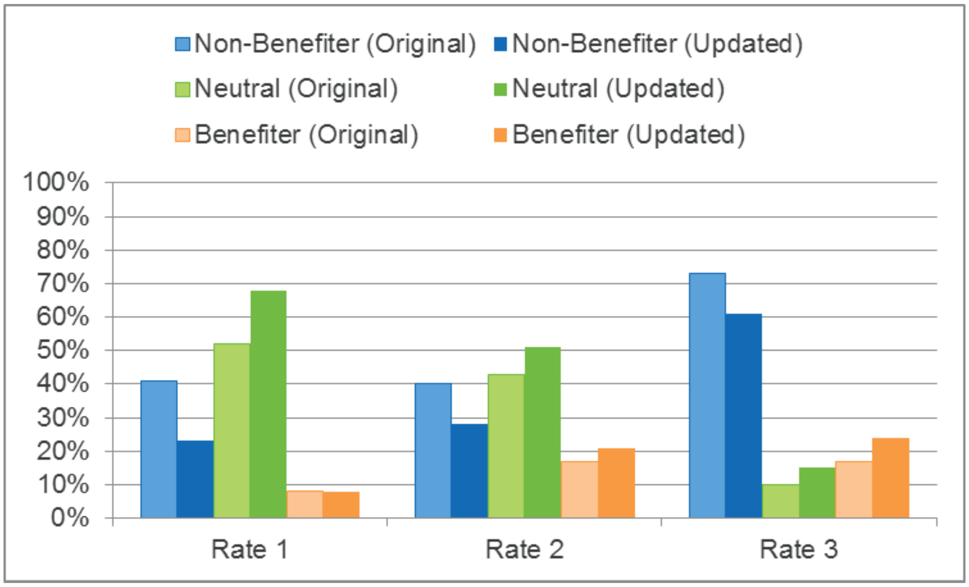


Figure 4.4-7 presents a comparison of the annual structural benefiter analysis using two versions of the pilot tariffs and the OAT. The lighter bars represent the outcome of the analysis based on the June 2016 tariffs, which were in effect at the launch of the pilot. The values here match what was reported in the First Interim Report. The darker bars are based on a combination of the original and January 2017 tariffs. The original tariff was used for the months of June through December, and the new tariffs were used for January through May. Incorporating the updated tariffs increases the number of customers in the neutral category and reduces the number of customers in the non-benefiter category. For a comparison of the two tariffs, see Appendix B.

Figure 4.4-7: Comparison of Structural Benefiter Analysis between Original and Updated Tariffs



4.4.2 Estimation of the Total Bill Impact Due to Differences in the Tariffs and Behavior Change

Total bill impacts experienced by customers on a TOU rate can be decomposed into two components: the structural impact, and the behavioral impact. As described above, the structural impact represents the change in customer bills based solely on the change in the underlying structure of the rate. In this case, it is the change from the OAT to the time-differentiated TOU pilot rates. The behavioral impact represents how customers change their energy usage in response to the new pricing structure of the rate—which includes higher prices in the afternoon and evening and lower prices at other times of day. During the winter period, nearly all customers on Rate 1 and Rate 2 experienced a decrease in their bills due to the change in tariff alone. Customers also had an opportunity to increase that reduction by changing their energy use behavior in response to the new price signals. As noted above, it is the combination of structural and behavioral bill impacts that produces the total bill impact experienced by the average study participant on each rate.

The results from this analysis represent the total annual cost and average monthly bill across the winter and spring. Three different bills were calculated for each customer segment:[50]

- **No Change in Behavior or Tariff [1]:** This represents what the treatment group bills would have been in the post-treatment period if they were on the OAT and had not changed their behavior
- **No Change in Behavior, Change in Tariff [2]:** This represents what the treatment group bills would have been in the post-treatment period if they were on the TOU rate and had not changed their behavior

[50] See section 3.2.3 in the First Interim Report for additional details on the methodology.

- **Change in Behavior and in Tariff [3]:** This represents what the treatment group bills were in the post-treatment period on the TOU rate with a change in behavior

Based on the components defined above, the following metrics were calculated:

- The difference between **[1]** and **[2]** is the structural bill impact (based on post-treatment usage after adjusting for any pretreatment difference between control and treatment customers);
- The difference between **[1]** and **[3]** is the bill impact due to structural differences in the rates, but mitigated by changes in behavior; and
- The difference between **[2]** and **[3]** is the amount customers were able reduce their bills by changing their behavior.

In the bill impact analysis, a major policy question was to better understand the relationship between the structural bill impacts, and how customers were able to respond. The outcome of this relationship is presented by the "Total Bill Impact" and "Percent Bill Impact" shown in the data table at the bottom of the figures below. These values represent the final outcome incorporating both the structural change, and the customer's behavioral response. Results are organized by rate, climate region, and segment; similarly to the other bill impact analysis sections. For each rate, results are presented for the first year of the pilot, followed by winter (and for Rate 3, spring) estimates.

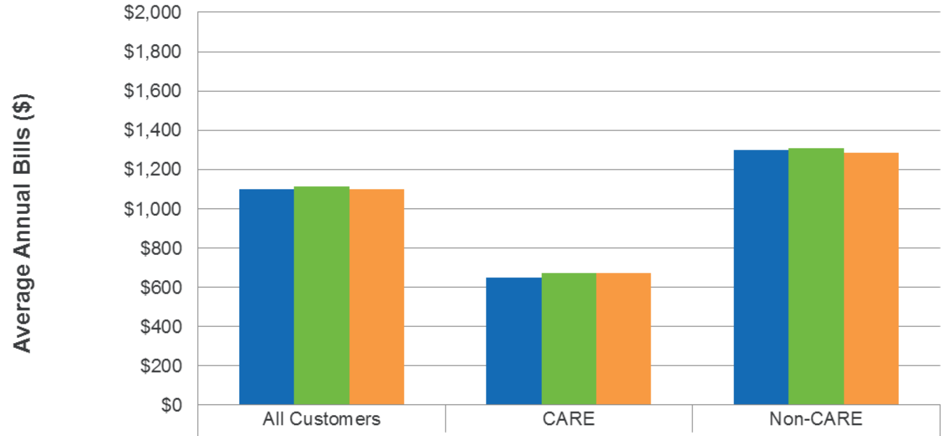
Annual

Figure 4.4-8 presents a set of three average annual bills (the total bill for twelve months, not the average monthly bills) as defined above for the first year of the pilot for all customers, CARE/FERA customers, and non-CARE/FERA customers on Rate 1. The blue bar represents a typical total yearly bill for a customer still on the OAT and not responding to a TOU rate— noted as "No Change in Behavior or Tariff." For the average customer on Rate 1, this dollar amount was $1,101 per month. The green bar represents what a typical total yearly bill would be for a customer who was billed on a TOU rate, but didn't change their energy use behavior— noted as "No Change in Behavior, Change in Tariff." This dollar amount is $1,112 for the average Rate 1 customer. The difference between the two values, $11, is the average increase a customer would see in their bills by changing from the OAT to Rate 1, and not changing their energy use behavior; this is also referred to as the customer's structural loss. The orange bar represents the average Rate 1 customer's total annual bill after factoring in the change in rate from the OAT to the Pilot Rate 1, and then also taking into account any changes in energy use behavior— noted as "With Change in Behavior and Tariff." This bill amount averaged $1,098 for the typical Rate 1 customer. Based on these values, it is possible to estimate the total change in the annual bill including both the change in tariff and in behavior, which, in this instance is a bill reduction of $3 per year (0.3%). This total change is calculated by subtracting the orange ($1,101) from the blue ($1,098).

Non-CARE/FERA customers experienced an average structural loss of $6 (0.4%). Through changes in energy use behavior they were able to offset all of it, resulting in a total annual reduction of $14 (1.1%) after factoring in both changes in the tariff and behavior. It should be noted that the bill impact from behavior change for non-CARE/FERA customers on Rate 1 was statistically significant.

Conversely, CARE/FERA customers were not able to mitigate their structural loss resulting in an annual bill increase of $21 or 3.3%.

Figure 4.4-8: Rate 1 Annual Bill Impact Due to Differences in the Tariff and Behavior Change[51]
All | CARE/FERA | Non-CARE/FERA

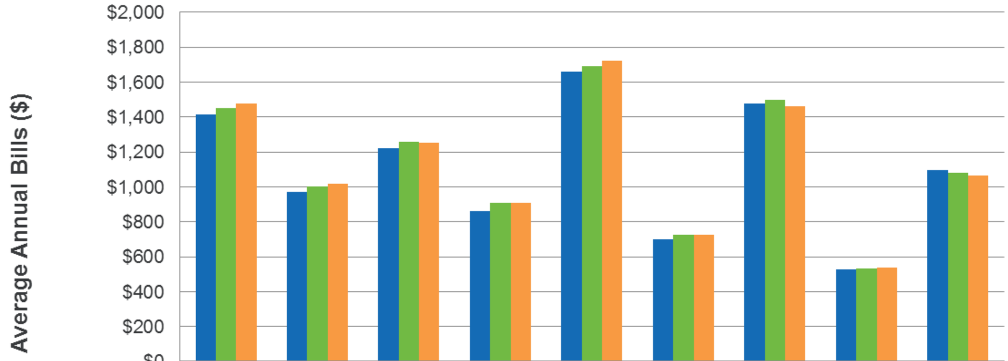


	All Customers	CARE	Non-CARE
	All		
No Change in Behavior or Tariff	$1,101	$651	$1,301
No Change in Behavior, Change in Tariff	$1,112	$671	$1,306
With Change in Behavior and Tariff	$1,098	$673	$1,286
Total Bill Impact	-$3	$21	-$14
Percent Bill Impact	-0.3%	3.3%	-1.1%

Figure 4.4-9 presents the three sets of average annual bills as defined above for the detailed segments by climate region on Rate 1. Non-CARE/FERA customers in the moderate and cool climate regions offset their structural bill increase and ultimately experienced lower total costs by 1.1% and 2.6%, respectively. All other customer segments faced higher costs over the course of the first year, with increases between 1.8% and 5.4%.

[51] Unlike for load impacts, where negative values mean loads went up relative to the reference load, here a negative value means bills fall relative to what they would under the OAT.

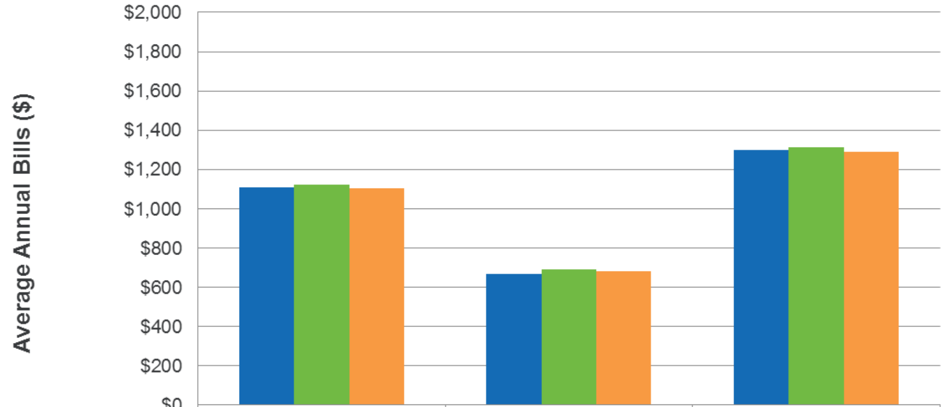
Figure 4.4-9: Rate 1 Annual Bill Impact Due to Differences in the Tariff and Behavior Change Detailed Segments by Climate Region



	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$1,415	$971	$1,220	$861	$1,661	$701	$1,477	$526	$1,095
No Change in Behavior, Change in Tariff	$1,453	$1,004	$1,258	$906	$1,693	$726	$1,500	$532	$1,082
With Change in Behavior and Tariff	$1,477	$1,017	$1,252	$908	$1,725	$725	$1,461	$536	$1,067
Total Bill Impact	$62	$46	$32	$47	$64	$24	-$16	$10	-$28
Percent Bill Impact	4.4%	4.7%	2.6%	5.4%	3.8%	3.4%	-1.1%	1.8%	-2.6%

Figure 4.4-10 presents the three sets of average annual bill for all customers, CARE/FERA customers, and non-CARE/FERA customers on Rate 2, which were similar to Rate 1. On average, customers faced structural losses of about $14, or 1.3%. Through changes in behavior, customers were able to mitigate this loss and ultimately did not face meaningful bill impacts. CARE/FERA customers faced total bill increases of about 2.2%, while non-CARE/FERA customers faced bill reductions equal to less than 1%.

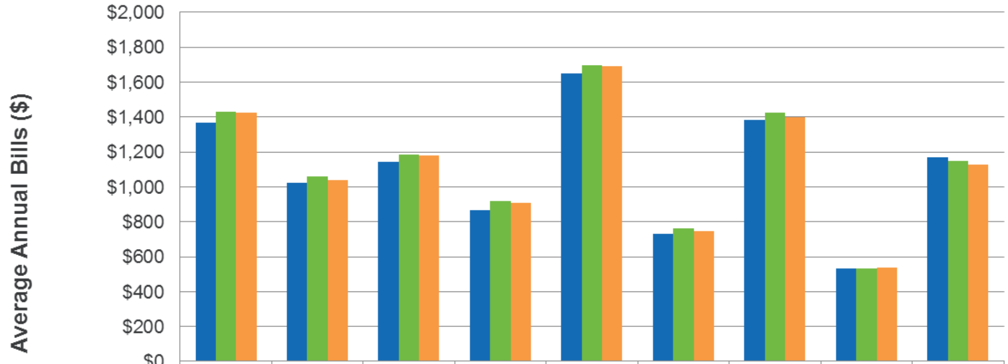
Figure 4.4-10: Rate 2 Annual Bill Impact Due to Differences in the Tariff and Behavior Change
All | CARE/FERA | Non-CARE/FERA



	All Customers	CARE	Non-CARE
		All	
No Change in Behavior or Tariff	$1,106	$669	$1,300
No Change in Behavior, Change in Tariff	$1,120	$690	$1,311
With Change in Behavior and Tariff	$1,104	$683	$1,290
Total Bill Impact	-$2	$15	-$10
Percent Bill Impact	-0.2%	2.2%	-0.8%

Figure 4.4-11 presents the three sets of average annual bills for the detailed segments by climate region on Rate 2. No customer segment was able to mitigate their small structural losses through changes in behavior, with the exception of non-CARE/FERA customers in the cool climate region. These customers experienced structural gains equal to about $20 or 1.7%. Through changes in behavior, they saved an additional $12, bringing their total annual bill reduction to $42 or 3.6%.

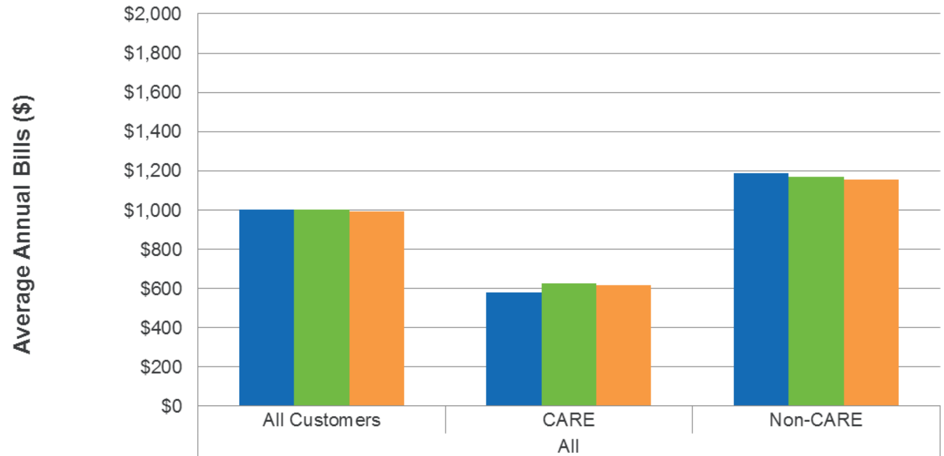
Figure 4.4-11: Rate 2 Annual Bill Impact Due to Differences in the Tariff and Behavior Change
Detailed Segments by Climate Region



	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$1,370	$1,021	$1,141	$868	$1,649	$731	$1,382	$535	$1,168
No Change in Behavior, Change in Tariff	$1,432	$1,060	$1,186	$919	$1,698	$763	$1,424	$534	$1,148
With Change in Behavior and Tariff	$1,426	$1,040	$1,179	$908	$1,691	$747	$1,401	$539	$1,126
Total Bill Impact	$57	$19	$38	$40	$42	$16	$19	$4	-$42
Percent Bill Impact	4.1%	1.9%	3.4%	4.6%	2.6%	2.2%	1.3%	0.8%	-3.6%

Figure 4.4-12 presents the three sets of total annual bills for the average customer and for CARE/FERA and non-CARE/FERA customers on Rate 3. On average, customers did not face significant structural bill impacts – only about $2 over the course of a year. This is similar to what was seen for Rate 1 and Rate 2. On average, CARE/FERA customers experienced structural losses of $45 or 7.8% and non-CARE/FERA customers faced structural gains equal to about $17 or 1.4%. After the first year of the pilot, CARE/FERA customers faced total bill increases of 6.9%, or about $40, while non-CARE/FERA customers faced bill reductions of 2.7% or $32.

Figure 4.4-12: Rate 3 Annual Bill Impact Due to Differences in the Tariff and Behavior Change[52]
All | CARE/FERA | Non-CARE/FERA

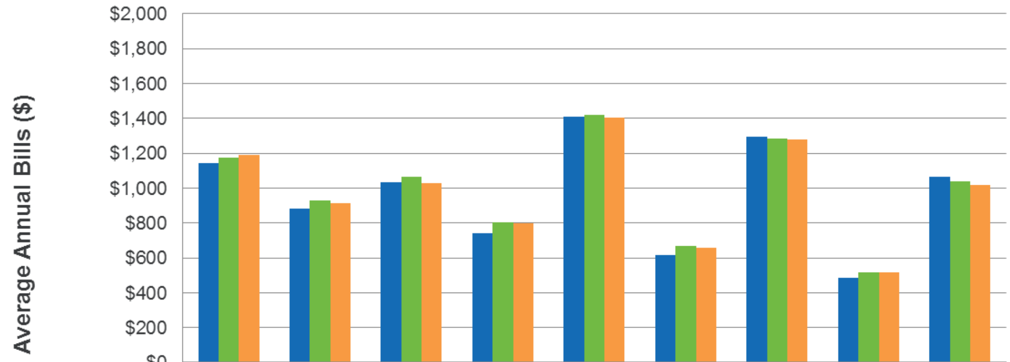


	All Customers	CARE	Non-CARE
No Change in Behavior or Tariff	$1,001	$579	$1,188
No Change in Behavior, Change in Tariff	$1,003	$624	$1,171
With Change in Behavior and Tariff	$992	$619	$1,157
Total Bill Impact	-$10	$40	-$32
Percent Bill Impact	-1.0%	6.9%	-2.7%

Figure 4.4-13 presents the three sets of annual bills for the average customer on Rate 3 by the detailed segments. Generally, structural bill impacts were greater than those experienced by customers on the other two rates. For example, CARE/FERA customers in the hot climate region had average annual structural losses of $60 or 8%. The same customers on Rate 1 faced structural losses of $45 or 5.2%. These customers were not able to mitigate all of their structural losses through behavior change and ultimately faced average annual increases of $56 or 7.6%.

[52] Estimates for Rate 3 do not include July 2016 due to a late start in enrollment.

Figure 4.4-13: Rate 3 Annual Bill Impact Due to Differences in the Tariff and Behavior Change
Detailed Segments by Climate Region



	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$1,144	$882	$1,032	$742	$1,408	$616	$1,295	$483	$1,064
No Change in Behavior, Change in Tariff	$1,176	$929	$1,066	$802	$1,418	$666	$1,282	$518	$1,038
With Change in Behavior and Tariff	$1,190	$914	$1,030	$799	$1,404	$655	$1,276	$519	$1,017
Total Bill Impact	$46	$32	-$2	$56	-$4	$39	-$18	$35	-$47
Percent Bill Impact	4.0%	3.6%	-0.2%	7.6%	-0.3%	6.4%	-1.4%	7.3%	-4.4%

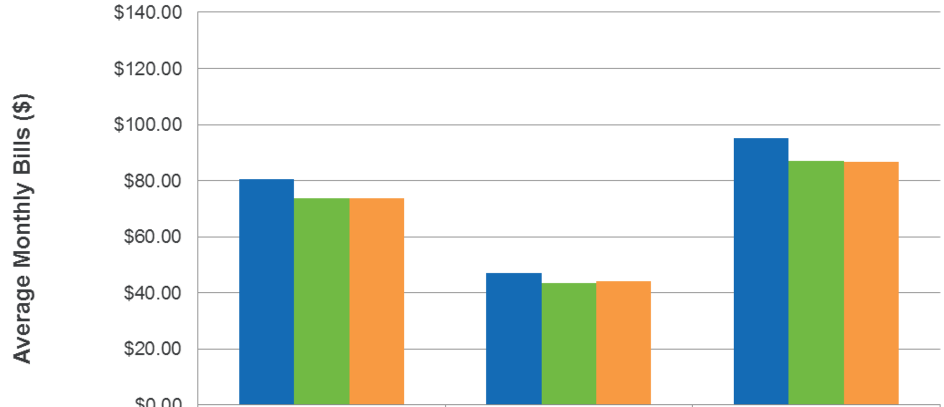
Winter and Spring

Figure 4.4-13 presents the three sets of average monthly bills for all customers and CARE/FERA and non-CARE/FERA customers on Rate 1. It should be noted that, unlike in the prior section, which presented the total change in the bill for the year, the values in this section represent average monthly bill impacts for winter and spring. As such, the total monthly bill impact of negative $6.64 for the average customer shown in Figure 4.4-14 represents a total savings of roughly $53 over the eight month winter period. On average, customers experienced structural gains equal to about $6.65 or 8.3% per month, on average. These customers did not have additional reductions in bills as a result of shifting energy use or reducing energy use overall.

Bill impacts due to behavior change were not statistically significant, so generally speaking total bill impacts were very similar to structural bill impacts for both CARE/FERA and non-CARE/FERA customers.

Figure 4.4-14: Rate 1 Winter Bill Impact Due to Differences in the Tariff and Behavior Change

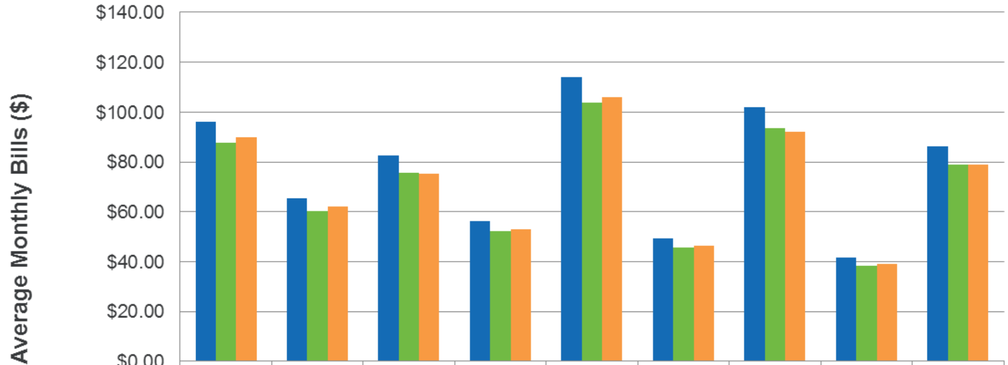
All | CARE/FERA | Non-CARE/FERA



	All Customers	CARE	Non-CARE
		All	
No Change in Behavior or Tariff	$80.38	$47.12	$95.07
No Change in Behavior, Change in Tariff	$73.72	$43.61	$87.03
With Change in Behavior and Tariff	$73.73	$44.27	$86.75
Total Bill Impact	-$6.64	-$2.85	-$8.32
Percent Bill Impact	-8.3%	-6.1%	-8.7%

Figure 4.4-15 presents the three sets of average winter monthly bills for the detailed segments by climate region for customers on Rate 1. Customers in each segment experienced total bill reductions during the winter months, with impacts falling between negative 5% and negative 9.5%. Bill impacts due to behavior change were not statistically significant, so generally speaking total bill impacts were very similar to structural bill impacts for each group of customers.

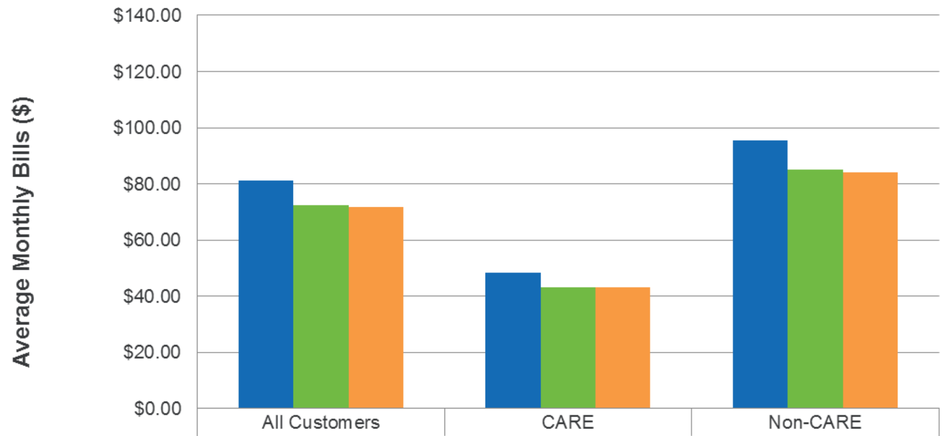
Figure 4.4-15: Rate 1 Winter Bill Impact Due to Differences in the Tariff and Behavior Change Detailed Segments by Climate Region



	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$96.14	$65.53	$82.52	$56.23	$114.10	$49.49	$101.84	$41.50	$86.16
No Change in Behavior, Change in Tariff	$87.57	$60.32	$75.58	$52.25	$103.90	$45.76	$93.42	$38.38	$78.84
With Change in Behavior and Tariff	$89.91	$62.22	$75.36	$52.88	$106.09	$46.37	$92.16	$39.10	$78.81
Total Bill Impact	-$6.22	-$3.31	-$7.16	-$3.35	-$8.02	-$3.12	-$9.67	-$2.40	-$7.35
Percent Bill Impact	-6.5%	-5.0%	-8.7%	-6.0%	-7.0%	-6.3%	-9.5%	-5.8%	-8.5%

Figure 4.4-16 presents the three sets of average winter monthly bills for customers on Rate 2, which are similar to those on Rate 1. In general, customers experience structural gains equal to about $8.77 (10.8%) in the winter months. Total bill reductions were equal to 9.44 or 11.6%, but the additional bill impacts as a result of behavior change were not statistically significant. Non-CARE/FERA customers experienced bill reductions that were slightly larger than those for CARE/FERA customers (11.9% versus 10.5%).

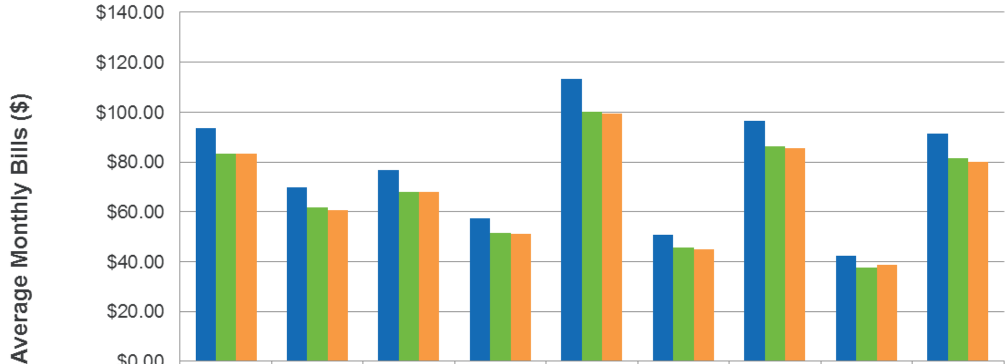
Figure 4.4-16: Rate 2 Winter Bill Impact Due to Differences in the Tariff and Behavior Change
All | CARE/FERA | Non-CARE/FERA



	All Customers	CARE	Non-CARE
		All	
No Change in Behavior or Tariff	$81.05	$48.22	$95.56
No Change in Behavior, Change in Tariff	$72.28	$43.03	$85.20
With Change in Behavior and Tariff	$71.61	$43.13	$84.20
Total Bill Impact	-$9.44	-$5.08	-$11.37
Percent Bill Impact	-11.6%	-10.5%	-11.9%

Figure 4.4-17 presents the three sets of average winter bills for the detailed segments by climate region. On average, customers experience structural gains in each segment. Non-CARE/FERA customers in the hot climate region faced the greatest structural gains on a percentage basis (11.6%) and the greatest total gains of 12.4% during the winter months.

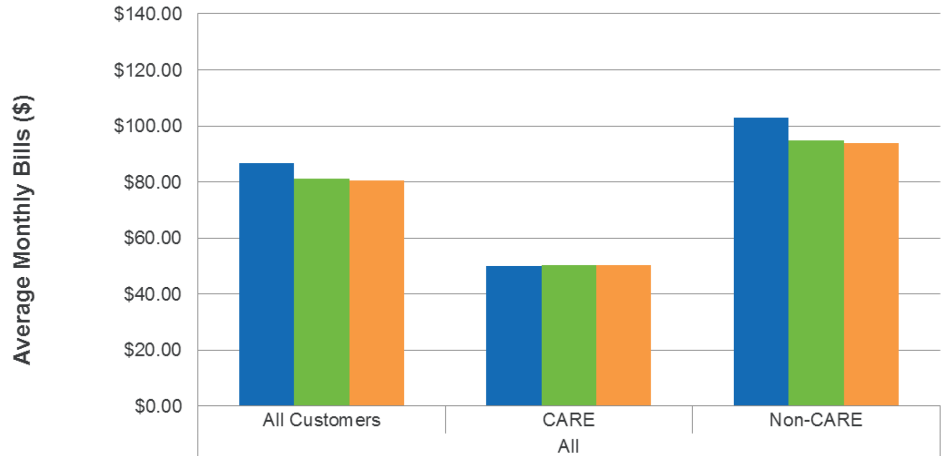
Figure 4.4-17: Rate 2 Winter Bill Impact Due to Differences in the Tariff and Behavior Change Detailed Segments by Climate Region



	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$93.40	$69.85	$76.70	$57.42	$113.38	$50.89	$96.33	$42.24	$91.42
No Change in Behavior, Change in Tariff	$83.33	$61.85	$67.87	$51.38	$100.23	$45.51	$86.31	$37.56	$81.36
With Change in Behavior and Tariff	$83.48	$60.68	$68.09	$51.02	$99.36	$44.84	$85.62	$38.62	$80.09
Total Bill Impact	-$9.92	-$9.17	-$8.62	-$6.39	-$14.02	-$6.04	-$10.71	-$3.63	-$11.34
Percent Bill Impact	-10.6%	-13.1%	-11.2%	-11.1%	-12.4%	-11.9%	-11.1%	-8.6%	-12.4%

Figure 4.4-18 presents the three sets of average winter monthly bills for customers on Rate 3. Recall that in Section 4.4.1, nearly half of the customers on Rate 3 are structural non-benefiters, but below the average customer faced a structural gain. This is because, while most customers would experience bill increases, those that face bill reductions experience large savings. This brings the average winter structural bill impact down to negative $5.45 or 6.3%. The total bill impact after changes in behavior is equal to a reduction of $6.13 or 7.1%. CARE/FERA customers experienced structural losses that they were not able to mitigate through changes in behavior; this behavioral impact was very small and not statistically significant.

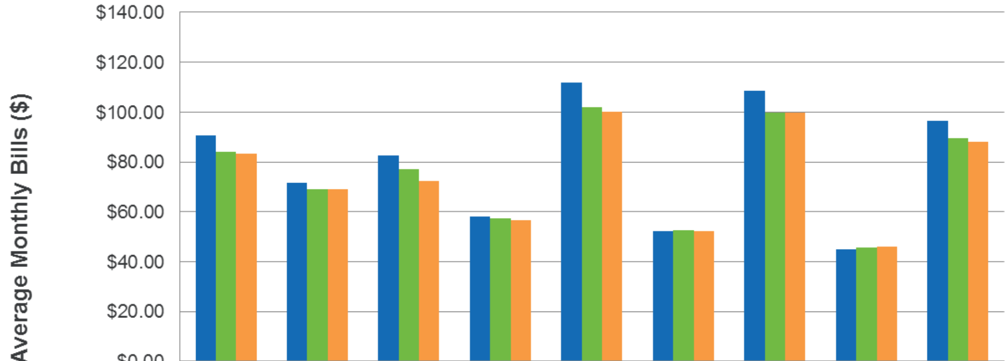
Figure 4.4-18: Rate 3 Winter Bill Impact Due to Differences in the Tariff and Behavior Change
All | CARE/FERA | Non-CARE/FERA



	All Customers	CARE	Non-CARE
No Change in Behavior or Tariff	$86.63	$50.07	$102.79
No Change in Behavior, Change in Tariff	$81.19	$50.38	$94.80
With Change in Behavior and Tariff	$80.51	$50.26	$93.87
Total Bill Impact	-$6.13	$0.19	-$8.92
Percent Bill Impact	-7.1%	0.4%	-8.7%

Figure 4.4-19 presents the three sets of average winter monthly bills for the detailed segments by climate region for Rate 3. As with the territory as a whole, the average customer in each segment faced a small structural gain, even though most customers fall into the non-benefiter category in the pretreatment period. The exceptions are CARE/FERA customers in the moderate and cool climate regions, who face trivial structural loses.

Figure 4.4-19: Rate 3 Winter Bill Impact Due to Differences in the Tariff and Behavior Change
Detailed Segments by Climate Region

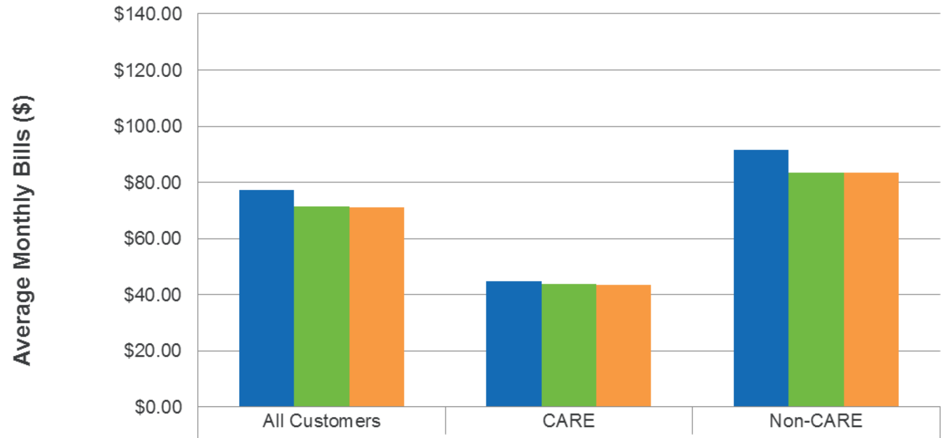


	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$90.74	$71.76	$82.63	$58.15	$111.77	$52.20	$108.59	$45.03	$96.63
No Change in Behavior, Change in Tariff	$83.97	$69.11	$77.08	$57.27	$101.80	$52.52	$99.78	$45.76	$89.65
With Change in Behavior and Tariff	$83.49	$69.06	$72.45	$56.78	$100.13	$52.13	$99.82	$46.05	$88.14
Total Bill Impact	-$7.25	-$2.69	-$10.18	-$1.37	-$11.64	-$0.07	-$8.77	$1.02	-$8.49
Percent Bill Impact	-8.0%	-3.8%	-12.3%	-2.4%	-10.4%	-0.1%	-8.1%	2.3%	-8.8%

Figure 4.4-20 presents the three sets of average spring monthly bills for customers on Rate 3, for all customers and for CARE/FERA and non-CARE/FERA customers separately. Non-CARE/FERA customers experienced structural gains of over $8 per month, on average, which is equal to about 8.9%. Though the bill impacts due to changes in behavior were not statistically significant, their total bill reductions were equal to $8.37 or 9.1%, on average. The total bill reductions for CARE/FERA customers were much smaller but still statistically significant, about 2.7% or $1.19 per month.

Figure 4.4-20: Rate 3 Spring Bill Impact Due to Differences in the Tariff and Behavior Change

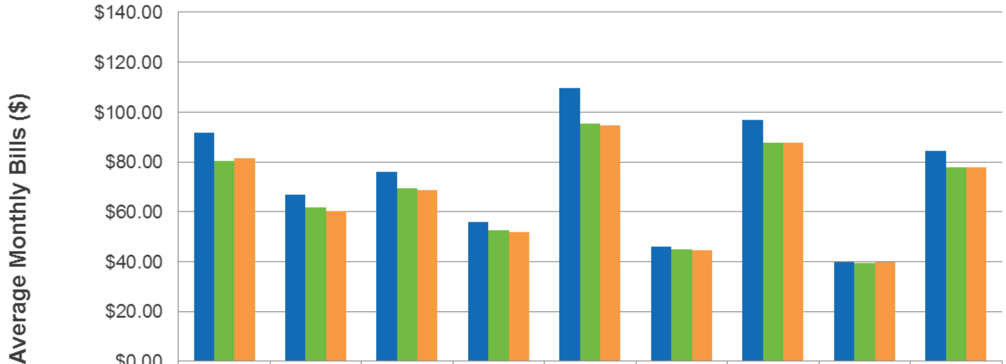
All | CARE/FERA | Non-CARE/FERA



	All Customers	CARE	Non-CARE
		All	
No Change in Behavior or Tariff	$77.32	$44.82	$91.68
No Change in Behavior, Change in Tariff	$71.36	$43.85	$83.51
With Change in Behavior and Tariff	$71.15	$43.63	$83.31
Total Bill Impact	-$6.17	-$1.19	-$8.37
Percent Bill Impact	-8.0%	-2.7%	-9.1%

Figure 4.4-21 presents the three sets of average spring monthly bills for the detailed segments by climate region. Each customer segment experienced statistically significant bill reductions, with the exception of CARE/FERA customers in the cool climate region. Non-CARE/FERA customers in the hot climate region had the greatest bill reductions on a percentage and absolute basis, about 13.6% or $14.92.

Figure 4.4-21: Rate 3 Spring Bill Impact Due to Differences in the Tariff and Behavior Change Detailed Segments by Climate Region



	Hot					Moderate		Cool	
	Senior	Below 100% FPG	100% - 200% FPG	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$91.66	$67.05	$76.02	$55.92	$109.47	$45.92	$96.71	$39.82	$84.32
No Change in Behavior, Change in Tariff	$80.21	$61.82	$69.29	$52.60	$95.55	$45.11	$87.68	$39.51	$77.97
With Change in Behavior and Tariff	$81.61	$60.44	$68.66	$51.75	$94.55	$44.63	$87.80	$39.76	$77.67
Total Bill Impact	-$10.05	-$6.61	-$7.35	-$4.17	-$14.92	-$1.29	-$8.92	-$0.06	-$6.65
Percent Bill Impact	-11.0%	-9.9%	-9.7%	-7.5%	-13.6%	-2.8%	-9.2%	-0.1%	-7.9%

4.4.3 Change in the Distribution of Bill Impacts Due to Behavior Change

The third analysis presents the distribution of bill impacts[53] for customers with and without behavioral change on an annual basis, and is designed to show how the distribution shifts when customers respond to the rates by changing behavior. Similar to the other analyses, impact distributions are based on the first year of the pilot.[54] Customers were segmented into ranges of bill impacts. The percentage of customers in each $10 increment from negative $100 to positive $100 per month was determined with and without behavior change. The underlying calculations used to develop the distributions are based on of a difference-in-differences approach that compares the treatment and control customers based on both pre- and post-treatment bill impacts.[55]

The two distributions are presented on a line graph, with the height of the line at any given $10 increment representing the percentage of customers experiencing a bill impact of the corresponding dollar amount. In this case, the bill impact is measured as the difference between the TOU bill and the OAT bill. If the line for the group with changes in behavior is to the left of the line representing the group with no change in behavior, it shows that at least some customers were able to modify their energy usage such that they had lower total bill impacts compared to if they had not changed their behavior.

[53] Bill impacts without behavior change represent the structural bill impact distribution; bill impacts with behavior change show how behavioral impacts affect the structural bill impact distribution.

[54] Rate 3 estimates do not include July 2016.

[55] See Section 3.2.4 in the First Interim Report for additional details on the methodology.

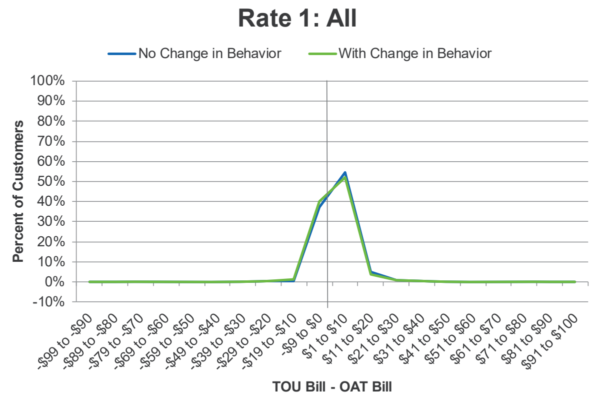
Figure 4.4-22 presents the distribution of annual bill impacts with and without energy use behavior change. The blue line represents the structural bill impacts that result when customers are billed on the TOU rate and do not change their energy use behavior. The green line shows the total bill impacts when customers have responded to the TOU rate and, in some cases, changed their energy use behavior. Bill impacts are calculated as the difference between the TOU bill and the OAT bill. Each point along the line graph represents the percentage of customers within a specific bill impacts bin or range. For example, on Rate 1, approximately 5% of the customers have a structural bill impact between $11 and $20 per month—the blue line. In other words, approximately 5% of the Rate 1 customers would experience an increase of $11 to $20 per month on Rate 1 compared to the OAT without changing their behavior. The green line represents the bill impacts when customers have had the opportunity to respond to the TOU rate. In this case, the percent of customers experiencing an increase of $11 to $20 per month on Rate 1 compared to the OAT is 4%, showing a slight decrease.

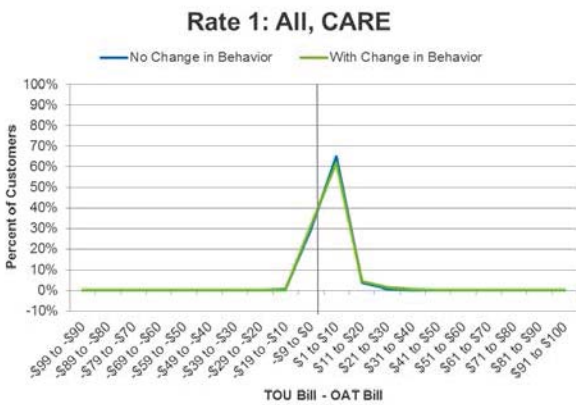
It is important to note that customers could move up or down through the incremental impact bins, and could potentially move more than one bin—meaning that a customer could potentially experience a bill increase due to their behavioral response, or they could jump down several bins and go from a $31 to $40 per month bill impact down to $11 to $20 impact, for example.

As noted in the previous two sections, annual bill impacts were small, and most customers experienced trivial structural losses over the course of the year. Without changes in behavior, about 55% of customers would expect bill impacts of $1 to $10. Through changes in behavior, 52% of customers fall in this category. With the increase in the percent of customers with bill reductions of $0 to $9, it appears that customers were able to mitigate some of their structural losses.

Figure 4.4-22: Rate 1 Change in the Distribution of Bill Impacts Due to Behavior Change
All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0%	0%
-$89 to -$80	0%	0%
-$79 to -$70	0%	0%
-$69 to -$60	0%	0%
-$59 to -$50	0%	0%
-$49 to -$40	0%	0%
-$39 to -$30	0%	0%
-$29 to -$20	1%	0%
-$19 to -$10	1%	1%
-$9 to $0	37%	40%
$1 to $10	55%	52%
$11 to $20	5%	4%
$21 to $30	1%	1%
$31 to $40	0%	1%
$41 to $50	0%	0%
$51 to $60	0%	0%
$61 to $70	0%	0%
$71 to $80	0%	0%
$81 to $90	0%	0%
$91 to $100	0%	0%





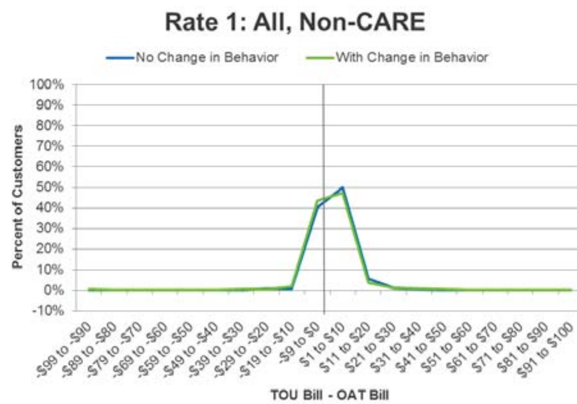
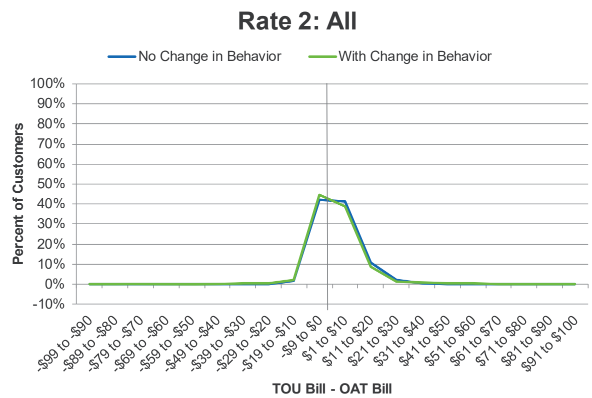
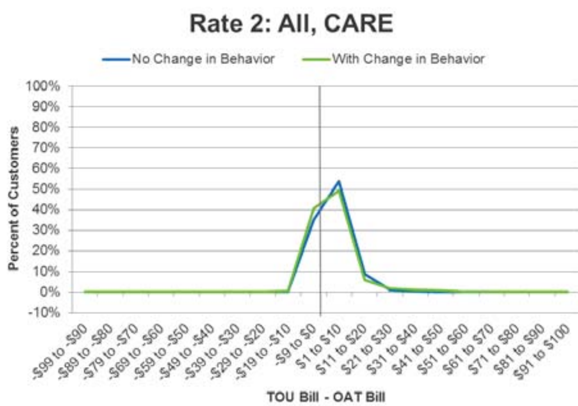


Figure 4.4-23 presents the distributions of bill impacts for customers on Rate 2, which are similar to those for Rate 1. Without changes in behavior, 41% of customers would experience bill impacts between $1 and $10 per month, on an annual basis. With changes in behavior, this is reduced to 39%. The distributions for CARE/FERA and non-CARE/FERA customers are similar in that just over half of customers face small bill increases, both with and without changes in behavior.

Figure 4.4-23: Rate 2 Change in the Distribution of Bill Impacts Due to Behavior Change
All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0%	0%
-$89 to -$80	0%	0%
-$79 to -$70	0%	0%
-$69 to -$60	0%	0%
-$59 to -$50	0%	0%
-$49 to -$40	0%	0%
-$39 to -$30	0%	0%
-$29 to -$20	0%	0%
-$19 to -$10	2%	2%
-$9 to $0	42%	45%
$1 to $10	41%	39%
$11 to $20	11%	9%
$21 to $30	2%	2%
$31 to $40	1%	1%
$41 to $50	0%	1%
$51 to $60	0%	0%
$61 to $70	0%	0%
$71 to $80	0%	0%
$81 to $90	0%	0%
$91 to $100	0%	0%





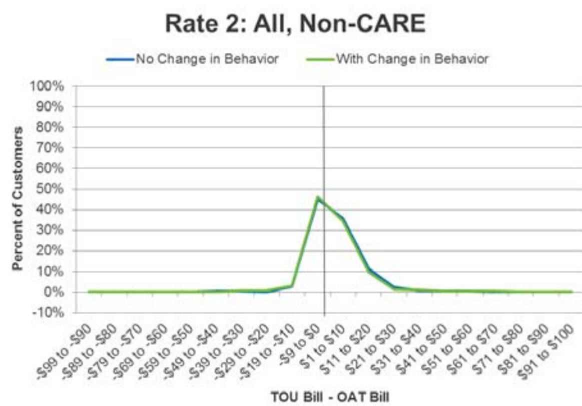
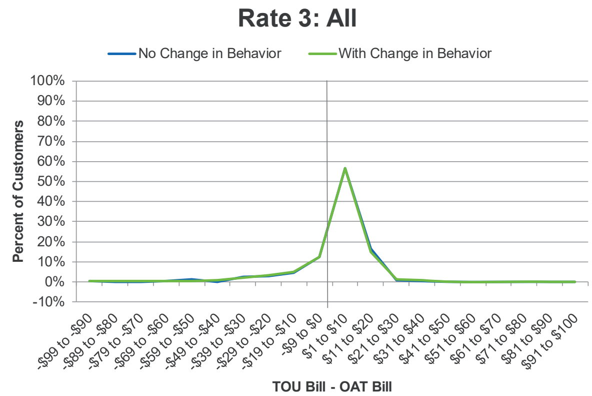
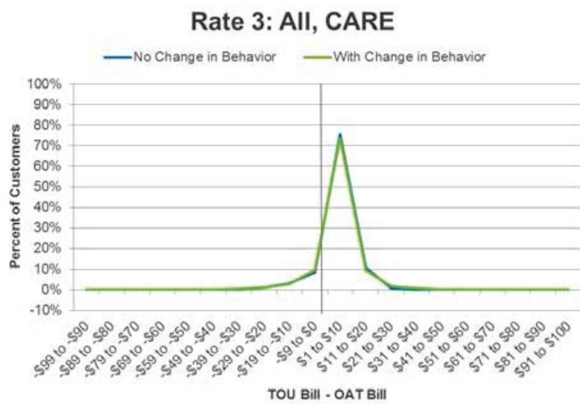


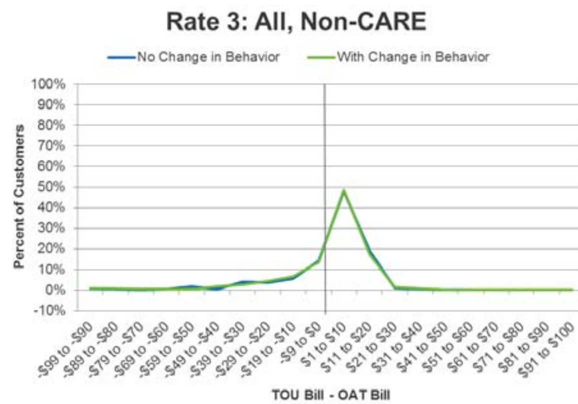
Figure 4.4-24 presents the distributions of bill impacts with and without behavior change for customers on Rate 3. The distributions are very different from those for the other two rates in that more customers face structural losses (about 75%) but there are more customers in the higher bill savings bins. For example, 1% of customers could experience monthly bill reductions of $50 to $59 on Rate without changes in their behavior. The shift in the distribution is small when customers change their behavior.

Figure 4.4-24: Rate 3 Change in the Distribution of Bill Impacts Due to Behavior Change
All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0%	0%
-$89 to -$80	0%	0%
-$79 to -$70	0%	0%
-$69 to -$60	0%	0%
-$59 to -$50	1%	0%
-$49 to -$40	0%	1%
-$39 to -$30	3%	2%
-$29 to -$20	3%	3%
-$19 to -$10	5%	5%
-$9 to $0	12%	12%
$1 to $10	56%	57%
$11 to $20	17%	15%
$21 to $30	1%	1%
$31 to $40	0%	1%
$41 to $50	0%	0%
$51 to $60	0%	0%
$61 to $70	0%	0%
$71 to $80	0%	0%
$81 to $90	0%	0%
$91 to $100	0%	0%







4.5 Synthesis for SCE Pilot

This section compares input from the load impact analysis, the bill impact analysis and the survey analysis. The objective of these comparisons, at least in part, is to determine if the information and conclusions observed for individual metrics are supported by findings from other metrics or, alternatively, findings for one metric contradict those for another metric. We also look for clues from the survey findings that might help explain why load or bill impacts for one rate differ from those for other rates.

Readers are referred to the beginning of Section 3.5 for an important caution when interpreting these results—namely that given the large samples underlying the survey analysis, statistically significant differences may not reflect meaningful differences from a policy perspective.

4.4.1 Synthesis

Table 4.5-1 through Table 4.5-3 summarize some of the relevant findings from the load impact, bill impact and survey analysis. Readers are directed to Section 3.5.1 for an explanation of the variables and symbols contained in the tables. As a reminder, unlike with PG&E where two pilot rates had two pricing periods and one had three, SCE's pilot Rates 1 and 2 had three pricing periods on weekdays and two on weekends. Rate 3 had two pricing periods on winter weekdays, and three pricing periods on spring weekdays and weekends in the winter and spring. The shoulder periods for all three period rates were long, beginning at 8 AM for two of the rates and at 11 AM for the third. Also, Rate 3 has no baseline credit whereas Rates 1 and 2 do.

Non-CARE/FERA Customers

Non-CARE/FERA customers in the hot climate region tended to have smaller peak period reductions compared to customers in the moderate and cool climate regions in the winter. This pattern of smaller impacts in the hot climate region is consistent with results from the first summer as well. It should be noted that in the winter, the hot climate region is in many cases the coldest climate region. With the inclusion of the high desert, the hot climate region experiences some of the most extreme temperature swings between seasons and by time of day. Average peak period impacts for non-CARE/FERA customers ranged from not statistically significant in the hot climate region on rate 1 to 4.7% in the cool climate region on rate 3. When comparing against summer impacts, the hot climate region produced winter impacts that were approximately half the size of the summer impact. The moderate and cool regions produced winter impacts that were approximately 80% of the summer impacts, in percentage terms.

On average, non-CARE/FERA Rate 1 customers tended to produce smaller winter impacts compared to Rate 2 or 3 customers. However, some of this may be driven specifically by the lack of impacts from the hot climate region on Rate 1. In the winter, Rate 1 has the longest peak period, the highest peak to off peak price ratio, and a peak period price similar to Rate 2—which would presumably result in larger impacts.

When comparing customers in the hot climate region on Rate 1 with those on Rate 3, it is important to remember that Rate 3 had a lower peak period price than Rates 1 and 2, and also had a relatively flat peak to off peak price ratio. However, Rate 3 didn't have the baseline credit of approximately $0.10 per kWh, which effectively lowered the prices for all pricing periods on Rates 1 and 2 until the customer reached 100% of the baseline usage allocation. This results in a situation where Rate 3 has the highest price across all pricing periods, and a minimal price differential, meaning that customers may be more inclined to reduce usage across the entire day rather than focusing only in the peak periods, similarly to Rate 2. In the hot climate region, this resulted in Rate 3 customers having the largest peak period reductions of 2.3% and the greatest net annual kWh reduction of 0.8%.

Total annual bill impacts for non-CARE/FERA customers in the hot climate region ranged from a reduction of $4 on Rate 3 to an increase of $64 on Rate 1. Customers on Rates 1 and 2 were ineffective at making behavioral changes that offset the structural loss. Rate 3 customers started out with the smallest structural loss, but ultimately made the largest behavioral changes. Average annual bills decreased for non-CARE/FERA customers in the moderate and cool climate regions on Rates 1 and 3, and in the cool climate region on Rate 2.

Across all rates and climate regions, non-CARE/FERA population weighted peak period impacts in the winter were approximately two-thirds the magnitude of the summer, but all were statistically significant except for the Rate 1 hot climate region. This is an important finding as it shows customers are continuing to respond to the TOU rates. Non-CARE/FERA customers understood the rates better than nearly any other segment (as indicated by the very low percent that failed to identify at least one peak period hour on Rates 1 and 3). However, it is worth noting that on average, Rate 1 and 2 customers performed worse on being able to identify the highest price hours on the second survey compared to the first. Additionally, Rate 2 customers generally had much lower performance across all customer segments regarding identifying the highest price hours compared to Rates 1 and 3.

The non-CARE/FERA customers had a low percentage of customers having difficulty paying their bills compared to other segments, and also had the lowest satisfaction ratings for the rate plan and for SCE compared with any other segment. However, there were no cases in which the satisfaction levels were significantly lower relative to the control group. In some cases the satisfaction levels for both the rate and for SCE were actually higher for the treatment group compared to the control group in the moderate climate region.

CARE/FERA Customers

Across all rates in all climate regions (with the exception of the hot climate zone for Rate 1), CARE/FERA customers had lower reductions in winter peak period electricity use than non-CARE/FERA customers. Although, as reported in Sections 4.3.1 through 4.3.3, not all of the differences between CARE/FERA and non-CARE/FERA customers were statistically significant. Peak period impacts for CARE customers ranged from not statistically significant across all rates in the cool climate region to 1.9% in the hot climate region on rate 3. The hot climate region produced winter impacts that were approximately 70% of the summer impact, in percentage terms. The moderate region produced winter impacts were approximately 22% of the summer impacts. The cool climate region produced 3% impacts in the summer, and -0.1% impacts in the winter. It should be noted that performance varied quite significantly when calculated by rate rather than by climate region, with 0.2% peak savings on Rate 1, 0.6% savings on Rate 2, and 0.7% on Rate 3 for CARE customers. The difference between results by climate region and by rate are driven by the proportion of customers in each climate region, with significantly more customers residing in the moderate and cool climate regions where the impacts are smaller. When comparing summer to winter impacts by rate, the winter impacts range between 6% of the summer impacts on Rate 1 to 23% of the summer impacts on Rate 3.

The average CARE/FERA customer was an annual structural non-benefiter across all rates and climate regions, ultimately resulting in all CARE/FERA customers experiencing higher total annual electricity costs ranging from a low of a $4 increase for Rate 2 CARE/FERA customers in the cool climate regions to a high of $56 for Rate 3 customers in the hot climate region.

Table 4.5-1: Load Impacts, Bill Impacts, and Selected Survey Findings for SCE Rate 1

Climate	Segment	Load Impacts			Bill Impacts		Survey						
		Summer Peak Period Load Reduction %	Winter Peak Period Load Reduction %	Net Annual kWh Change %	Annual Total Bill Impact $	Annual Total Bill Impact %	Health Index (Range 0-10)	Bill Higher than Expected	Difficulty Paying Bills	Economic Index (Range 0-10)	Understanding TOU Pricing (None-Correct)	Satisfaction w/ Rate (11 pt. Scale)	Satisfaction w/ Utility (11 pt. Scale)
Hot	Non-CARE/FERA	1.1% ▼	-0.2% -	1.8% ▲	$64 ▲	3.8% ▲	1.9 ▼	23% -	22% -	2.2 -	11%	6.5 -	7.1 -
	CARE/FERA	1.8% ▼	0.5% -	0.3% ▼	$47 ▲	5.4% ▲	2.5 -	23% -	60% -	3.9 -	20%	7.3 -	7.9 -
Moderate	Non-CARE/FERA	5.5% ▼	3.3% ▼	2.2% ▼	-$16 ▼	1.1% ▼	2.0 -	19% ▼	24% -	2.2 -	14%	6.9 ▲	7.2 -
	CARE/FERA	3.3% ▼	0.6% -	-0.2% ▲	$24 ▲	3.4% ▲	2.5 -	24% -	57% -	3.7 -	23%	7.6 -	7.9 -
Cool	Non-CARE/FERA	5.8% ▼	1.1% ▼	0.6% ▼	-$28 ▼	2.6% ▼	2.2 -	22% -	20% -	2.1 -	12%	6.9 -	7.4 -
	CARE/FERA	2.4% ▼	-0.4% -	1.1% ▲	$10 ▲	1.8% ▲	2.2 ▼	18% -	60% -	3.7 -	18%	8.0 -	8.3 -

Table 4.5-2: Load Impacts, Bill Impacts, and Selected Survey Findings for SCE Rate 2

Climate	Segment	Load Impacts			Bill Impacts		Survey						
		Summer Peak Period Load Reduction %	Winter Peak Period Load Reduction %	Net Annual kWh Change %	Annual Total Bill Impact $	Annual Total Bill Impact %	Health Index (Range 0-10)	Bill Higher than Expected	Difficulty Paying Bills	Economic Index (Range 0-10)	Understanding TOU Pricing (None-Correct)	Satisfaction w/ Rate (11 pt. Scale)	Satisfaction w/ Utility (11 pt. Scale)
Hot	Non-CARE/FERA	2.9% ▼	1.5% ▼	0.2% ▼	$42 ▲	2.6% ▲	2.1 -	24% -	24% -	2.3 -	27%	6.5 -	7.0 -
	CARE/FERA	3.5% ▼	1.4% ▼	1.2% ▼	$40 ▲	4.6% ▲	2.7 -	24% -	67% -	4.1 -	37%	7.2 -	7.8 -
	Senior	4.1% ▼	1.1% ▼	0.4% ▼	$57 ▲	4.1% ▲	2.6 -	23% -	36% -	2.9 -	34%	7.0 -	7.5 -
	HH < 100% FPG	3.1% ▼	2.7% ▼	1.9% ▼	$19 ▲	1.9% ▲	2.8 -	27% -	59% -	3.9 -	35%	7.3 -	7.8 -
	100% FPG < HH < 200% FPG	N/A	N/A	N/A	$38 ▲	3.4% ▲	2.7 -	24% -	58% -	3.5 -	33%	6.7 -	7.4 -
Moderate	Non-CARE/FERA	5.6% ▼	3.1% ▼	1.1% ▼	$19 ▲	1.3% ▲	2.0 -	20% -	23% -	2.2 -	26%	6.9 ▲	7.4 ▲
	CARE/FERA	1.7% ▼	1.1% -	1.0% ▼	$16 ▲	2.2% ▲	2.5 -	22% -	58% -	3.6 ▼	44%	7.8 -	8.0 -
Cool	Non-CARE/FERA	4.2% ▼	2.2% ▼	1.2% ▼	-$42 ▼	3.6% ▼	2.0 -	20% -	19% -	2.0 -	28%	7.0 -	7.4 -
	CARE/FERA	4.6% ▼	-0.5% -	1.4% ▲	$4 ▲	0.8% ▲	2.5 -	20% -	61% -	3.7 -	40%	8.0 -	8.4 -

Table 4.5-3: Load Impacts, Bill Impacts, and Selected Survey Findings for SCE Rate 3

Climate	Segment	Load Impacts			Bill Impacts		Survey						
		Summer Peak Period Load Reduction %	Winter Peak Period Load Reduction %	Net Annual kWh Change %	Annual Total Bill Impact $	Annual Total Bill Impact %	Health Index (Range 0-10)	Bill Higher than Expected	Difficulty Paying Bills	Economic Index (Range 0-10)	Understanding TOU Pricing (None-Correct)	Satisfaction w/ Rate (11 pt. Scale)	Satisfaction w/ Utility (11 pt. Scale)
Hot	Non-CARE/FERA	3.0% ▼	2.3% ▼	0.8% ▼	-$4 -	0.3% -	2.3 -	30% -	23% -	2.3 -	7%	6.4 -	7.0 -
	CARE/FERA	-0.1% ▼	1.9% ▼	0.8% ▼	$56 ▲	7.6% ▲	2.5 -	29% -	70% ▲	4.2 -	19%	7.4 -	7.9 -
Moderate	Non-CARE/FERA	1.4% -	3.8% ▼	0.3% ▼	-$18 ▼	1.4% ▼	1.8 ▼	29% -	22% -	2.2 -	10%	6.5 -	7.1 -
	CARE/FERA	4.8% ▼	0.4% -	1.5% ▼	$39 ▲	6.4% ▲	2.9 -	25% -	60% -	3.9 -	20%	7.4 -	7.9 -
Cool	Non-CARE/FERA	4.3% ▼	4.7% ▼	1.7% ▼	-$47 ▼	4.4% ▼	2.1 -	30% ▲	18% -	2.0 -	6%	6.8 -	7.3 -
	CARE/FERA	2.0% ▼	0.5% -	-0.4% ▲	$35 ▲	7.3% ▲	2.5 -	24% -	62% -	3.7 -	18%	7.8 -	8.3 -

The Rate 3 hot climate region CARE/FERA customers were the only segment to have a statistically significantly higher percentage of TOU customers having difficulty paying their bill compared to control group customers. In all other segments and rates, a comparable percentage of treatment and control group customers expressed difficulty in paying bills. Generally speaking, CARE/FERA customers were not able to offset a significant portion of the structural bill increases, with the largest offset of 50% ($16) from Rate 2 customers in the moderate climate region.

The economic index for CARE/FERA customers was roughly twice as high as for non-CARE/FERA customers in all climate regions and for all rate options, including the control group. In short, CARE/FERA customers had higher economic index scores compared with non-CARE/FERA customers, but the increase in the economic index scores moving from the OAT to TOU rates is not statistically significant for any rate in any climate region.

Importantly, in spite of the above, CARE/FERA customers had higher satisfaction ratings for the TOU rates than non-CARE/FERA customers for all rates and climate regions. In all climate regions, none of the satisfaction ratings for CARE/FERA customers were statistically significantly lower than the control group ratings. CARE/FERA customers also had higher ratings for satisfaction with SCE than non-CARE/FERA customers in all climate regions for all rates.

Senior Households

Senior households in the hot climate region had load reductions in the peak period for the average weekday that were slightly lower compared to average reductions for the overall population in the hot region, as reported for Rate 2 in Section 4.3.2. The average peak period load impact of 1.1% is slightly smaller than the load impacts of the non-CARE/FERA group of 1.5% and the impacts from the CARE/FERA group with 1.4%. The net annual kWh change of 0.4% was between the values for non-CARE/FERA and CARE/FERA, suggesting the population of senior households responds to price signals in a manner consistent with the general population.

Total annual bill impacts are similar between senior households and the hot general population in percentage terms, reflecting the split between non-CARE/FERA and CARE/FERA customers. On Rate 2, 23% of senior households, along with around a quarter of the customers from other segments, indicated that their bills were higher than expected. However, this percentage was not statistically significantly different for the customers on TOU rates compared to the OAT. There was no statistically significant difference in the percent of seniors reporting difficulty in paying bills, or in the economic index, compared with the control group.

Senior households had a higher percentage of participants that could not identify any peak period hours (34%) compared with non-CARE/FERA customers (27%) in the hot region. However, they performed slightly better than the CARE/FERA customers (37%). Performance on the second survey declined from the first survey where 30% of senior households couldn't identify any of the peak periods. The percentage of customers not identifying any correct peak period hours tended to be higher in general for Rate 2 compared to the other rates.

Finally, satisfaction ratings by senior households for the rate plan (7.0) and for SCE (7.5) were somewhat higher than the ratings for the hot climate zone population as a whole (as calculated by a weighted average for CARE/FERA and non-CARE/FERA households, whose ratings were 6.7 and 7.3 respectively).

Seniors on TOU rates did not have statistically different satisfaction ratings for the rate plan or SCE compared with the control group.

Households with Incomes Below 100% of FPG

Households with incomes below 100% of FPG on Rate 2 in the hot climate region had the largest peak period load reductions in the winter for the hot climate region. The 2.7% winter impact was 87% of the summer percentage impact. This group also had the largest decrease in net annual kWh electricity use in the hot climate region, equal to almost 2%. Annual structural bill impacts averaged $39, and these customers were able to offset around half of the increase, or around $20, resulting in an average annual cost increase for this segment of $19 or 1.9%.

This segment had the highest score on the health index compared to other segments on Rate 2.[56] However, the score was not statistically different for the treatment group compared to the control group on this index.

59% of households with incomes below 100% of FPG reported that they had difficulty paying bills and this segment had the second highest economic index score (3.9) of any segment on Rate 2. However, the difference in the economic index for TOU customers compared with the control group was not statistically significant for customers on Rate 2. The percentage of treatment customers reporting difficulty paying bills was also not statistically different from the percent of control customers reporting difficulty. 27% of households with incomes below 100% of FPG stated they received bills higher than expected. However, this was not statistically significantly different from the control group.

Customers in this segment were among the highest percent of participants who could not identify any peak period hours among all segments on Rate 2. For Rate 2, this segment did not have statistically different levels of satisfaction with the rate or with SCE. Satisfaction was not measured for this segment on Rates 2 or 3.

4.4.2 Key Findings

Key findings pertaining to load impacts from the SCE pilots include:

1. Customers can and will respond to TOU rates with peak periods that extend well into the evening hours during the winter – peak period load reductions averaged roughly 1.4% for Rate 1, 2.0% for Rate 2, and 3.2% for Rate 3 across the service territory as a whole.
2. The average winter impact of 2.2% is slightly more than half the size of the load impact from the first summer of approximately 3.8%. However, there was significant variation in the relationship between summer and winter impacts across rates and customer segments.
3. For Rate 3, which has the same peak period prices in effect on weekends as on weekdays, the peak period load reductions are similar on the two day types– that is, customers can and will reduce loads on weekends in the winter.
4. There was a statistically significant reduction in net annual electricity use for all three rates - 0.6% for Rate 1, 0.8% for Rate 2, and 0.9% for Rate 3.

[56] This metric is not reported for Rates 1 or 3.

5. The pattern of winter load reductions across climate regions in both percentage and absolute terms was not consistent across rates and was quite different from the pattern seen in PG&E's service territory, which showed a significant decline in load reductions in both percentage and absolute terms moving from the hot to the cool climate regions. For SCE, peak period load reductions for customers on Rate 1 were largest in the moderate and cool regions and not significant in the hot region. For Rates 2 and 3, differences across climate regions were not always statistically significant.
6. Households who had previously purchased smart thermostats reduced winter peak period usage by approximately 4.7%, which was significantly higher compared to non-CARE/FERA population weighted load reductions of 1.8%. Nest offered its "Time of Savings" support service for the second summer, which could affect second summer impacts in the final report.
7. Unlike for PG&E's customers, where CARE/FERA customers generally had significantly lower peak period load reductions compared with non-CARE/FERA customers, the load impacts for CARE/FERA and non-CARE/FERA customers in SCE's service territory were not statistically significantly different in the hot climate regions.
8. Senior households on Rate 2 in the hot climate region had load impacts (1.1%) slightly lower compared to the hot climate region population as a whole (1.4%).
9. Households with incomes below 100% of FPG on Rate 2 in the hot climate region had a statistically significant reduction in the peak period of 2.7%, and a statistically significant decrease in net annual electricity use of 1.9%.

Key findings pertaining to bill impacts include:

1. Average monthly winter bills were lower under TOU rates than under the OAT for all customer segments and all climate regions (except for CARE/FERA customers in the cool climate region on Rate 3) – the average monthly bill decrease ranged from a low of $0.07 for CARE/FERA customers in the moderate climate region on Rate 3 to a high of $14.02 for non-CARE/FERA customers on Rate 2 in the hot climate region. This is driven in part by the fact that the TOU rates are seasonally differentiated (prices are lower in the winter than in the summer), whereas SCE's standard rate is not.
2. Average annual total bill impacts varied by rate and climate region. The average customer on Rate 1 and Rate 2 experienced slight decreases on an annual basis of $3 and $2, respectively. Average customers on Rate 3 experienced a slightly larger net decrease in annual bills of $10. However, the distribution of annual bill impacts varied significantly by climate region. The average customer from the moderate or cool climate regions across all rates experienced net annual total cost changes ranging from a decrease of $47 for non-CARE/FERA customers in the cool climate region on Rate 3 to an increase of $39 for CARE/FERA customers on Rate 3 in the moderate climate region. Non-CARE/FERA customers in the hot climate region on Rates 1 and 2 experienced annual net cost increases of $64 on Rate 1, and $42 on Rate 2. Rate 3 households saw bill decreases of $4. CARE/FERA customers in the hot climate region all experienced annual total bill increases between $0 and $56. Households below 100% of FPG and seniors on Rate 1 in the hot climate region also experienced net annual cost increases of $19 and $57, respectively.
3. Average bill increases due to the change in the tariff are reduced modestly by changes in usage behavior, but most segments were unable to come close to offsetting the structural change by changing usage behavior.

Key findings from the survey research include the following:

1. **Economic Hardship:** No SCE customer segment in any climate region had significantly higher average economic index scores when compared to the Control group. Rate 2 CARE/FERA customers and those eligible for CARE/FERA in the moderate region had lower economic index scores compared to the Control groups. Corroborating this finding, CARE/FERA customers in the moderate region also reported less difficulty paying their bills than control customers.
2. **Health Hardship:** No customer segment in any climate region had significantly higher average health index scores when compared to the Control group. Rate 1 non-CARE/FERA customers in the hot region and CARE/FERA customers in the cool region, and Rate 3 non-CARE/FERA customers in the moderate region reported lower health index scores compared to the Control groups. In addition, about 6% more Rate 1 CARE/FERA customers and Rate 1 and 2 customers on or eligible for CARE/FERA in the hot climate region sought medical attention due to excessive cold when compared to their Control groups.57 In contrast, about 10% fewer Rate 1 CARE/FERA and Rate 2 non-CARE/FERA customers in the moderate region, and Rate 2 customers on or eligible for CARE/FERA in the cool region sought medical attention due to excessive heat compared to the Control groups.58
3. **Satisfaction:** Across non-CARE/FERA and senior customer segments, satisfaction with their rate and with SCE was the same or higher for TOU customers when compared to Control group customers, which is a reversal of trends from the first survey. Most CARE/FERA customer segments, however, reported slightly lower levels of satisfaction compared to the Control groups, but none were statistically significant. These differences are small and not necessarily meaningful. For example, non-CARE/FERA customers on Rate 1 in the moderate region gave an average rating of 7.4, while control group customers' average rating is 7.0. This 0.4 increase is statistically significant but is not necessarily meaningful. On average, satisfaction ratings are slightly higher or the same for Rate group customers, and are slightly lower for Control group customers, compared to results from the first survey.
4. **Bill protection, understanding of rates, and actions taken:**
    - About half of customers reported receiving a letter from SCE mentioning their bill protection and about two-thirds reported knowing when their bill protection ends. When customers were asked if they understand bill protection, 87% or more reported they did.
    - Though agreement ratings for "rate is easy to understand" were high (generally between 6.8 and 7.6), customer's understanding of their rates indicate a disconnect between customer's rating of understandability and actual understanding (with 7% to 40% of customers unable to identify peak hours). The percent of customers who could not identify any peak period hours was much higher for CARE/FERA customers than for non-CARE/FERA customers. In addition, the percentage of Rate 3 customers who selected over 50% of the correct peak hours improved while the percentage of Rate 1 and 2 customers declined compared to results from the first survey. Also, more than

[57] These customers all had electric heating.

[58] These customers all had air-conditioning and a household member with a disability that requires cooling.

two-thirds of customers selected the correct answer when asked if their rate is higher, lower, or the same in the summer vs. in the winter.

- When asked if customers agreed that peak and off-peak times were easy to remember, Rate 1 customers provided lower agreement ratings than Rate 2 and 3 customers. However, Rate 3 customers were most likely to select over half of the correct peak hours compared to Rate 1 and 2 customers.[59]
- Customers on TOU rates were more likely to take time-specific actions than customers in the control condition. For example, while a similar proportion of customers from control and rate groups indicated they turned off their lights to conserve energy, a larger proportion of treatment customers indicated they shifted doing laundry and running the dishwasher during peak hours. This trend suggests that while fewer rate customers understood the nuances of their rates, they did know and take actions that helped them shift use. This trend is particularly striking for non-CARE/FERA customers in the hot region, but less prominent for CARE/FERA and less than 100% FPG customers in the hot region.

Overall findings and conclusions include:

- Customers continued to respond to the TOU price signals at the end of a full year. As expected, the load impacts were lower during the winter compared to the first summer. Load impact persistence will be examined in the final report once data from the second summer becomes available.
- The majority of customers across all three rates experienced slight net annual total bill decreases. However, customers in the hot climate regions and CARE/FERA customers were more likely to experience net annual bill increases.
- For seniors and households with incomes below 100% of FPG, there was no statistically significant increase in economic or health index scores after a full year on Rate 2 (the only rate where measurements are reported for this segment).
- Evidence from the second survey still suggests that the education and outreach to low income customers (CARE/FERA and households with incomes below 100% of FPG) did not generate the same level of understanding of TOU rates as it did for non-low income customers. This could partly result from the fact that more CARE/FERA customers have English as a second language but there may be other reasons. In some cases the level of understanding between the first and second survey went down, such as with Rate 2. The level of understanding went up for Rate 3, and was mixed for Rate 1. Nexant continues to recommend that this issue be carefully addressed and studied further in the upcoming default pilots where there is a much greater emphasis on and opportunity to test ME&O alternatives for all segments.

[59] These survey items were coded much like a test with partial credit; customers would get 50% right if they could identify half of the peak hours for their test rate.

5 SDG&E Evaluation

This report section summarizes the attrition, load impacts, and bill impacts for the first year of SDG&E's pilot, with specific attention to the winter months and annual savings. Load and bill impacts from the first summer season can be found in the First Interim Report.

5.1 Summary of Pilot Treatments

Figure 5.1-1 and Figure 5.1-2 summarize the two tariffs that are being tested in the SDG&E service territory. Both tariffs have peak periods that include the evening hours from 4 to 9 PM. The rates have changed since the launch of the pilot, and the figures represent the tariffs that were in effect in March 2017 and do not reflect the baseline credit of 22 ¢/kWh in the summer and 20 ¢/kWh in the winter. Appendix B shows the prices that were in effect in each rate period for each tariff, including the OAT. Two sets of prices are shown in the appendix, one covering the period from pilot start through February 2017, and the other beginning on March 1, 2017. While several minor rate changes occurred over the course of the pilot, the rate adjustment that occurred on March 1, 2017 was more significant and, as such, it was factored into the estimation of bill impacts summarized in Section 5.4 below.

Figure 5.1-1: SDG&E Pilot Rate 1 (March 2017)[60]

Tariff	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Super Off-Peak (32¢)						Off-Peak (38¢)										Peak (62¢)							
	Winter	Super Off-Peak (39¢)						Off-Peak (40¢)										Peak (41¢)							
Weekend	Summer	Super Off-Peak (32¢)														Off-Peak (38¢)		Peak (62¢)							
	Winter	Super Off-Peak (39¢)														Off-Peak (40¢)		Peak (41¢)							

Figure 5.1-2: SDG&E Pilot Rate 2 (March 2017)

Tariff	Season	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
Weekday	Summer	Off-Peak (36¢)																Peak (62¢)							
	Winter	Off-Peak (39¢)																Peak (41¢)							
Weekend	Summer	Off-Peak (36¢)																Peak (62¢)							
	Winter	Off-Peak (39¢)																Peak (41¢)							

Rate 1 has three rate periods in all seasons and all days of the week. The peak period, from 4 to 9 PM, is constant across all days of the week and seasons. The timing and length of the off-peak and super-off-peak periods are also constant across seasons but differ on weekdays and weekends. The peak to super-off-peak price ratio[9] (without the baseline credit) is roughly 1.9 to 1 in summer and a very modest 1.06 to 1 in winter. The summer peak to off-peak price ratio is roughly 1.6 to 1.

The primary difference between SDG&E's Rate 2 and Rate 1 is that Rate 2 has only two rate periods whereas Rate 1 has three. Rate 2 has the same peak period, from 4 to 9 PM, as Rate 1 and the peak period prices are also the same as Rate 1. The peak period and peak period prices, are the same all year. In winter, the peak-to-off-peak price ratio for Rate 2 is roughly 1.05 to 1, making the rate relatively flat.

[60] See Appendix B for comparison of tariffs.

Figure 5.1-3 presents the seasons for each rate. For both rates, the summer season covers the months of May through October. The winter season is November through April.

Figure 5.1-3 Seasons by Rate

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rate 1	Winter				Summer						Winter	
Rate 2	Winter				Summer						Winter	

In addition to the above rate options, SDG&E's pilot is testing the impact of weekly usage alerts, known as Weekly Alert Emails (WAE), on demand response under TOU rates. The WAE used in summer 2016 provided weekly emails to participants that report the prior week's electricity usage by rate period. A new WAE was launched in mid-October. This version includes a bill-to date forecast, an updated usage chart displaying usage by peak period, and a doughnut chart illustrating the total amount of usage by peak period for the billing period. A random sample of 2,500 Rate 2 customers was chosen to receive the WAEs on a default basis. SDG&E had email addresses on just over 70% of this sample, so WAE's actually were delivered to roughly 1,775 customers out of the target group of 2,500.

The next section, Section 5.2, is a discussion of customer attrition over the first year of the pilot. Section 5.3 presents the load impact estimates for the winter period for each rate and Section 5.4 summarizes the bill impacts for the winter months and on an annual basis.

5.2 Customer Attrition

Figure 5.2-1 through Figure 5.2-3 show the cumulative opt-out rates over time for each test cell and climate region. The cumulative number of opt-outs is similar in the hot and moderate climate regions, between 1.5% and 3.5%. The control group in the hot climate region is made up of customers who were turned away from the pilot, therefore they cannot opt out. The opt-out rate in the cool climate region is very low for all customer segments, only reaching about 2% by the end of the first year of the pilot. In the moderate and cool climate regions, non-CARE/FERA customers had slightly higher opt-out rates than CARE/FERA customers. Opt-out rates appear to level off near the beginning of November, when customers were transitioned to the winter rate period and they remain generally level through June 2017.

Figure 5.2-1: Cumulative SDG&E Opt Outs by Month – Hot Climate Region

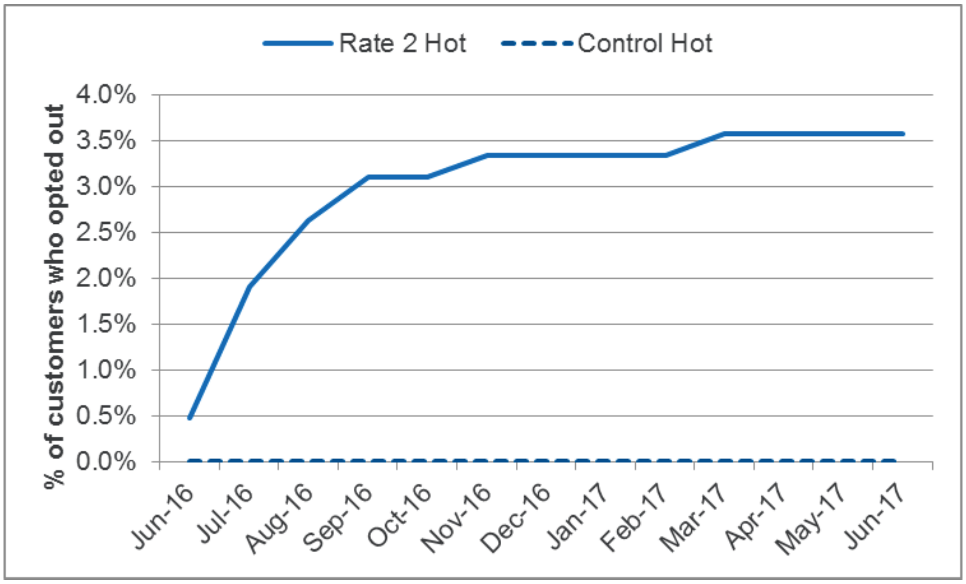


Figure 5.2-2: Cumulative SDG&E Opt Outs by Month – Moderate Climate Region

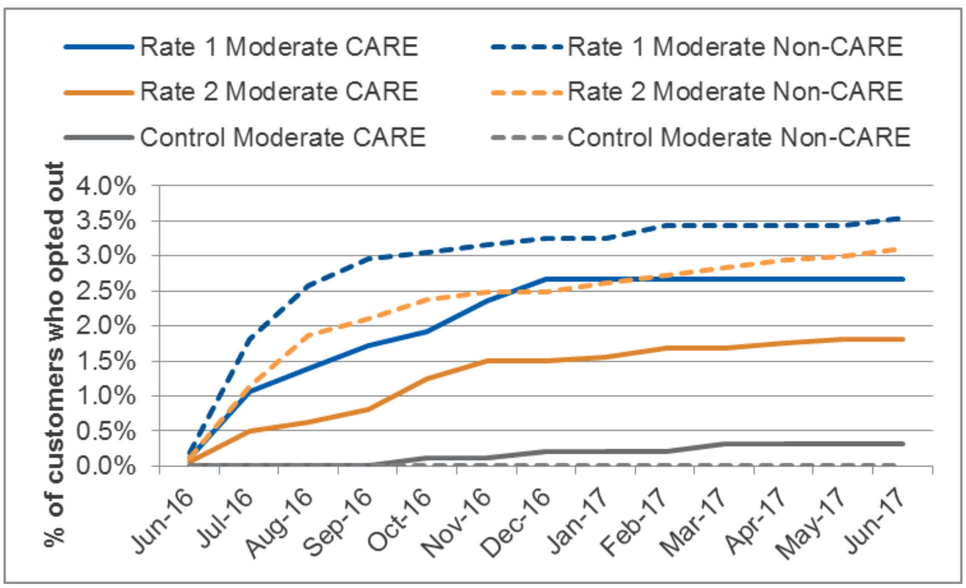


Figure 5.2-3: Cumulative SDG&E Opt Outs by Month – Cool Climate Region

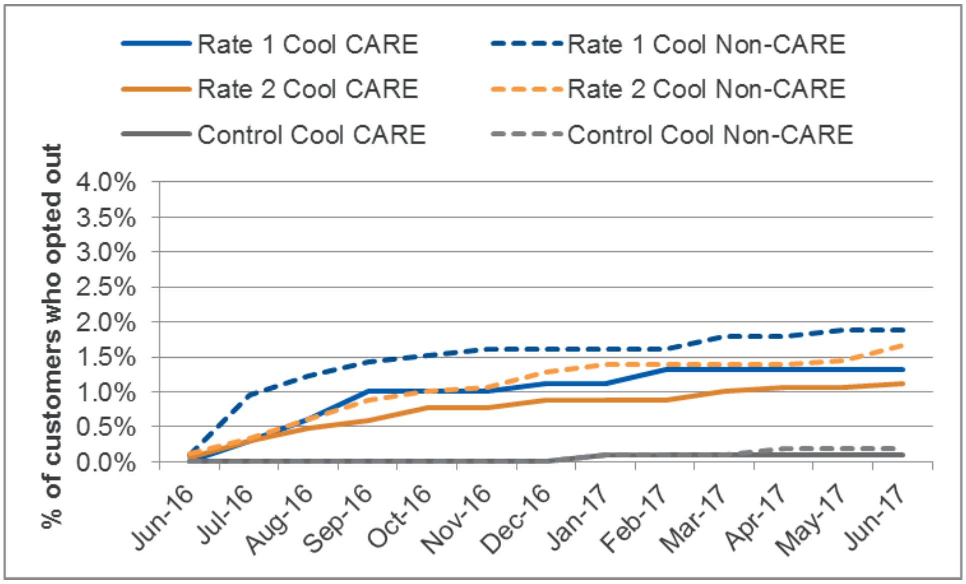


Figure 5.2-4 through Figure 5.2-6 show the overall attrition rate over time for each climate region, customer segment, and TOU rate. Generally attrition rates are fairly steady in the time period between June 2016 and June 2017. Among treated customers, those in the moderate and cool climate region have similar attrition rates. Attrition rates are lowest in the hot climate region.

Figure 5.2-4: Cumulative SDG&E Attrition by Month – Hot Climate Region

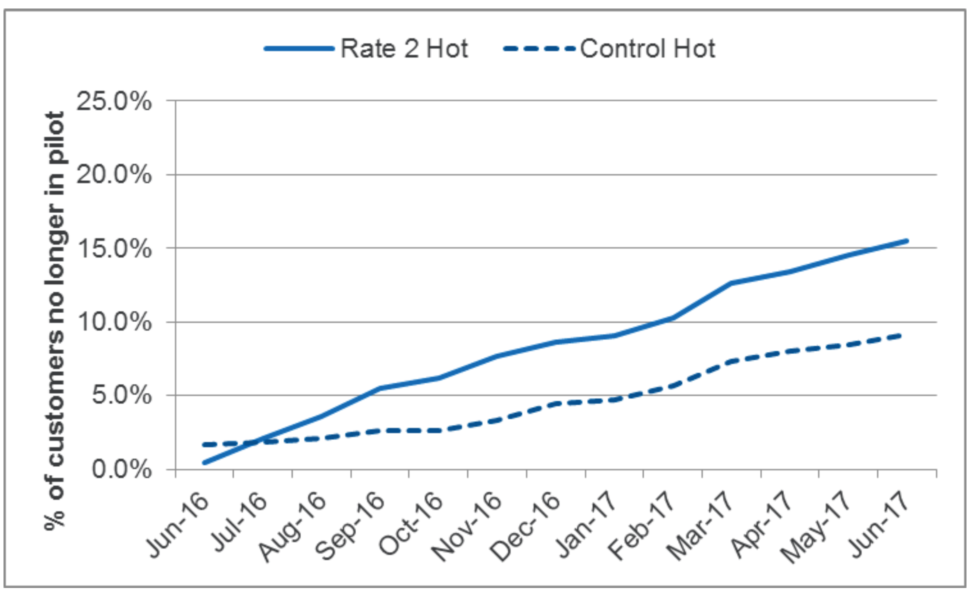


Figure 5.2-5: Cumulative SDG&E Attrition by Month – Moderate Climate Region

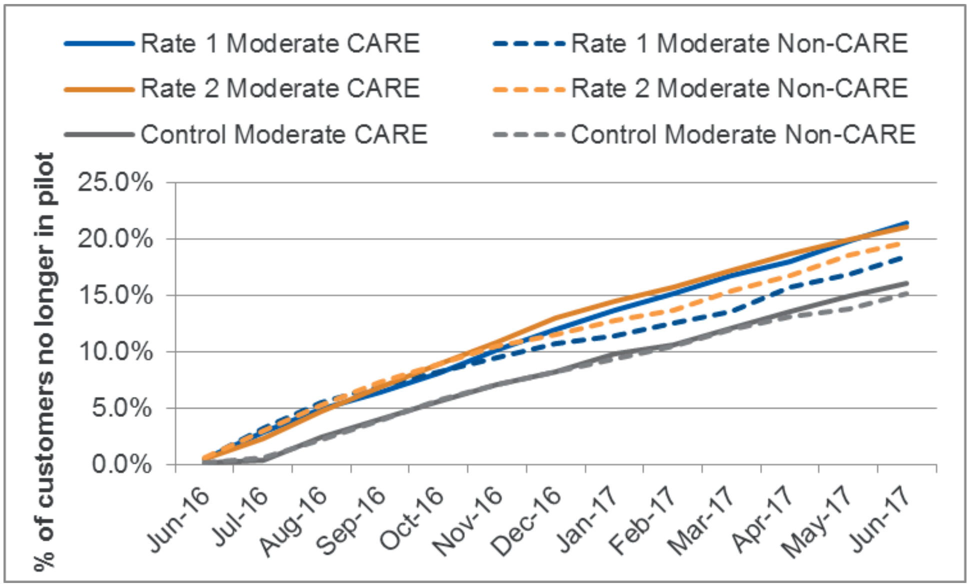
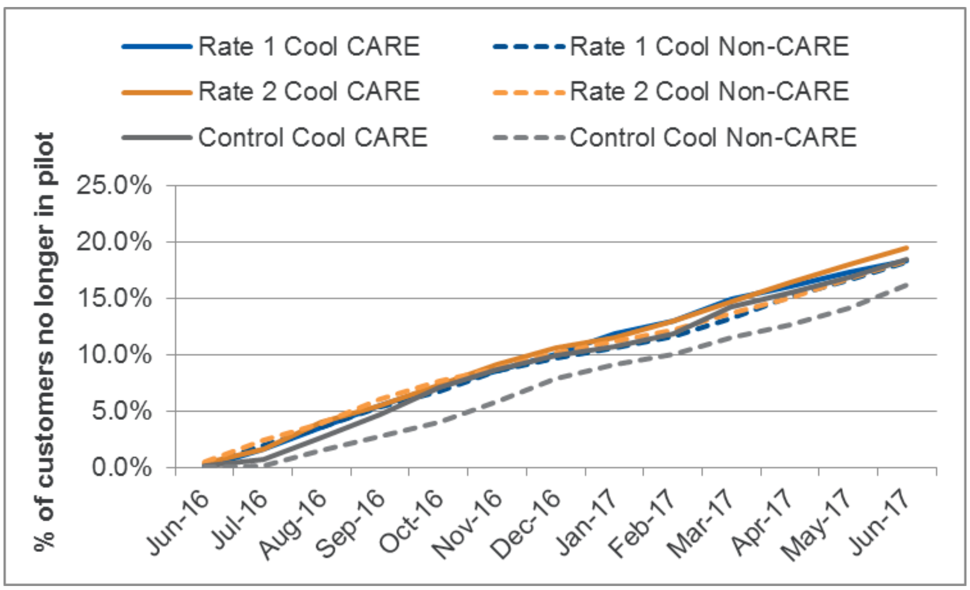


Figure 5.2-6: Cumulative SDG&E Attrition by Month – Cool Climate Region



5.3 Load Impacts

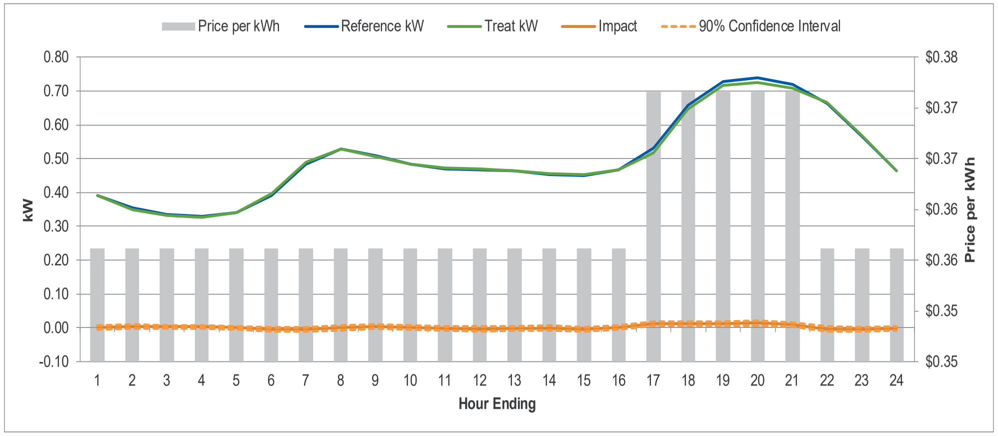
This section summarizes the load impact estimates for the two rate treatments tested by SDG&E. Load impacts are reported for each rate period for the average weekday, average weekend, and for the average monthly peak day for the winter months of November through April for CARE/FERA and non-CARE/FERA customers in SDG&E's moderate and cool climate regions. As discussed previously, SDG&E's hot climate region is quite small and the sample of customers recruited into the pilot is not large enough to support estimation of load impacts separately for CARE/FERA and non-CARE/FERA customers nor to support segmentation of the sample into seniors or various income groups as was done in the hot regions for PG&E and SCE. All customers in the hot region were placed on Rate 2 or were in the control group.

As with PG&E and SCE, electronic tables that contain estimates for each hour of the day for each day type and climate zone and for each month separately are also available upon request through the CPUC. Figure 5.3-1 shows an example of the content of these tables for SDG&E Rate 2 for all eligible customers in the service territory. Pull down menus in the upper left hand corner allow users to select different climate regions, day types (e.g., weekdays, weekends, monthly peak day) and time period (individual months or the average of the winter period).

Figure 5.3-1: Example of Content of Electronic Tables Underlying Load Impacts Summarized in this Report (SDG&E Rate 2, Average Winter Weekday, All Customers)

Segment	All
Rate	Rate 2
Month	Winter 2016 2017
Day Type	Average Weekday
Treated Customers	6,662

Period	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval	
Peak	0.67	0.66	0.012	1.7%	0.01	0.01
Partial Peak	N/A	N/A	N/A	N/A	N/A	N/A
Off-Peak	0.45	0.45	0.00	-0.2%	0.00	0.00
Super Off-Peak	N/A	N/A	N/A	N/A	N/A	N/A
Daily kWh	11.98	11.93	0.04	0.4%	0.02	0.07



Hour Ending	Reference kW	Treat kW	Impact	Percent Impact	90% Confidence Interval		Price	Period
1	0.39	0.39	0.00	0.2%	0.00	0.01	$0.36	Off-Peak
2	0.35	0.35	0.00	0.9%	0.00	0.01	$0.36	Off-Peak
3	0.33	0.33	0.00	1.0%	0.00	0.01	$0.36	Off-Peak
4	0.33	0.33	0.00	1.0%	0.00	0.01	$0.36	Off-Peak
5	0.34	0.34	0.00	0.1%	0.00	0.01	$0.36	Off-Peak
6	0.39	0.40	0.00	-1.2%	-0.01	0.00	$0.36	Off-Peak
7	0.48	0.49	0.00	-1.0%	-0.01	0.00	$0.36	Off-Peak
8	0.53	0.53	0.00	0.0%	-0.01	0.01	$0.36	Off-Peak
9	0.51	0.51	0.00	0.7%	0.00	0.01	$0.36	Off-Peak
10	0.48	0.48	0.00	0.2%	-0.01	0.01	$0.36	Off-Peak
11	0.47	0.47	0.00	-0.4%	-0.01	0.00	$0.36	Off-Peak
12	0.47	0.47	0.00	-0.7%	-0.01	0.00	$0.36	Off-Peak
13	0.46	0.47	0.00	-0.4%	-0.01	0.00	$0.36	Off-Peak
14	0.45	0.45	0.00	-0.1%	-0.01	0.01	$0.36	Off-Peak
15	0.45	0.45	0.00	-1.0%	-0.01	0.00	$0.36	Off-Peak
16	0.47	0.47	0.00	0.0%	-0.01	0.01	$0.36	Off-Peak
17	0.53	0.52	0.01	2.2%	0.01	0.02	$0.37	Peak
18	0.66	0.65	0.01	1.8%	0.01	0.02	$0.37	Peak
19	0.73	0.72	0.01	1.6%	0.01	0.02	$0.37	Peak
20	0.74	0.73	0.01	1.9%	0.01	0.02	$0.37	Peak
21	0.72	0.71	0.01	1.3%	0.00	0.02	$0.37	Peak
22	0.66	0.67	0.00	-0.5%	-0.01	0.00	$0.36	Off-Peak
23	0.56	0.57	0.00	-0.7%	-0.01	0.00	$0.36	Off-Peak
24	0.46	0.46	0.00	-0.3%	-0.01	0.00	$0.36	Off-Peak
Daily kWh	**11.98**	**11.93**	**0.04**	**0.4%**	**0.02**	**0.07**	**N/A**	**N/A**

The remainder of this section is organized by rate treatment—that is, load impacts are presented for each relevant climate region and each customer segment for each of the two rates. Following the summary for each rate, load impacts are compared across rates.

As discussed in Section 6 of the First Interim Report, in addition to the two rate treatments, SDG&E tested the incremental impact of Weekly Alert Emails (WAEs) sent to customers on a default basis. Results of this analysis are presented in Section 5.3.3.

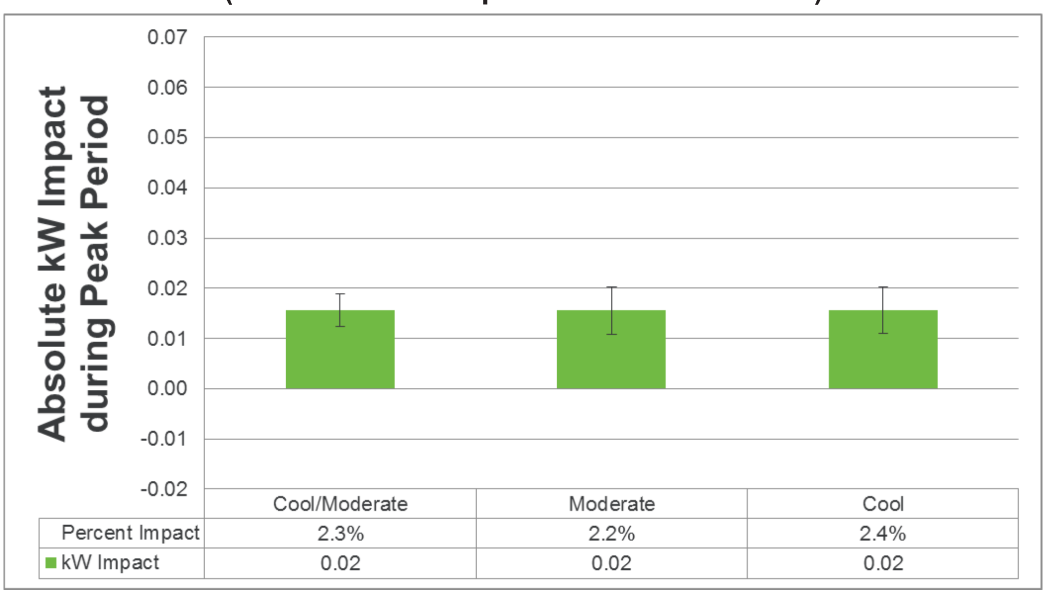
5.3.1 Rate 1

SDG&E's Rate 1 is a three-period rate with a peak period from 4 to 9 PM on weekdays and weekends. On weekdays, the off-peak (or shoulder) period runs from 6 AM to 4 PM and 9 PM to midnight. On weekends, this period is much shorter, running from 2 to 4 PM and 9 PM to midnight. In winter, for electricity usage above 130% of the baseline quantity, prices equal roughly 37.3 ¢/kWh[61] in the peak period, 36.2 ¢/kWh in the off-peak (or shoulder) period and 35.1 ¢/kWh in the super off-peak period. For usage below 130% the baseline quantity, a credit of 18.6 ¢/kWh is applied.

Winter Load Impacts

Figure 5.3-2 below shows the average peak-period load reduction in absolute terms for Rate 1 for customers in the moderate and cool climate regions, separately and combined. As with the other IOUs, the lines bisecting the top of each bar in the figures show the 90% confidence band for each estimate.

Figure 5.3-2: Average Load Impacts For Peak Period for SDG&E Rate 1 (Positive values represent load reductions)



[61] Prices reflect tariffs in effect at the launch of the pilot through the end of February 2017. As indicated above and shown in Appendix B, rates changed on March 1, 2017.

As seen in the figures, the average peak load impacts for the cool and moderate climate regions, separately and combined, are statistically significant at the 90% level of confidence in both percentage and absolute terms. On average, pilot participants in both climate regions combined reduced electricity use by 2.3% or 0.02 kW across the five hour peak period from 4 to 9 PM. Customers in the moderate climate region reduced their usage by 2.2% or 0.02 kW, which is an absolute impact nearly identical to the cool climate region.

Table 5.3-1 shows the average percent and absolute load impacts for Rate 1 for each rate period for weekdays and weekends and for the average monthly system peak day for the cool and moderate climate regions. The percent reduction equals the load impact in absolute terms (kW) divided by the reference load. Shaded cells in the table contain load impact estimates that are not statistically significant at the 90% confidence level. The percentage and absolute values in the first row of Table 5.3-1, which represent the load impacts in the peak period on the average weekday, equal the values shown in Figure 5.3-2, discussed above.

The reference loads shown in Table 5.3-1 represent estimates of what customers on the TOU rate would have used if they had not responded to the price signals contained in the TOU tariff. As seen in the table, average hourly usage during the peak period is roughly 0.67 kW for the moderate and cool climate regions combined and around 0.50 kW for the 24 hour average weekday. In the moderate climate region, average usage in the peak period is larger at 0.71 kW than in the cool climate region (0.64 kW).

As seen in Table 5.3-1, on the average weekday, there were statistically significant reductions in usage during the peak and off-peak periods and for the day for both climate regions, and statistically significant increases in usage in the super-off-peak period from midnight to 6 AM on weekdays and the monthly system peak day. On weekends, there was also an increase in super off-peak usage in the moderate climate region. For the cool climate region, the change in usage in the super off-peak period was not statistically significant, as highlighted in gray. Load impacts were greatest for customers in the moderate climate region during the peak period on monthly system peak days, at 2.7% or 0.02 kW.

For the moderate and cool climate regions combined, there was a 1.0% reduction in daily electricity use on the average weekday. In the moderate climate region it is 0.6% and in the cool climate region it is 1.3%. While the daily reduction in energy use for Rate 1 is small in percentage and absolute terms, this average is spread over 24 hours each day, so the average reduction in electricity use on weekdays equals roughly 0.11 kWh. Over six months, this adds up to about 21 kWh per customer.

Table 5.3-1: Rate 1 Load Impacts by Rate Period and Day Type*
(Positive values represent load reductions, negative values represent load increases)

Rate 1											
Day Type	Period	Hours	Cool/Moderate			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.67	0.02	2.3%	0.71	0.02	2.2%	0.64	0.02	2.4%
	Off-Peak	6 AM to 4 PM, 9 PM to 12 AM	0.49	0.01	1.3%	0.53	0.01	1.1%	0.47	0.01	1.5%
	Super Off-Peak	12 AM to 6 AM	0.35	-0.01	-2.1%	0.38	-0.01	-3.5%	0.34	0.00	-1.1%
	Day	**All Hours**	0.50	0.00	1.0%	0.53	0.00	0.6%	0.47	0.01	1.3%
Average Weekend	Peak	4 PM to 9 PM	0.68	0.01	2.0%	0.73	0.01	1.5%	0.65	0.02	2.4%
	Off-Peak	2 PM to 4 PM, 9 PM to 12 AM	0.55	0.01	1.1%	0.59	0.00	0.2%	0.52	0.01	1.7%
	Super Off-Peak	12 AM to 2 PM	0.45	0.00	-0.7%	0.49	-0.01	-1.3%	0.42	0.00	-0.3%
	Day	**All Hours**	0.52	0.00	0.4%	0.56	0.00	-0.2%	0.49	0.00	0.9%
Monthly System Peak Day	Peak	4 PM to 9 PM	0.75	0.01	1.9%	0.80	0.02	2.7%	0.71	0.01	1.3%
	Off-Peak	6 AM to 4 PM, 9 PM to 12 AM	0.54	0.00	0.8%	0.58	0.01	1.1%	0.51	0.00	0.5%
	Super Off-Peak	12 AM to 6 AM	0.37	-0.01	-2.4%	0.40	-0.02	-4.5%	0.35	0.00	-0.7%
	Day	**All Hours**	0.54	0.00	0.6%	0.58	0.00	0.6%	0.51	0.00	0.5%

* A shaded cell indicates estimate is not statistically significant

Figure 5.3-3 shows the absolute peak period load impacts for Rate 1 for CARE/FERA and non-CARE/FERA customers for the moderate and cool climate regions combined and separately. In the combined region, both the percent and absolute load impacts were greater for non-CARE/FERA customers than for CARE/FERA customers and the differences are statistically significant. Generally, CARE/FERA customers in the cool and moderate climate regions did not reduce their energy use during the peak periods. The greatest load reductions came from non-CARE/FERA customers in the cool climate region, at 2.9% and 0.02 kW. However, the impacts were very similar for the same segment in the moderate climate region.

Figure 5.3-3: Average Load Impacts for Peak Period for SDG&E Rate 1 for CARE/FERA and non-CARE/FERA Customers

(Positive values represent load reductions)

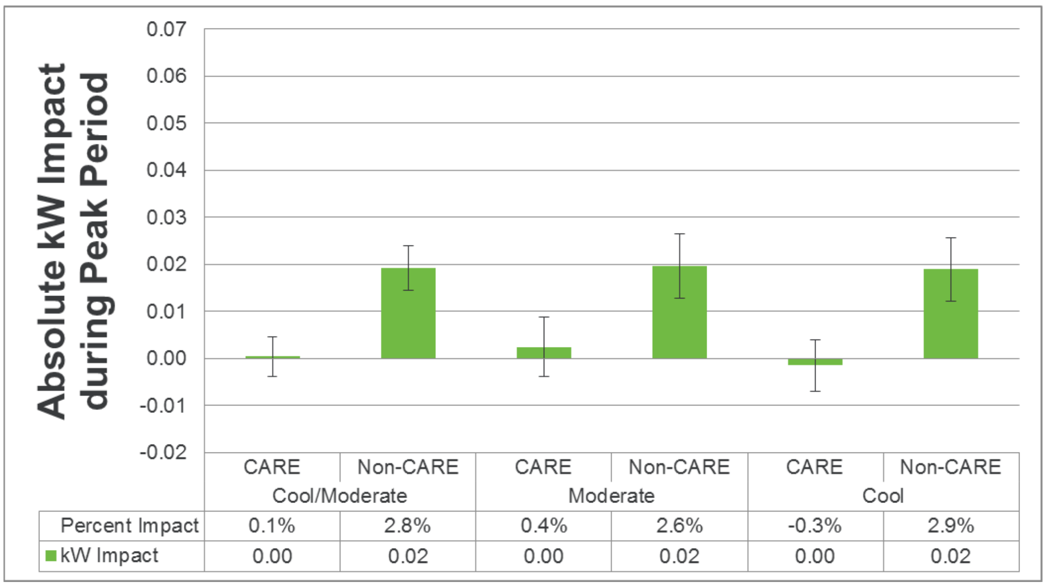


Table 5.3-2 shows the estimated load impacts for each rate period and day type for the moderate and cool climate zones separately and combined for non-CARE/FERA customers. Table 5.3-3 shows the same but for CARE/FERA customers. For both climate regions, non-CARE/FERA customers have greater peak period demand than CARE/FERA customers. For example, on the average weekday in the two climate zones combined, peak period demand is equal to 0.69 kW for non-CARE/FERA customers and 0.59 kW for CARE/FERA customers. Average overall weekday consumption is similar between the two groups, 0.51 kW and 0.45 kW for non-CARE/FERA and CARE/FERA customers, respectively. This indicates that non-CARE/FERA customers have a higher concentration of electricity use in the peak period, which may have made it easier to reduce their consumption during that time.

Customers in the non-CARE/FERA segments had load impacts of 1.7% during the off-peak period on average weekdays, and 1.5% on the average weekend. Only non-CARE/FERA customers were able to reduce their overall daily consumption on all three day types. CARE/FERA customers increased their daily consumption on all day types.

Table 5.3-2: Rate 1 Load Impacts by Rate Period and Day Type – Non-CARE/FERA*
(Positive values represent load reductions, negative values represent load increases)

Rate 1											
Day Type	Period	Hours	Cool/Moderate, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.69	0.02	2.8%	0.74	0.02	2.6%	0.66	0.02	2.9%
	Off-Peak	6 AM to 4 PM, 9 PM to 12 AM	0.51	0.01	1.7%	0.55	0.01	1.6%	0.48	0.01	1.8%
	Super Off-Peak	12 AM to 6 AM	0.36	-0.01	-1.8%	0.39	-0.01	-3.7%	0.34	0.00	-0.5%
	Day	**All Hours**	0.51	0.01	1.4%	0.55	0.01	0.9%	0.48	0.01	1.7%
Average Weekend	Peak	4 PM to 9 PM	0.70	0.02	2.5%	0.76	0.02	2.0%	0.67	0.02	2.8%
	Off-Peak	2 PM to 4 PM, 9 PM to 12 AM	0.56	0.01	1.5%	0.61	0.00	0.6%	0.53	0.01	2.2%
	Super Off-Peak	12 AM to 2 PM	0.46	0.00	-0.6%	0.51	-0.01	-1.3%	0.43	0.00	0.0%
	Day	**All Hours**	0.53	0.00	0.7%	0.58	0.00	0.0%	0.50	0.01	1.3%
Monthly System Peak Day	Peak	4 PM to 9 PM	0.77	0.02	2.3%	0.83	0.03	3.1%	0.73	0.01	1.9%
	Off-Peak	6 AM to 4 PM, 9 PM to 12 AM	0.55	0.01	1.4%	0.60	0.01	1.9%	0.52	0.01	1.0%
	Super Off-Peak	12 AM to 6 AM	0.37	-0.01	-1.6%	0.40	-0.02	-4.8%	0.35	0.00	0.7%
	Day	**All Hours**	0.55	0.01	1.2%	0.60	0.01	1.1%	0.52	0.01	1.2%

* A shaded cell indicates estimate is not statistically significant

Table 5.3-3: Rate 1 Load Impacts by Rate Period and Day Type – CARE/FERA*
(Positive values represent load reductions, negative values represent load increases)

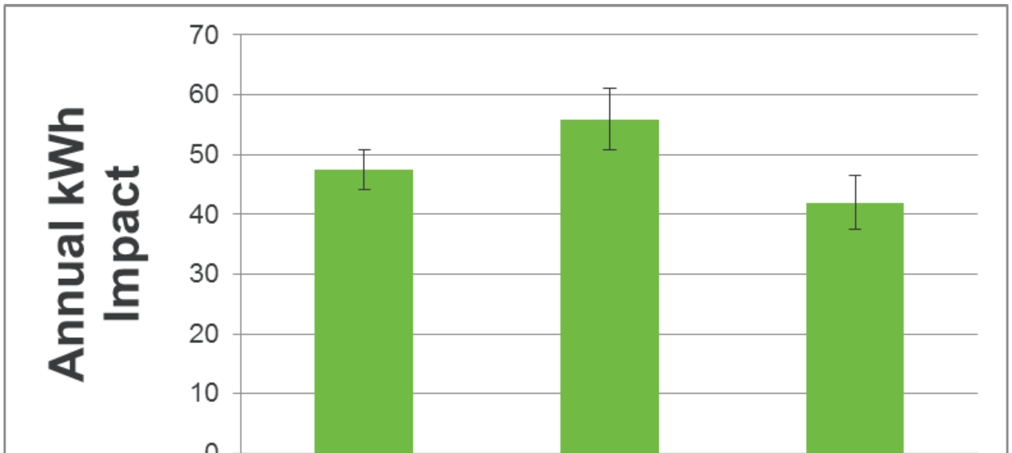
Rate 1											
Day Type	Period	Hours	Cool/Moderate, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.59	0.00	0.1%	0.62	0.00	0.4%	0.56	0.00	-0.3%
	Off-Peak	6 AM to 4 PM, 9 PM to 12 AM	0.45	0.00	-0.6%	0.48	0.00	-0.7%	0.42	0.00	-0.5%
	Super Off-Peak	12 AM to 6 AM	0.33	-0.01	-3.6%	0.36	-0.01	-2.9%	0.31	-0.01	-4.4%
	Day	**All Hours**	0.45	0.00	-1.0%	0.48	0.00	-0.8%	0.42	0.00	-1.1%
Average Weekend	Peak	4 PM to 9 PM	0.59	0.00	-0.2%	0.62	0.00	-0.4%	0.55	0.00	-0.1%
	Off-Peak	2 PM to 4 PM, 9 PM to 12 AM	0.50	0.00	-1.0%	0.54	-0.01	-1.1%	0.46	0.00	-0.9%
	Super Off-Peak	12 AM to 2 PM	0.41	-0.01	-1.5%	0.44	-0.01	-1.2%	0.38	-0.01	-1.9%
	Day	**All Hours**	0.47	0.00	-1.1%	0.50	0.00	-0.9%	0.43	-0.01	-1.2%
Monthly System Peak Day	Peak	4 PM to 9 PM	0.66	0.00	-0.3%	0.71	0.01	1.3%	0.62	-0.01	-2.1%
	Off-Peak	6 AM to 4 PM, 9 PM to 12 AM	0.49	-0.01	-1.9%	0.53	-0.01	-1.6%	0.46	-0.01	-2.1%
	Super Off-Peak	12 AM to 6 AM	0.35	-0.02	-5.9%	0.38	-0.01	-3.5%	0.32	-0.03	-8.7%
	Day	**All Hours**	0.49	-0.01	-2.1%	0.53	-0.01	-1.1%	0.46	-0.01	-3.3%

* A shaded cell indicates estimate is not statistically significant

Annual Conservation Effect

Figure 5.3-4 shows the average customer’s annual conservation effect for customers on SDG&E’s Rate 1. Energy savings were similar between the moderate and cool climate regions, about 1%. Overall, customers in the two zones saved approximately 47.5 kWh during the first year of the pilot. This is comparable to the conservation effects seen for the other two utilities.

Figure 5.3-4: Average Annual Conservation Effect for SDG&E Rate 1 (Positive values represent usage reductions)

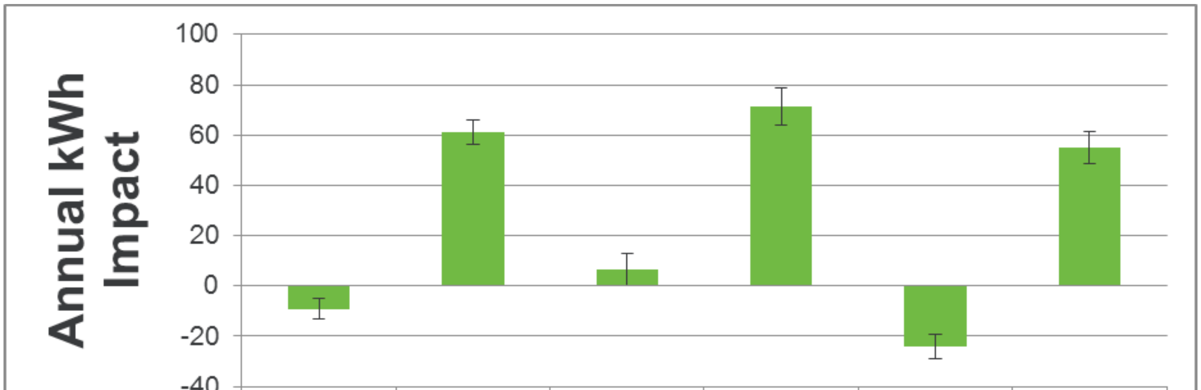


	Cool/Moderate	Moderate	Cool
Percent Impact	1.0%	1.1%	1.0%
kWh Impact	47.5	55.9	42.0

Figure 5.3-5 shows the total energy savings for CARE/FERA and non-CARE/FERA customers in the cool and moderate climate regions separately and combined. Non-CARE/FERA customers attributed to most of the energy savings, while CARE/FERA customers had either small energy savings or small energy usage increases.

Figure 5.3-5: Average Annual Conservation Effect for SDG&E Rate 1 for CARE/FERA and Non-CARE/FERA Customers

(Positive values represent load reductions)



	Cool/Moderate		Moderate		Cool	
	CARE	Non-CARE	CARE	Non-CARE	CARE	Non-CARE
Percent Impact	-0.2%	1.3%	0.1%	1.3%	-0.6%	1.3%
kWh Impact	-9.2	61.2	6.5	71.3	-24.3	55.1

5.3.2 Rate 2

SDG&E's Rate 2 differs from Rate 1 in that it is a two-period rate, rather than a three-period rate. Like Rate 1, the peak period is from 4 to 9 PM on weekdays and weekends. In winter, for electricity usage above 130% of the baseline quantity, prices equal roughly 37.3 ¢/kWh in the peak period and 35.8 ¢/kWh in the off-peak period. Like Rate 1, a credit of 18.6 ¢/kWh is applied to usage below 130% the baseline quantity[62].

Winter Load Impacts

Figure 5.3-6 shows the absolute load impacts for the weekday peak period for Rate 2 for SDG&E's service territory as a whole and for each climate region. For the service territory as a whole, load impacts were equal to 1.7% or 0.01 kW. Like Rate 1, customers in the moderate and cool climate regions had similar load impacts of 1.6% and 1.7% respectively. Customers in the hot climate zone had the greatest peak period impacts at 3.9% or 0.04 kW. Impacts in the hot climate zone are statistically significantly greater than those in the cool and moderate climate regions.

[62] Prices reflect tariffs in effect at the launch of the pilot through the end of February 2017. As indicated above and shown in Appendix B, rates changed on March 1, 2017.

Figure 5.3-6: Average Load Impacts For Peak Period for SDG&E Rate 2 (Positive values represent load reductions)

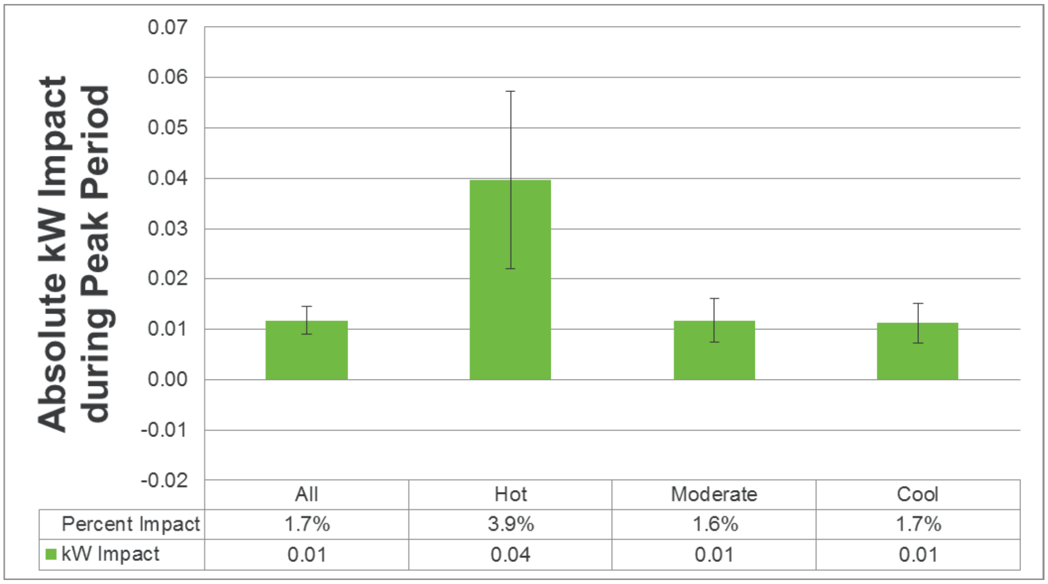


Table 5.3-4contains estimates of load impacts for all relevant rate periods and day types. Reference loads and load impacts in each rate period and over the course of the day were similar between weekends and weekdays for the service territory as a whole and also for each climate region. The overall conservation effect (e.g., the reduction in daily usage) did not have a consistent pattern. Customers in the hot climate region increased their daily consumption on weekdays, while customers in the cool climate region reduced their loads.

Table 5.3-4: Rate 2 Load Impacts by Rate Period and Day Type*
(Positive values represent load reductions, negative values represent load increases)

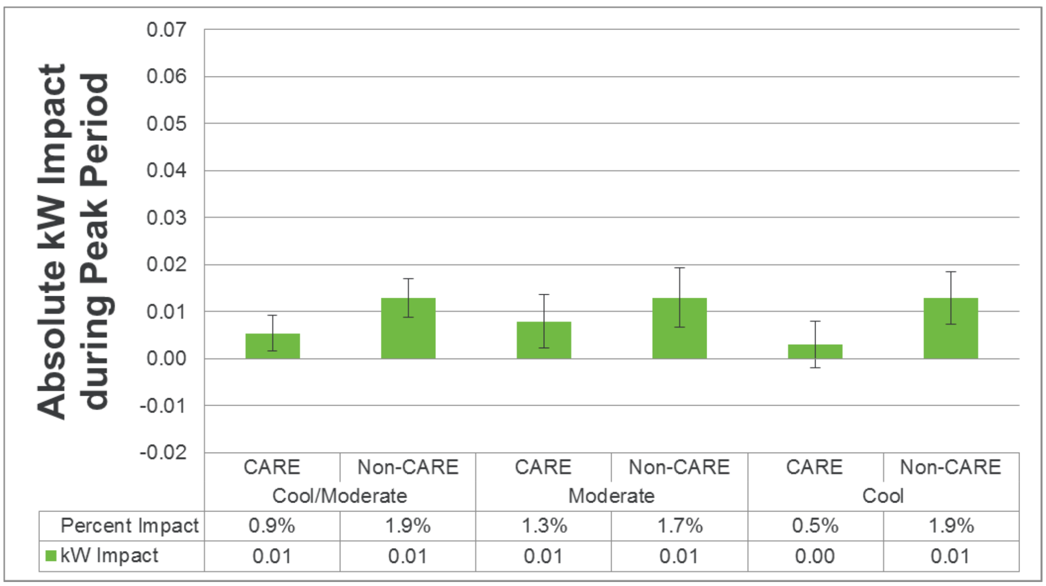
Day Type	Period	Hours	Rate 2											
			All			Hot			Moderate			Cool		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.67	0.01	1.7%	1.02	0.04	3.9%	0.71	0.01	1.6%	0.64	0.01	1.7%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.45	0.00	-0.2%	0.73	-0.03	-4.7%	0.48	0.00	-0.9%	0.43	0.00	0.5%
	Day	**All Hours**	0.50	0.00	0.4%	0.79	-0.02	-2.4%	0.53	0.00	-0.2%	0.47	0.00	0.9%
Average Weekend	Peak	4 PM to 9 PM	0.68	0.01	1.4%	1.05	0.02	1.6%	0.73	0.01	1.3%	0.65	0.01	1.5%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.48	0.00	-0.5%	0.78	-0.04	-4.7%	0.52	-0.01	-1.1%	0.45	0.00	0.1%
	Day	**All Hours**	0.52	0.00	0.0%	0.84	-0.03	-3.1%	0.56	0.00	-0.5%	0.49	0.00	0.5%
Monthly System Peak Day	Peak	4 PM to 9 PM	0.75	0.01	1.7%	1.10	0.05	4.2%	0.80	0.01	0.9%	0.71	0.02	2.3%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.49	0.00	0.0%	0.77	-0.02	-3.0%	0.52	0.00	-0.8%	0.46	0.00	0.6%
	Day	**All Hours**	0.54	0.00	0.5%	0.84	-0.01	-1.0%	0.58	0.00	-0.3%	0.51	0.01	1.1%

* A shaded cell indicates estimate is not statistically significant

Figure 5.3-7 shows the peak period load reductions on weekdays for non-CARE/FERA and CARE/FERA customers and Table 5.3-5 and Table 5.3-6 show the load impacts for each rate period and day type for the two segments. There are not enough customers in the hot climate region to segment between CARE/FERA and non-CARE/FERA, so these tables only include customers in the moderate and cool climate regions, separately and combined.

Like Rate 1, non-CARE/FERA customers in the cool climate region had greater percent impacts (1.9% and 0.01 kW) than their CARE/FERA counterparts (0.9% and 0.01 kW) and these differences are statistically significant in both absolute and percentage terms. This is not the case in the moderate climate region, where load impacts for CARE/FERA and non-CARE/FERA customers were more similar.

Figure 5.3-7: Average Load Impacts for Peak Period for SDG&E Rate 2 for CARE/FERA and non-CARE/FERA Customers
(Positive values represent load reductions)



As seen in Table 5.3-5 and Table 5.3-6, non-CARE/FERA customers had greater on-peak and average weekday demand than CARE/FERA customers. Only non-CARE/FERA customers reduced their overall consumption. For example, non-CARE/FERA customers in the moderate and cool climate regions combined reduced their average weekday electricity demand by 0.5% or less than 0.01 kW. CARE/FERA and non-CARE/FERA segments were not available in the hot climate region due to the small population of customers, resulting in insufficient sample size to allow for segmentation.

Table 5.3-5: Rate 2 Load Impacts by Rate Period and Day Type – Non-CARE/FERA*
(Positive values represent load reductions, negative values represent load increases)

Rate 2											
Day Type	Period	Hours	Cool/Moderate, Non-CARE			Moderate, Non-CARE			Cool, Non-CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.69	0.01	1.9%	0.74	0.01	1.7%	0.66	0.01	1.9%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.46	0.00	0.0%	0.50	-0.01	-1.1%	0.44	0.00	0.7%
	Day	**All Hours**	0.51	0.00	0.5%	0.55	0.00	-0.3%	0.48	0.01	1.1%
Average Weekend	Peak	4 PM to 9 PM	0.70	0.01	1.5%	0.76	0.01	1.4%	0.67	0.01	1.6%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.49	0.00	-0.5%	0.53	-0.01	-1.5%	0.46	0.00	0.2%
	Day	**All Hours**	0.53	0.00	0.1%	0.58	0.00	-0.7%	0.50	0.00	0.6%
Monthly System Peak Day	Peak	4 PM to 9 PM	0.77	0.01	1.8%	0.83	0.00	0.4%	0.73	0.02	2.8%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.49	0.00	0.4%	0.53	0.00	-0.9%	0.47	0.01	1.2%
	Day	**All Hours**	0.55	0.00	0.8%	0.60	0.00	-0.5%	0.52	0.01	1.7%

* A shaded cell indicates estimate is not statistically significant

Table 5.3-6: Rate 2 Load Impacts by Rate Period and Day Type –CARE/FERA*
(Positive values represent load reductions, negative values represent load increases)

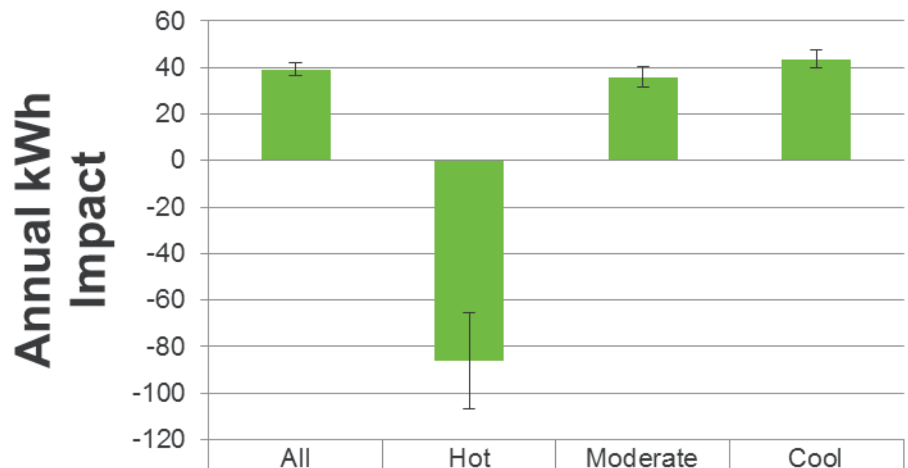
Rate 2											
Day Type	Period	Hours	Cool/Moderate, CARE			Moderate, CARE			Cool, CARE		
			Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact	Ref. kW	Impact kW	% Impact
Average Weekday	Peak	4 PM to 9 PM	0.59	0.01	0.9%	0.62	0.01	1.3%	0.56	0.00	0.5%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.41	0.00	-0.4%	0.44	0.00	-0.1%	0.39	0.00	-0.8%
	Day	**All Hours**	0.45	0.00	-0.1%	0.48	0.00	0.3%	0.42	0.00	-0.5%
Average Weekend	Peak	4 PM to 9 PM	0.59	0.00	0.7%	0.62	0.01	1.1%	0.55	0.00	0.3%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.43	0.00	-0.1%	0.47	0.00	0.1%	0.40	0.00	-0.3%
	Day	**All Hours**	0.47	0.00	0.1%	0.50	0.00	0.4%	0.43	0.00	-0.1%
Monthly System Peak Day	Peak	4 PM to 9 PM	0.66	0.01	1.2%	0.71	0.02	2.6%	0.62	0.00	-0.5%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.45	-0.01	-1.6%	0.48	0.00	-0.3%	0.41	-0.01	-3.0%
	Day	**All Hours**	0.49	0.00	-0.8%	0.53	0.00	0.5%	0.46	-0.01	-2.3%

* A shaded cell indicates estimate is not statistically significant

Annual Conservation Effect

Figure 5.3-8 shows the conservation effect over the first year of the pilot for customers on SDG&E's Rate 2. Overall, customers reduced their energy consumption by about 0.8% or 39.1 kWh over the course of the year. These savings are attributable to the moderate and cool climate regions, as customers in the hot region actually increased their energy consumption by 1.2%. All conservation effects were statistically significant at the 90% confidence level.

Figure 5.3-8: Average Annual Conservation Effect for SDG&E Rate 2 (Positive values represent usage reductions)

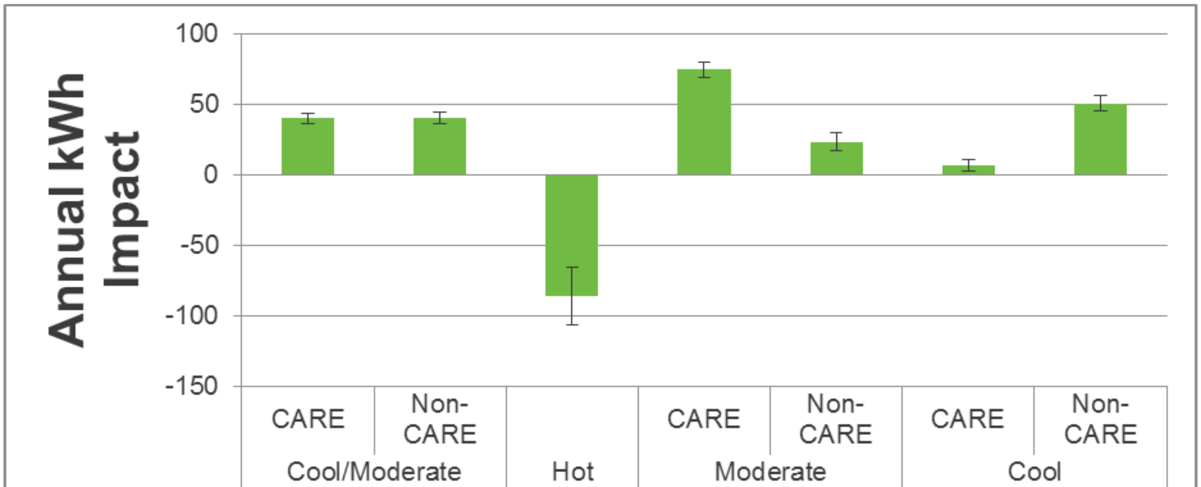


	All	Hot	Moderate	Cool
Percent Impact	0.8%	-1.2%	0.7%	1.0%
kWh Impact	39.1	-86.0	35.9	43.6

Figure 5.3-9 presents the annual conservation effect for CARE/FERA and non-CARE/FERA customers. There were not enough customers in the hot climate region to estimate savings for individual segments. Unlike Rate 1, there is not a clear pattern in the difference in conservation effects between CARE/FERA and non-CARE/FERA customers. In the cool and moderate climate regions combined, each group reduced their energy consumption by over 40 kWh during the course of the year.

Figure 5.3-9: Average Annual Conservation Effect for SDG&E Rate 2 for CARE/FERA and Non-CARE/FERA Customers

(Positive values represent load reductions)



	Cool/Moderate CARE	Cool/Moderate Non-CARE	Hot	Moderate CARE	Moderate Non-CARE	Cool CARE	Cool Non-CARE
Percent Impact	1.0%	0.9%	-1.2%	1.6%	0.4%	0.2%	1.2%
kWh Impact	40.3	40.6	-86.0	75.1	23.7	6.9	50.9

5.3.3 Weekly Alert Emails

Winter Load Impacts

Table 5.3-7shows peak period impacts for customers who are not receiving alerts ("controls") and those who are ("recipients") and Table 5.3-8 contains estimated impacts for all rate periods and day types. As seen, the incremental impacts during the peak period were very small and, as shown by the fact that the 90% confidence interval includes 0, incremental impacts for the territory as a whole were not statistically significant. It is worth noting that the incremental impact for the combined moderate climate region is statistically significant at the 90% confidence level. It should also be noted that, although the % increase in the impact is large in percentage terms, this is a bit misleading since the estimated values are based on a very small impact to begin with. That is, the denominator in the calculation is quite small so that even very small incremental effects represent a reasonably large percent of the impact.

As seen in Table 5.3-8, there are small but statistically significant increases in electricity use during the off-peak period in the cool/moderate regions combined on both weekdays and weekends and also in the cool region.

In October, SDG&E modified the WAE content and formatting. This new format may have been more effective in impacting customer behavior in the moderate climate region.

Table 5.3-7: Incremental Impacts of SDG&E Weekly Alert Emails

Climate Zone	Number of Customers		kW Impact during Peak Period					% Increase in Impact
	Controls	Recipients	Controls	Recipients	Incremental	90% Confidence Interval		
Cool	1,632	916	0.019	0.006	-0.012	-0.018	-0.007	-65%
Moderate	1,493	832	0.005	0.018	0.013	0.006	0.020	289%
Cool/Moderate	3,124	1,748	0.013	0.011	-0.002	-0.006	0.002	-15%

Table 5.3-8: Incremental Impacts of SDG&E Weekly Alert Emails by Rate Period and Day Type*

Rate 2											
Day Type	Period	Hours	WAE - Cool/Moderate			WAE - Moderate			WAE - Cool		
			Non-WAE Impact	Inc. Impact	% Inc. Impact	Non-WAE Impact	Inc. Impact	% Inc. Impact	Non-WAE Impact	Inc. Impact	% Inc. Impact
Average Weekday	Peak	4 PM to 9 PM	0.013	-0.002	-15.0%	0.005	0.013	289.3%	0.019	-0.012	-65.2%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.001	-0.003	-211.9%	-0.004	0.000	3.2%	0.005	-0.004	-86.9%
	Day	**All Hours**	0.004	-0.003	-68.7%	-0.003	0.003	-103.7%	0.008	-0.006	-76.3%
Average Weekend	Peak	4 PM to 9 PM	0.011	-0.003	-25.4%	0.002	0.015	593.0%	0.017	-0.014	-84.5%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	-0.001	-0.003	210.8%	-0.008	0.000	0.4%	0.003	-0.004	-136.2%
	Day	**All Hours**	0.001	-0.003	-183.7%	-0.005	0.003	-55.1%	0.006	-0.006	-105.4%
Monthly System Peak Day	Peak	4 PM to 9 PM	0.014	-0.003	-19.0%	-0.002	0.015	-775.9%	0.025	-0.015	-59.9%
	Off-Peak	12 AM to 4 PM, 9 PM to 12 AM	0.000	-0.005	-2364.0%	-0.007	0.000	6.2%	0.005	-0.007	-141.4%
	Day	**All Hours**	0.003	-0.004	-135.7%	-0.006	0.003	-46.6%	0.009	-0.009	-96.0%

* A shaded cell indicates estimate is not statistically significant

5.3.4 Comparison Across Rates

Figure 5.3-10 shows the average peak period impact for Rate 1 and Rate 2 in the winter months. The peak period covers the same hours for each rate (4 to 9 PM). The differences in impacts between the two rates are not statistically significant. Recall that there are no customers in SDG&E's hot climate region on Rate 1, meaning that the "All" category is not an apples to apples comparison.

Figure 5.3-11 shows the average daily kWh impact during the winter period for Rate 1 and Rate 2. Impacts are fairly similar in the cool climate region, but not in the moderate climate region.

Figure 5.3-10: Average Peak Period Impacts Across Rates

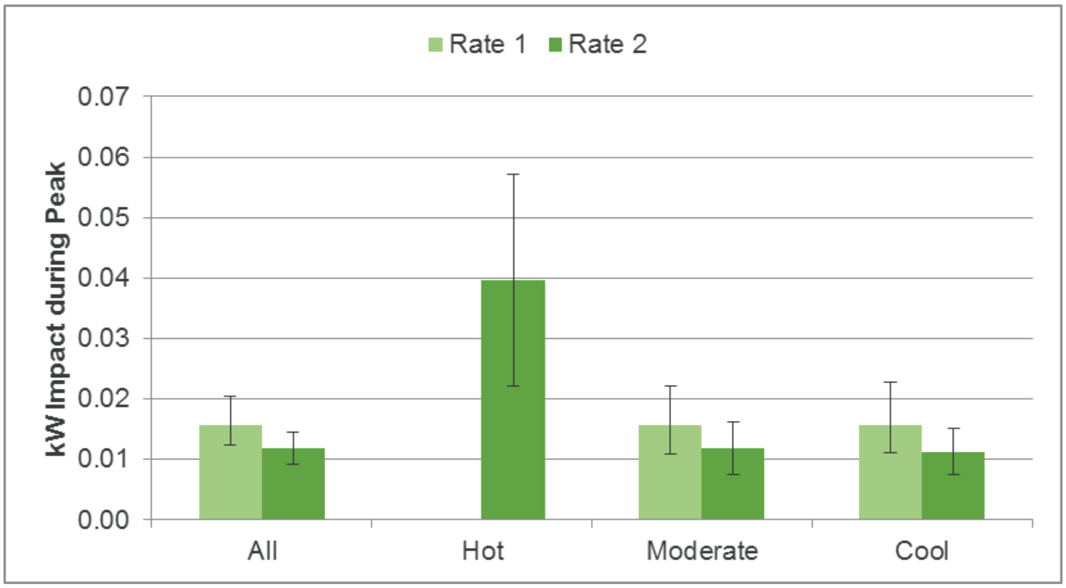
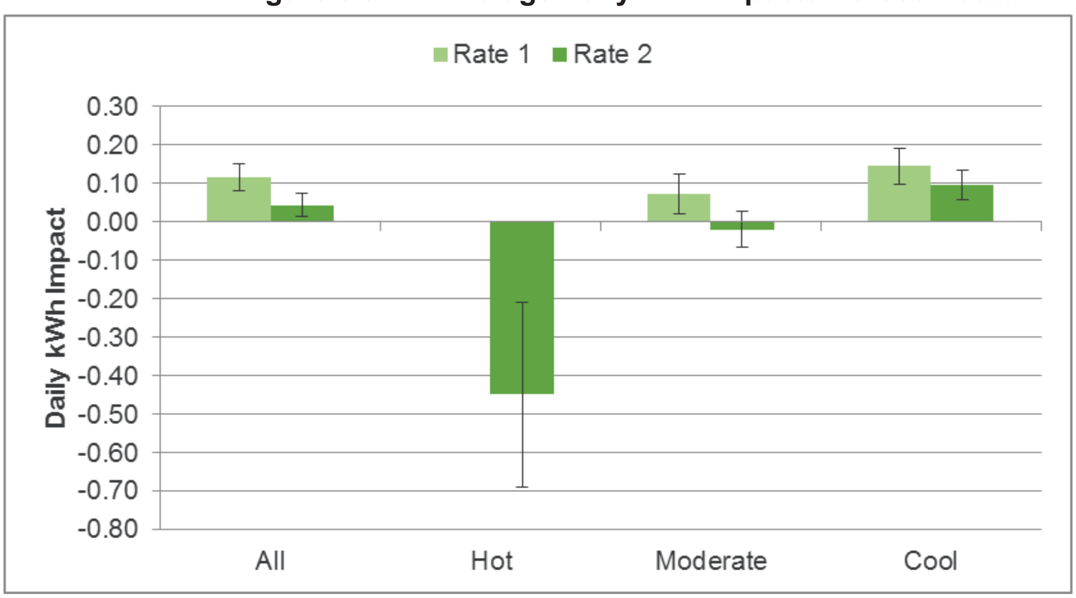


Figure 5.3-11: Average Daily kWh Impacts Across Rates



5.4 Bill Impacts

This section summarizes the bill impact estimates for the two rate treatments tested by SDG&E. Bill impacts are reported for each climate region separately and combined, and for CARE/FERA and non-CARE/FERA customers in the moderate and cool climate regions. As discussed previously, SDG&E's hot climate region is quite small and the sample of customers recruited into the pilot is not large enough to support estimation of load impacts separately for CARE/FERA and non-CARE/FERA customers nor to support segmentation of the sample into seniors or various income groups as was done in the hot regions for PG&E and SCE. All customers in the hot region were placed on Rate 2 or were in the control group.

Bill impacts are reported as the average total impact for the first year of the pilot and as the average monthly impact for the winter months of November through April for each rate, climate zone, and customer segment summarized above. As described in Section 3.2 of the First Interim Report, the following three analyses were conducted:

- **Structural benefiter/non-benefiter analysis based on pretreatment usage-** Displaying the proportions of structural benefiters and non-benefiters for each rate and relevant customer segment based on pretreatment data on an annual and summer season basis;
- **Estimation of the total bill impact due to both the difference in the tariffs and behavior change[25]-** Displaying the bill impact for each rate and relevant customer segment due to structural differences in the rate mitigated by changes in behavior; and
- **Change in the distribution of bill impacts due to behavior change-** Displaying the distribution curves of bill impacts (percentage of customers with bill impacts within $10 incremental bins) with and without behavior change in the same graph to illustrate if the distribution for participants shifted to the left or changed shape compared with the distribution for control customers without behavior change.

A more detailed explanation of each type of analysis and how the analysis was conducted is contained in Section 3.2 of the First Interim Report. The remainder of this section is organized according to the three analysis types summarized above—that is, bill impacts are presented for each rate, relevant customer segment, and climate region for each of the three analyses.

Unlike in the First Interim Report which relied on only one tariff per pilot rate and OAT, the impacts presented in this report are based on two SDG&E tariffs. All monthly bills form July 2016 through February 2017 (and their corresponding pretreatment months) are based on the tariffs that were in effect at the start of the pilot. Estimated bills for March 2017 through June 2017 (and their corresponding pretreatment months) are based on the March 2017 tariff. The reason for incorporating a second tariff was a significant change in both the pilot rates and OAT. Because of this change, which is documented in Appendix B, the annual structural benefiter analysis was updated for this report.

5.4.1 Structural Benefiter/Non-Benefiter Analysis Based on Pretreatment Usage

As with PG&E and SCE, the structural benefiter analysis was conducted for the winter and annual time periods using pretreatment usage data for the treatment group for each rate and relevant customer segment. Annual impacts were based on hourly load data from May 2015 through April 2016. Winter impacts were based on November 2015 through April 2016. Monthly bills were estimated for each treatment group customer on the OAT and TOU rate using the hourly load data. The difference in bills based on the TOU rate and the OAT determines if a customer is a structural benefiter, a structural non-benefiter, or falls in a neutral range defined as having a structural bill impact between ±$3.[63]

Final results from the structural benefiter / non-benefiter analysis are presented in column graphs and shown as percentages for the summer season and on an annual basis. For each rate and relevant segment, the percentage of customers who are non-benefiters, neutral (+/- $3), or benefiters based on their average monthly bills for the time period of interest are shown as individual columns. The three columns within each rate and segment combination total to 100%, thus showing the distribution of structural benefiters and non-benefiters for each rate and segment of interest.

Figure 5.4-1 presents the outcome of the structural benefiter analysis for Rate 1 for the cool and moderate climate regions combined for all customers as well as for CARE/FERA and non-CARE/FERA customers. The graph on the left presents the analysis on an annual basis, and the graph on the right presents the findings for the winter period. In the two climate regions combined, a large proportion of customers are in the neutral category and very few are benefiters on an annual basis. Over 90% of CARE/FERA customers in the cool and moderate climate regions have bill impacts in the neutral range. On a winter basis, essentially all customers are structurally neutral. The price differential between periods is very small (less than one cent), making the rate relatively flat. This combined with the baseline credit means that pilot bills are very similar to bills estimated with the OAT.

[63] See Section 3.2.1 in the First Interim Report for additional details on the methodology.

Figure 5.4-1: Rate 1 Structural Benefiter / Non-Benefiter Analysis
All | CARE/FERA | Non-CARE/FERA

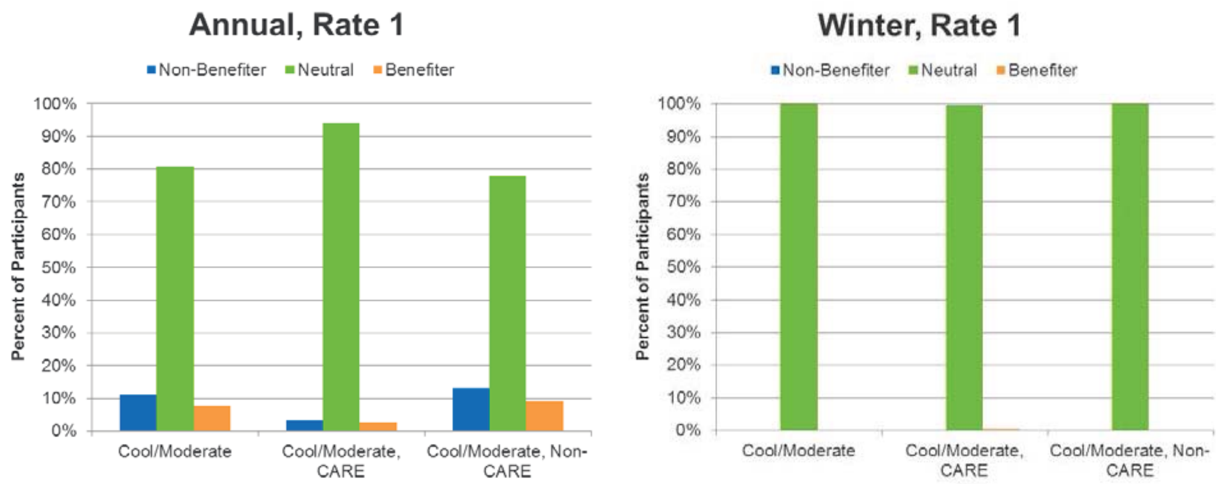


Figure 5.4-2 presents the outcome of the structural benefiter analysis for Rate 1 at the detailed segment level for the cool and moderate climate regions, separately. The findings at the aggregate level still hold, with most customers in the neutral category, and a small percentage of non-CARE/FERA customers in the benefiter category on an annual basis. Nearly all customers in each segment are neutral in the winter months, for the reasons explained above.

Figure 5.4-2: Rate 1 Structural Benefiter / Non-Benefiter Analysis
Detailed Segments by Climate Region

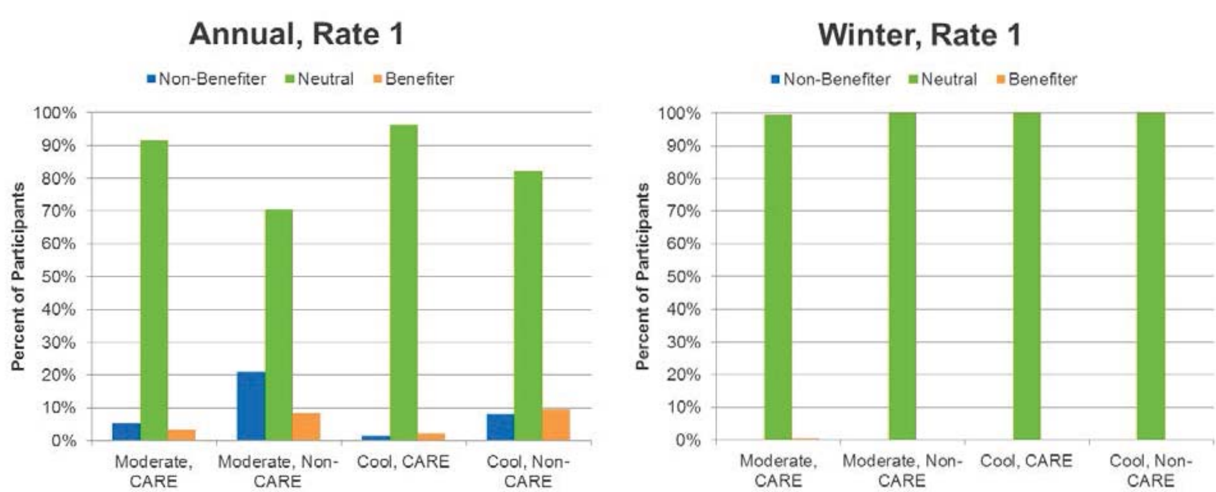


Figure 5.4-3 presents the outcome of the structural benefiter analysis for Rate 2 at the aggregate level across climate regions, and by CARE/FERA and non-CARE/FERA for the cool and moderate climate regions combined. The results are nearly identical to those for Rate 1. Once again, most CARE/FERA customers in the cool and moderate climate regions are in the neutral category on an annual basis and essentially all customers are in the neutral category in the winter months. Like Rate 1, the price differential between off-peak and peak periods is very small, resulting in a nearly flat rate. In other words, bills estimated using the OAT and Rate 2 are nearly identical.

Figure 5.4-3: Rate 2 Structural Benefiter / Non-Benefiter Analysis
All | CARE/FERA | Non-CARE/FERA

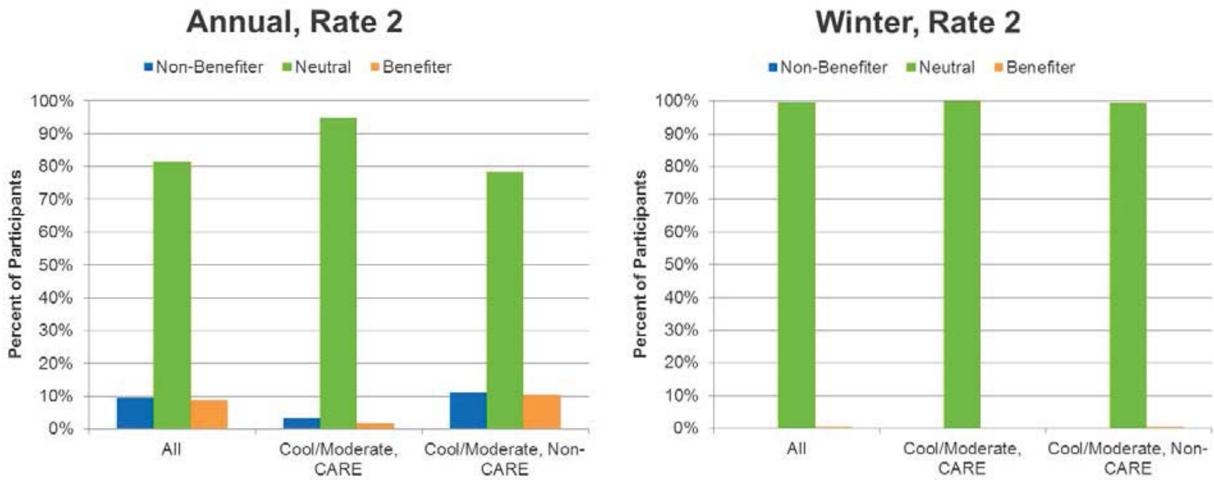
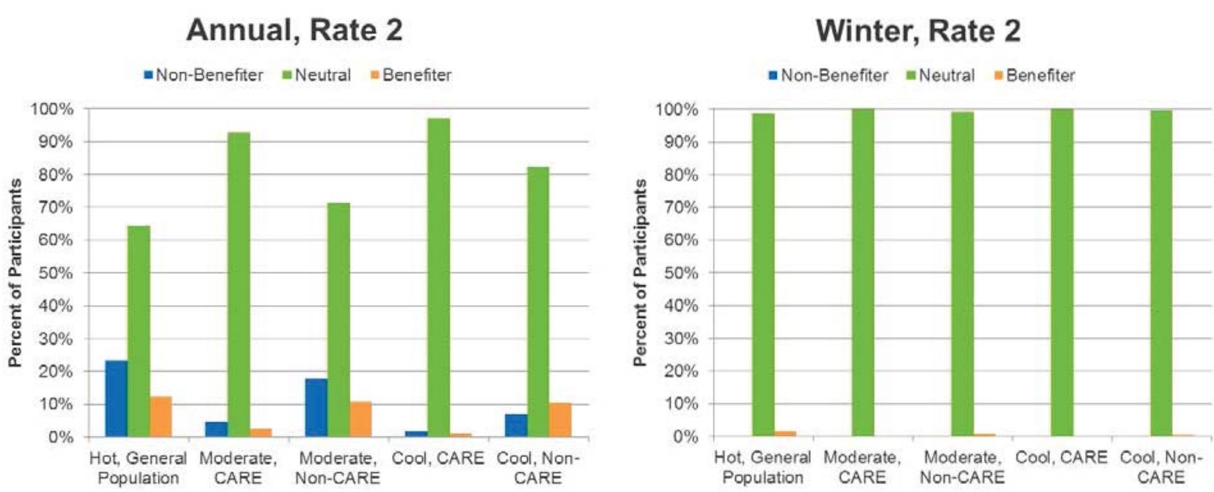


Figure 5.4-4 presents the outcome of the structural benefiter analysis for Rate 2 at the detailed segment level by climate region. As mentioned previously, the hot climate region is too small to segment by CARE/FERA status. Just over 20% of customers in the hot climate region are non-benefiters on an annual time frame, but almost all customers in that region are in the neutral category in the winter months. As with Rate 1, most CARE/FERA customers in the cool and moderate climate regions fall into the neutral category on an annual and winter basis.

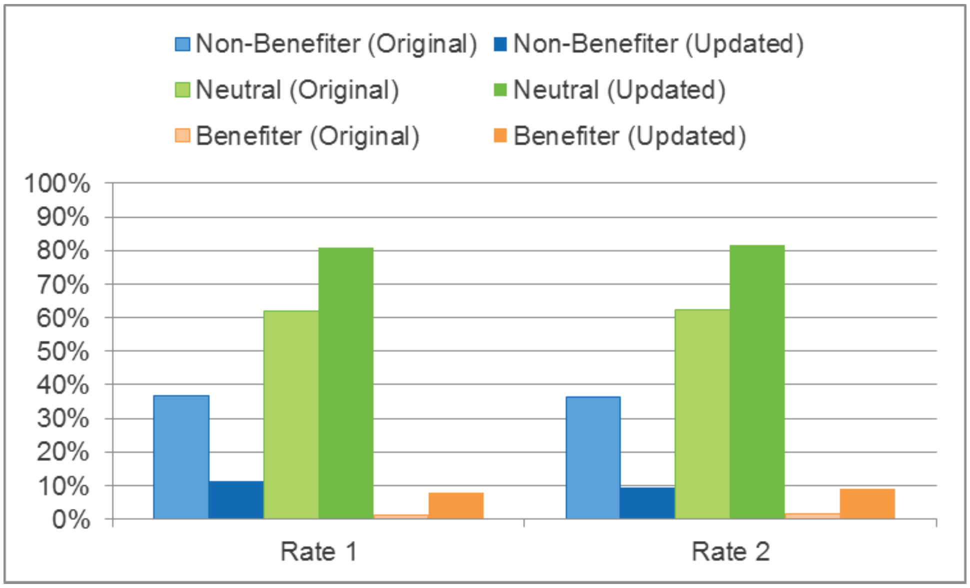
Figure 5.4-4: Rate 2 Structural Benefiter / Non-Benefiter Analysis
Detailed Segments by Climate Region



Overall, a general pattern of structural benefiters and non-benefiters emerged that was constant across rates. Generally, CARE/FERA customers tend to have very small bill impacts compared to non-CARE/FERA customers, as shown by their larger share of customers in the neutral category on an annual basis. These results stand in contrast to those from PG&E and SCE who had very large proportions of benefiters in nearly all customer segments during the winter period.

Figure 5.4-5 presents a comparison of the annual structural benefiter analysis using two versions of the pilot tariffs and the OAT. The lighter bars represent the outcome of the analysis based on the June 2016 tariffs, which were in effect at the launch of the pilot. The values here match what was reported in the First Interim Report. The darker bars are based on a combination of the original and March 2017 tariffs. The original tariff was used for the months of June through February, and the new tariffs were used for March through May. Incorporating the updated tariffs increases the number of customers in the neutral category and reduces the number of customers in the non-benefiter category. For a comparison of the two tariffs, see Appendix B.

Figure 5.4-5: Comparison of Structural Benefiter Analysis between Original and Updated Tariffs



The next section presents the full picture of how customer's bills changed with a change in their tariff and changes in behavior.

5.4.2 Estimation of the Total Bill Impact Due to Differences in the Tariffs and Behavior Change

Total bill impacts experienced by customers on a TOU rate can be decomposed into two components: the structural impact, and the behavioral impact. The structural impact represents the change in customer bills based solely on the change in the underlying structure of the rate. In this case, it is the change from the OAT to the time-differentiated TOU pilot rates. The behavioral impact represents how the customer changed their energy usage in response to the new pricing structure of the rate—which includes higher prices in the afternoon and evening and lower prices at other times of the day. As noted above, it is the combination of structural and behavioral bill impacts that produces the total bill impact experienced by the average study participant on each rate.

The results from this analysis represent the total cost to the customer over the first year of the pilot and the average monthly bill across the winter months of November 2016 through April 2017. Three different bills were calculated for each customer segment:[64]

- **No Change in Behavior or Tariff [1]:** This represents what the treatment group bills would have been in the post-treatment period if they were on the OAT and had not changed their behavior
- **No Change in Behavior, Change in Tariff [2]:** This represents what the treatment group bills would have been in the post-treatment period if they were on the TOU rate and had not changed their behavior
- **Change in Behavior and in Tariff [3]:** This represents what the treatment group bills were in the post-treatment period on the TOU rate with a change in behavior

Based off of components defined above, the following metrics were calculated:

- The difference between **[1]** and **[2]** is the structural bill impact (based on post-treatment usage after adjusting for any pretreatment difference between control and treatment customers);
- The difference between **[1]** and **[3]** is the bill impact due to structural differences in the rates, but mitigated by changes in behavior; and
- The difference between **[2]** and **[3]** is the amount customers were able reduce their bills by changing their behavior.

In the bill impact analysis, a major policy question was to better understand the relationship between the structural bill impacts, and how customers were able to respond. This outcome is represented by the "total bill impact" shown in the data table at the bottom of the figures below. Put differently, this percentage represents how much of the structural bill increase from the TOU rate the average customer was able to offset. Results are organized by rate, climate region, and segment; similarly to the other bill impact analysis sections.

Annual

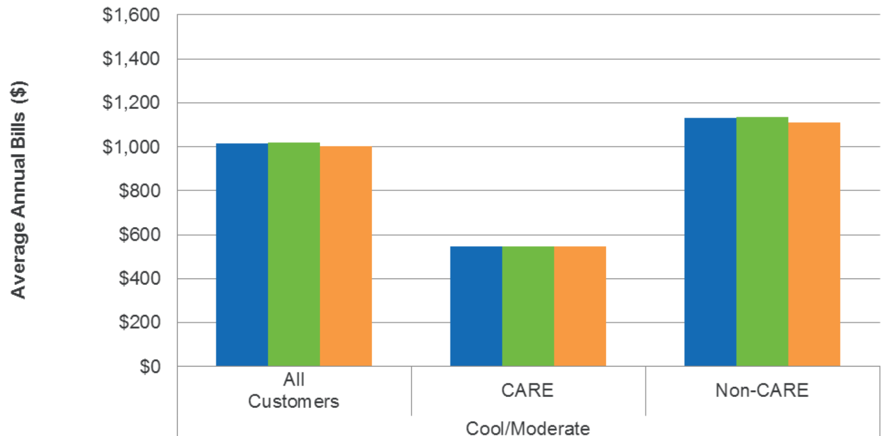
Figure 5.4-6 presents a set of three average annual bills (the total cost across twelve monthly bills) as defined above for all customers, CARE/FERA customers, and non-CARE/FERA customers on Rate 1 in the cool and moderate climate regions combined. The blue bar represents a typical total yearly cost for a customer still on the OAT and not responding to a TOU rate— noted as "No Change in Behavior or Tariff." For the average customer on Rate 1, this dollar amount was $1,017. The green bar represents what a typical total cost would be for a customer who was billed on a TOU rate, but didn't change their energy use behavior— noted as "No Change in Behavior, Change in Tariff." This dollar amount is $1,019 for the average Rate 1 customer. The difference between the two values, $2, is the average increase a customer would see in their bills by changing from the OAT to Rate 1, and not changing their energy use behavior; this is also referred to as the customer's structural loss. The orange bar represents the average Rate 1 customer's bill after factoring in the change in rate from the OAT to the Pilot Rate 1, and then also taking into account any changes in energy use behavior— noted as "With Change in Behavior and

[64] See Section 3.2.3 of the First Interim Report for additional details on the methodology.

Tariff." This bill amount averaged $1,000 for the typical Rate 1 customer. Based off these values, it is possible to estimate the total change in bills including both the change in tariff and in behavior, which was a bill reduction of about $16 per month (less than 2%). The total change in bill is calculated by subtracting the orange ($1,000) from the blue ($1,017)[65].

Non-CARE/FERA customers were able to avoid all of their structural loss, which was equal to about $3.

Figure 5.4-6: Rate 1 Annual Bill Impact Due to Differences in the Tariff and Behavior Change
All | CARE/FERA | Non-CARE/FERA

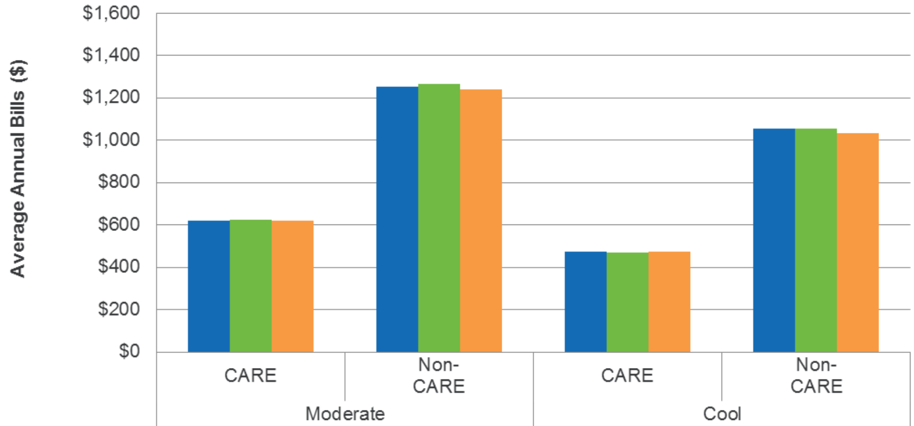


	All Customers	CARE	Non-CARE
No Change in Behavior or Tariff	$1,017	$546	$1,130
No Change in Behavior, Change in Tariff	$1,019	$546	$1,133
With Change in Behavior and Tariff	$1,000	$547	$1,110
Total Bill Impact	-$16	$1	-$21
Percent Bill Impact	-1.6%	0.1%	-1.8%

Figure 5.4-7 presents the three sets of total yearly costs as defined above for the detailed segments for the cool and moderate climate regions on Rate 1. Generally, customers had very small structural bill impacts, with the exception of non-CARE/FERA customers in the moderate climate region who faced cost increases of about 12% without changes in their behavior. Fortunately, these customers were able to ultimately reduce their overall costs by about $14 or 1.1% by shifting or reducing their energy use. CARE/FERA customers in both climate regions did not have meaningful bill impacts over the course of the year in either direction.

[65] There is some rounding error.

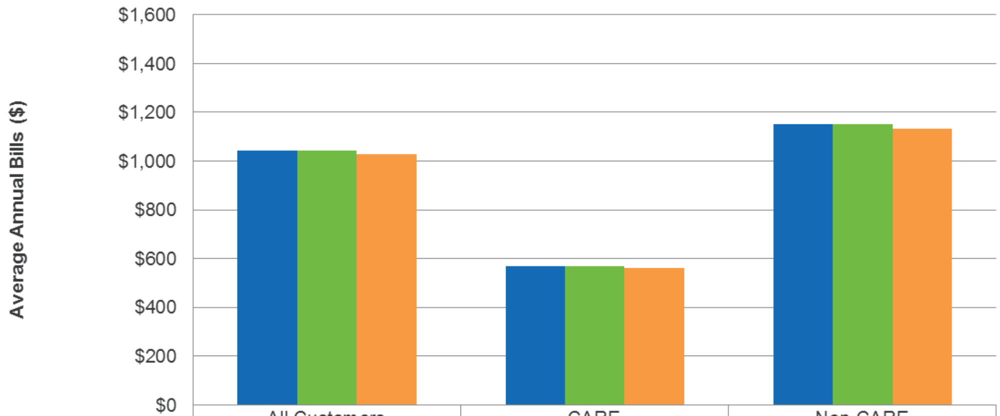
Figure 5.4-7: Rate 1 Annual Bill Impact Due to Differences in the Tariff and Behavior Change Detailed Segments by Climate Region



	Moderate CARE	Moderate Non-CARE	Cool CARE	Cool Non-CARE
No Change in Behavior or Tariff	$622	$1,253	$473	$1,055
No Change in Behavior, Change in Tariff	$624	$1,265	$470	$1,053
With Change in Behavior and Tariff	$621	$1,239	$475	$1,031
Total Bill Impact	-$1	-$14	$2	-$24
Percent Bill Impact	-0.1%	-1.1%	0.4%	-2.3%

Figure 5.4-8 presents the three sets of bills for customers on Rate 2 for customers in the service territory as a whole and for CARE/FERA and non-CARE/FERA customers in the cool and moderate climate regions combined. Like Rate 1, differences in total annual costs are very small (less than 2%) when compared across the three bill calculations. Overall, customers faced essentially no structural losses, and were able to reduce their total costs by about $15 or 1.5%. CARE/FERA customers faced structural losses of only $1 over the course of the year, but in the end they reduced their costs by $8 or 1.4% through changes in behavior.

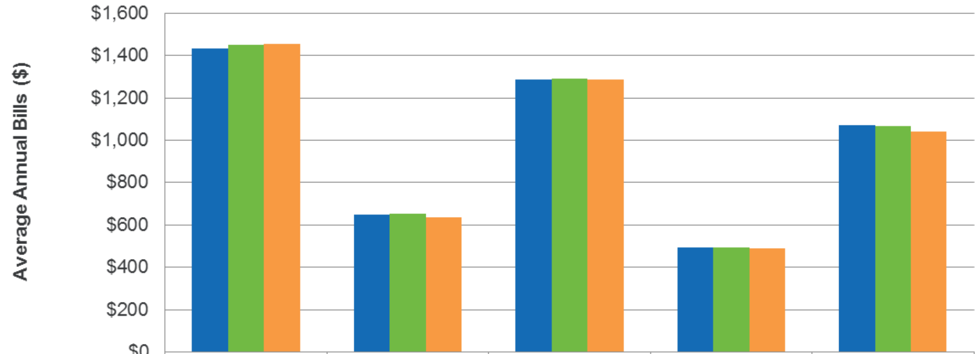
Figure 5.4-8: Rate 2 Annual Bill Impact Due to Differences in the Tariff and Behavior Change
All | CARE/FERA | Non-CARE/FERA



	All Customers All Climates	CARE Cool/Moderate	Non-CARE Cool/Moderate
No Change in Behavior or Tariff	$1,043	$569	$1,152
No Change in Behavior, Change in Tariff	$1,043	$570	$1,151
With Change in Behavior and Tariff	$1,028	$560	$1,134
Total Bill Impact	-$15	-$8	-$17
Percent Bill Impact	-1.5%	-1.4%	-1.5%

Figure 5.4-9 presents the three sets of bills for the detailed segments for the moderate and cool climate regions, and for the hot climate region as a whole. On an annual basis, customers in the hot climate region faced structural losses of $16. Unfortunately, these customers could not reduce their total bills through behavior change and ultimately paid about $20 or 1.4% more, on average, than they would have on the OAT. Non-CARE/FERA customers in the cool climate region saved the most money over the course of the year, about $28 on average which is equal to a reduction of 2.6%.

Figure 5.4-9: Rate 2 Annual Bill Impact Due to Differences in the Tariff and Behavior Change Detailed Segments by Climate Region

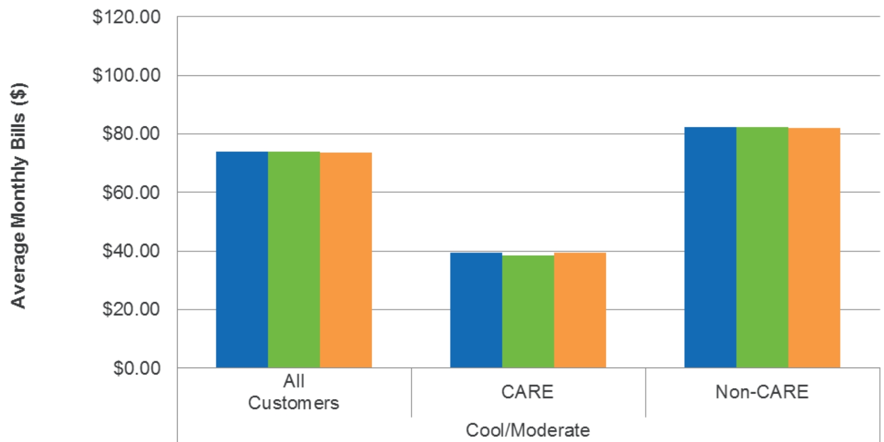


	Hot	Moderate		Cool	
	General	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$1,433	$648	$1,285	$492	$1,071
No Change in Behavior, Change in Tariff	$1,449	$652	$1,291	$491	$1,065
With Change in Behavior and Tariff	$1,453	$635	$1,284	$488	$1,043
Total Bill Impact	$20	-$13	$0	-$4	-$28
Percent Bill Impact	1.4%	-2.0%	0.0%	-0.8%	-2.6%

Winter

Figure 5.4-10 presents the three average monthly bills for customers on Rate 1 during the winter period. Bills are presented for customers in the cool and moderate regions combined, and by CARE/FERA and non-CARE/FERA for the combined climate regions. Similar to the annual estimates, customers face very small structural impacts that are less than $1 during the winter months. Total bill impacts were less than 1% for the CARE/FERA and non-CARE/FERA customers combined and separately. This is not surprising considering the relatively flat nature of Rate 1 during the winter period.

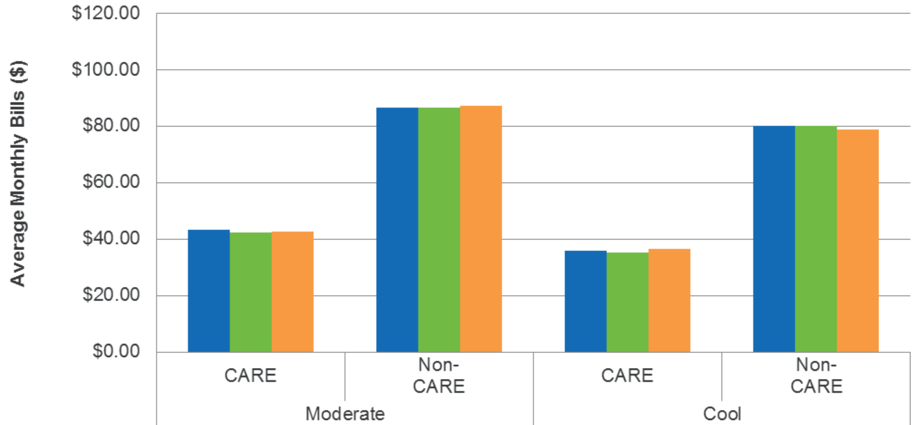
Figure 5.4-10: Rate 1 Winter Bill Impact Due to Differences in the Tariff and Behavior Change
All | CARE/FERA | Non-CARE/FERA



	All Customers	CARE	Non-CARE
No Change in Behavior or Tariff	$74.09	$39.49	$82.43
No Change in Behavior, Change in Tariff	$73.95	$38.60	$82.47
With Change in Behavior and Tariff	$73.67	$39.43	$81.92
Total Bill Impact	-$0.42	-$0.06	-$0.51
Percent Bill Impact	-0.6%	-0.1%	-0.6%

Figure 5.4-11 presents the three sets of average winter monthly bills for the detailed segments by climate region. Once again, structural bill impacts are essentially zero for the average customer in each segment. For example, CARE/FERA customers faced structural gains of less than $1 and ultimately experienced bill increases of only $0.47 or 1.3% in the winter months.

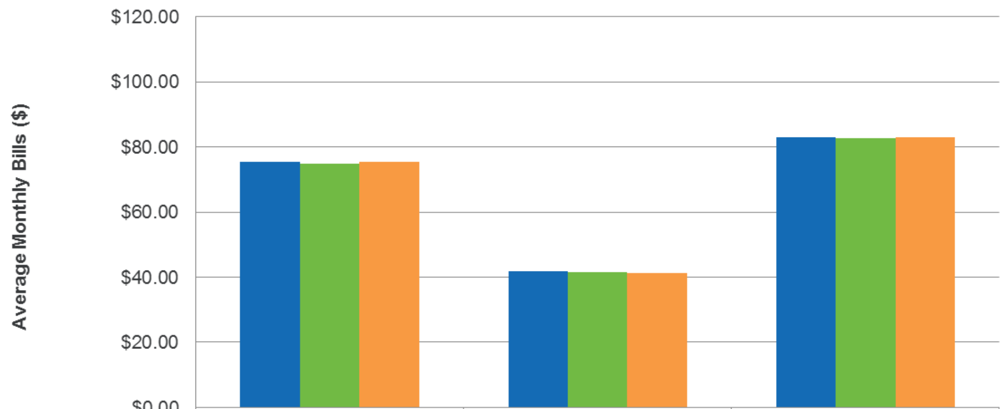
Figure 5.4-11: Rate 1 Winter Bill Impact Due to Differences in the Tariff and Behavior Change
Detailed Segments by Climate Region



	Moderate CARE	Moderate Non-CARE	Cool CARE	Cool Non-CARE
No Change in Behavior or Tariff	$43.25	$86.51	$35.87	$79.94
No Change in Behavior, Change in Tariff	$42.29	$86.54	$35.05	$79.99
With Change in Behavior and Tariff	$42.64	$87.14	$36.34	$78.74
Total Bill Impact	-$0.61	$0.64	$0.47	-$1.20
Percent Bill Impact	-1.4%	0.7%	1.3%	-1.5%

Figure 5.4-12 presents the three sets of average monthly bills for customers on Rate 2 in the winter period. Similar to Rate 1, customers did not face meaningful structural or total bill impacts. In fact, for customers in the territory as a whole and for non-CARE/FERA customers in the cool and moderate climate regions combined, their total bill impact was 0% on average. Rate 2 is rather flat, much like Rate 1, in the winter months, so this aligns with the expected outcome.

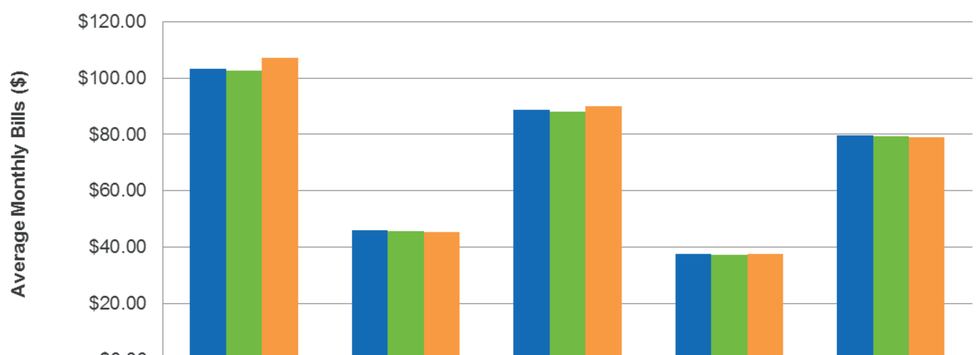
Figure 5.4-12: Rate 2 Winter Bill Impact Due to Differences in the Tariff and Behavior Change
All | CARE/FERA | Non-CARE/FERA



	All Customers All Climates	CARE Cool/Moderate	Non-CARE Cool/Moderate
No Change in Behavior or Tariff	$75.32	$41.73	$83.02
No Change in Behavior, Change in Tariff	$74.90	$41.44	$82.58
With Change in Behavior and Tariff	$75.31	$41.34	$83.05
Total Bill Impact	-$0.01	-$0.39	$0.02
Percent Bill Impact	0.0%	-0.9%	0.0%

Figure 5.4-13 presents the three sets of average winter monthly bills for the individual customer segments for Rate 2. Customers in the hot climate region experienced small bill increases in the winter months, about $4.03 or 3.9% on average. Non-CARE/FERA customers in the moderate climate region also experienced a loss, but to a smaller extent, only $1.24 or 1.4%.

Figure 5.4-13: Rate 2 Winter Bill Impact Due to Differences in the Tariff and Behavior Change
Detailed Segments by Climate Region



	Hot	Moderate		Cool	
	General	CARE	Non-CARE	CARE	Non-CARE
No Change in Behavior or Tariff	$103.25	$45.98	$88.64	$37.64	$79.59
No Change in Behavior, Change in Tariff	$102.55	$45.66	$88.13	$37.37	$79.18
With Change in Behavior and Tariff	$107.28	$45.33	$89.88	$37.48	$78.87
Total Bill Impact	$4.03	-$0.64	$1.24	-$0.16	-$0.72
Percent Bill Impact	3.9%	-1.4%	1.4%	-0.4%	-0.9%

Generally, bill impacts were very small on an annual basis and in the winter months. This is likely due to the fact that both Rate 1 and Rate 2 have very small price differentials in the winter period, which is from November to April.

5.4.3 Change in the Distribution of Bill Impacts Due to Behavior Change

The third analysis presents the distribution of bill impacts[66] for customers with and without behavioral change, and is designed to show how the distribution shifts when customers respond to the rates by changing behavior. Similar to the other analyses, impact distributions are based on the average monthly bills for the first year of the pilot. Bill impacts were estimated for two cases—with and without behavior change. Both are based on the structural bill impact calculations; however, impacts with behavior change show how behavioral impacts are able to affect the structural impact distribution. Customers were segmented into ranges of bill impacts. The percentage of customers in each $10 increment from negative $100 to positive $100 per month (with and without behavior change) was determined with and without behavior change. The underlying calculations used to develop the distributions are based off of a difference-in-differences approach that compares the treatment and control customers based on both pre- and post-treatment bill impacts.[67]

The two distributions are presented on a line graph, with the height of the line at any given $10 increment representing the percentage of customers experiencing a bill impact of the corresponding dollar amount. In this case, the bill impact is measured as the difference between the TOU bill and the OAT bill. If the line for the group with changes in behavior is to the left of the line representing the group with no change in behavior, it shows that at least some customers were able to modify their energy usage such that they had lower total bill impacts compared to if they had not changed their behavior.

Figure 5.4-14 presents the distribution of bill impacts with and without energy use behavior change. The blue line represents the structural bill impacts that result when customers are billed on the TOU rate and do not change their energy use behavior. The green line shows the total bill impacts when customers have responded to the TOU rate and, in some cases, changed their energy use behavior. Bill impacts are calculated as the difference between the TOU bill and the OAT bill. Each point along the line graph represents the percentage of customers within a specific bill impacts bin or range. For example, on Rate 1, approximately 45.5% of the customers have structural bill impact of $1 to $10 per month—the blue line. In other words, approximately 45.5% of the Rate 1 customers would experience an increase of $1 to $10 per month on Rate 1 compared to the OAT without changing their behavior. The green line represents the total bill impacts when customers have had the opportunity to respond to the TOU rate. In this case, the percent of customers experiencing an increase of $1 to $10 per month on Rate 1 compared to the OAT is 40.0%, showing a meaningful decrease.

[66] Bill impacts without behavior change represent the structural bill impact distribution; bill impacts with behavior change show how behavioral impacts affect the structural bill impact distribution.

[67] See Section 3.2.4 in the First Interim Report for additional details on the methodology.

It is important to note that customers could move up or down through the incremental impact bins, and could potentially move more than one bin—meaning that a customer could potentially experience a bill increase due to their behavioral response, or they could jump down several bins and go from a $31 to $40 per month bill impact down to $11 to $20 impact, for example. In the case of the average Rate 1 customers, there is an increase in the percent of customers with a total bill decrease of between $0 and $9 per month. With no change in behavior, 51.5% of customers were in this bin and with behavior change 57.1% of customers are now in this bin.

As noted in the previous section, most customers did not face meaningful structural bill increases or decreases. This is also apparent in the graph below, where the distribution is very evenly split between bill increase and decreases. It's important to remember that instances where the green line is to the right of or above the blue line in the lower bill impact ranges indicate more customers have moved into that bin, likely from higher impact bins.

Figure 5.4-14: Rate 1 Change in the Distribution of Bill Impacts Due to Behavior Change
All | CARE/FERA | Non-CARE/FERA

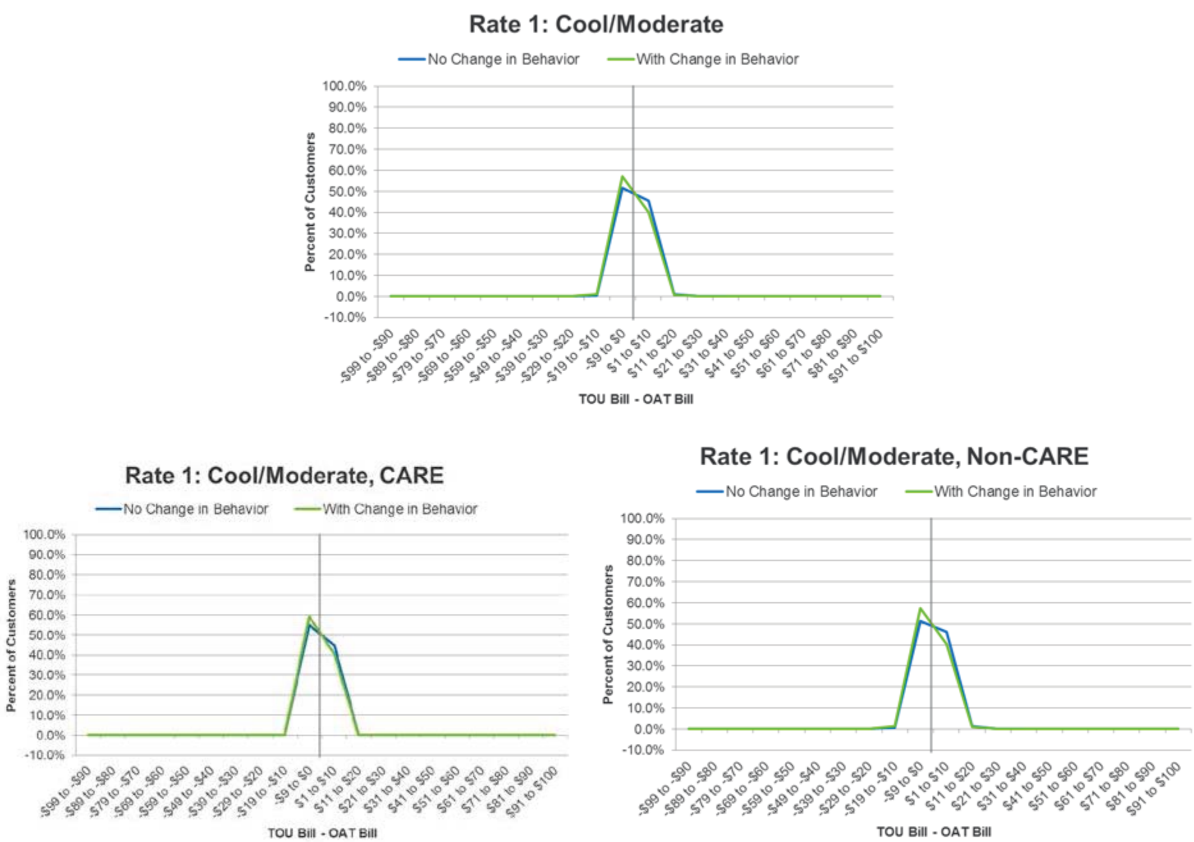
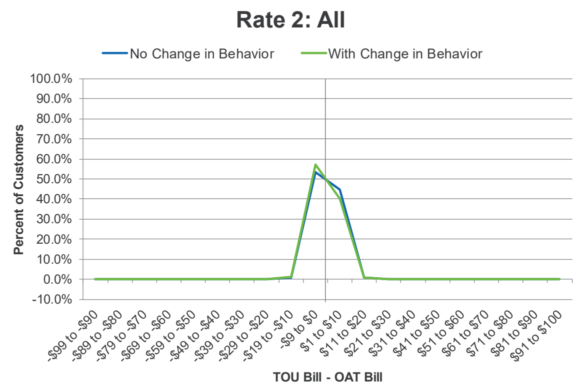


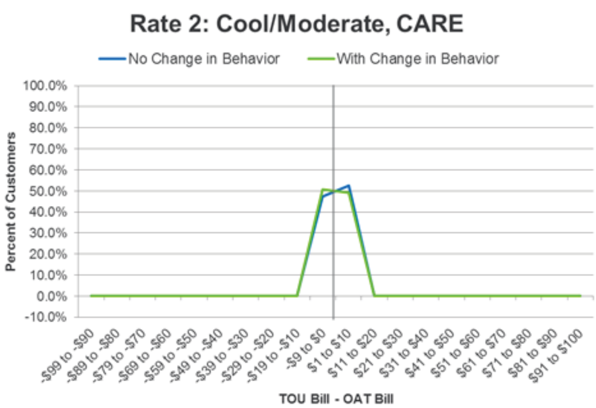
Figure 5.4-15 provides the distribution of average monthly bill impacts for all customers and CARE/FERA and non-CARE/FERA customers in the moderate and cool climate regions on Rate 2 over the first year of the pilot. Without changes in behavior, 44.6% of customers faced bill impacts between $1 and $10. With

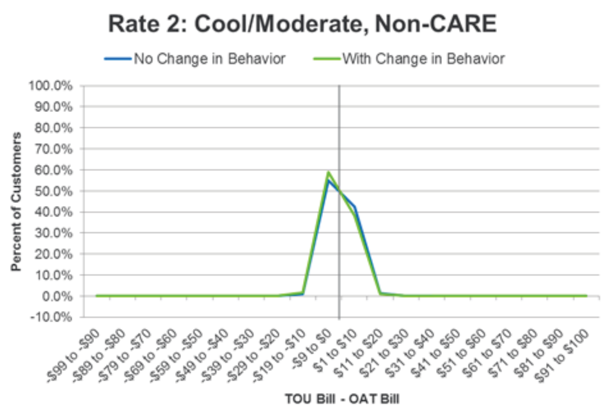
changes in behavior, this was reduced to 40.4% of customers. The distributions of bill impacts for CARE/FERA and non-CARE/FERA customers in the cool and moderate climate regions are very similar to those for Rate 1.

Figure 5.4-15: Rate 2 Change in the Distribution of Bill Impacts Due to Behavior Change
All | CARE/FERA | Non-CARE/FERA

Pilot Bill - Tiered Bill	No Change in Behavior	With Change in Behavior
-$99 to -$90	0.0%	0.0%
-$89 to -$80	0.0%	0.0%
-$79 to -$70	0.0%	0.0%
-$69 to -$60	0.0%	0.0%
-$59 to -$50	0.0%	0.0%
-$49 to -$40	0.0%	0.0%
-$39 to -$30	0.0%	0.0%
-$29 to -$20	0.1%	0.1%
-$19 to -$10	0.9%	1.4%
-$9 to $0	53.3%	57.3%
$1 to $10	44.6%	40.4%
$11 to $20	1.0%	0.8%
$21 to $30	0.1%	0.1%
$31 to $40	0.0%	0.0%
$41 to $50	0.0%	0.0%
$51 to $60	0.0%	0.0%
$61 to $70	0.0%	0.0%
$71 to $80	0.0%	0.0%
$81 to $90	0.0%	0.0%
$91 to $100	0.0%	0.0%







5.5 Synthesis for SDG&E Pilot

This section compares input from the load impact analysis, the bill impact analysis, and the survey analysis. The objective of these comparisons, at least in part, is to determine if the information and conclusions observed for individual metrics are supported by findings from other metrics or, alternatively, findings for one metric contradict those for another metric. We also look for clues from the survey findings that might help explain why load or bill impacts for one rate differ from those for other rates. As in the other synthesis sections, readers are reminded once again that, given the large samples underlying the survey analysis, statistically significant differences may not reflect meaningful differences from a policy perspective.

5.5.1 Synthesis

Table 5.5-1 and Table 5.5-2 summarize some of the relevant findings from the load impact, bill impact and survey analysis. Readers are directed to Section 3.5.1 for an explanation of the variables and symbols contained in the tables. As a reminder, SDG&E had two pilot rates, one with two pricing periods during the winter and the other with three. The peak periods were the same for both rates and start at 4 PM and end at 9 PM. Each rate has the same number of periods on weekdays and weekends, but the shoulder period on weekends is much shorter for the three period rate (Rate 1). The weekday shoulder period for the three period rate is long, beginning at 6 AM, whereas on weekends, the shoulder period begins at 2 PM.

Looking across the various metrics for each customer segment, the load impact and bill impact findings are typically similar across rates. During the winter season, the weekday peak period prices are identical, and the off peak prices are within half a cent of one another. This leaves the primary difference between the rates being the super off peak rate period for Rate 1, which also happens to be within about one cent of the off peak rate. Altogether, this makes for Rates 1 and 2 to be extremely similar during the winter. As such, the performance between rates is expected to be somewhat similar.

Table 5.5-1: Load Impacts, Bill Impacts, and Selected Survey Findings for SDG&E Rate 1

Climate	Segment	Load Impacts			Bill Impacts		Survey						
		Summer Peak Period Load Reduction %	Winter Peak Period Load Reduction %	Net Annual kWh Change %	Annual Total Bill Impact $	Annual Total Bill Impact %	Health Index (Range 0-10)	Bill Higher than Expected	Difficulty Paying Bills	Economic Index (Range 0-10)	Understanding TOU Pricing (None-Correct)	Satisfaction w/ Rate (11 pt. Scale)	Satisfaction w/ Utility (11 pt. Scale)
Hot	General Population	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Moderate	Non-CARE/FERA	6.3% ▼	2.6% ▼	1.3% ▼	-$14 ▼	-1% ▼	2.2	26% -	26% -	2.4 -	6%	6.4 ▲	6.8 -
	CARE/FERA	5.2% ▼	0.4% -	0.1% ▼	-$1 -	0% -	2.7	26% -	68% -	4.2 ▲	13%	7.2 -	7.6 -
Cool	Non-CARE/FERA	5.2% ▼	2.9% ▼	1.3% ▼	-$24 ▼	-2% ▼	2.0	29% -	18% ▼	2.0 ▼	5%	6.6 ▲	7.0 -
	CARE/FERA	1.7% ▼	-0.3% -	0.6% ▲	$2 -	0% -	2.6	21% ▼	60% -	3.8 -	12%	7.4 ▲	7.8 -

Table 5.5-2: Load Impacts, Bill Impacts, and Selected Survey Findings for SDG&E Rate 2

Climate	Segment	Load Impacts			Bill Impacts		Survey						
		Summer Peak Period Load Reduction %	Winter Peak Period Load Reduction %	Net Annual kWh Change %	Annual Total Bill Impact $	Annual Total Bill Impact %	Health Index (Range 0-10)	Bill Higher than Expected	Difficulty Paying Bills	Economic Index (Range 0-10)	Understanding TOU Pricing (None-Correct)	Satisfaction w/ Rate (11 pt. Scale)	Satisfaction w/ Utility (11 pt. Scale)
Hot	General Population	6.8% ▼	3.9% ▼	1.2% ▲	$20 ▲	1% ▲	N/A	N/A	35% N/A	N/A	14%	5.8 N/A	6.5 N/A
Moderate	Non-CARE/FERA	5.1% ▼	1.7% ▼	0.4% ▼	$0 -	0% -	2.2	26% -	28% -	2.4 -	14%	6.4 ▲	6.8 -
	CARE/FERA	5.3% ▼	1.3% ▼	1.6% ▼	-$13 ▼	-2% ▼	3.0 ▲	26% -	64% -	4.1 -	28%	7.3 -	7.7 -
Cool	Non-CARE/FERA	4.3% ▼	1.9% ▼	1.2% ▼	-$28 ▼	-3% ▼	2.0	27% -	18% ▼	2.1 -	13%	6.5 ▲	7.1 -
	CARE/FERA	2.6% ▼	0.5% -	0.2% ▼	-$4 ▼	-1% ▼	2.5	23% ▼	63% -	3.8 -	25%	7.6 ▲	8.0 ▲

Non-CARE/FERA Customers

Non-CARE/FERA customers had larger load reductions than CARE/FERA customers for both Rates 1 and 2 in both absolute and percentage terms for the cool/moderate climate regions combined and also in the cool climate region. In the moderate climate region, the non-CARE/FERA absolute and percentage load reductions were also greater for Rate 1, but were not statistically different for Rate 2. The average peak-period load reduction for non-CARE/FERA customers in the cool/moderate regions combined equaled 2.8% and 0.02 kW for Rate 1 and 1.9% and 0.01 kW for Rate 2. The difference in load impacts across the two rates was statistically significant. Absolute impacts were larger in the moderate region for Rate 1 compared with the cool climate region, and the same between climate regions for Rate 2; neither of the differences was statistically significant. In percentage terms, impacts were larger in cool region compared to the moderate region for Rates 1 and 2, but the differences were not statistically significant. Load impacts were generally half the size (in percentage terms) in the winter compared to the summer for non-CARE/FERA customers.

Non-CARE/FERA customers in the moderate climate region on Rates 1 and 2 experienced the largest structural bill impacts, which were almost as large as the structural impacts of the general population in the hot climate region on Rate 2. Non-CARE/FERA customers on Rates 1 and 2 in both the moderate and cool climate regions were able to achieve either no total annual bill impact or annual bill reductions up to $28 for the cool climate region customers on Rate 2.

Non-CARE/FERA customers tended to have low percentages of customers receiving bills higher than expected, and also had low percentages of customers having difficulty paying bills. Neither of these metrics have statistically significant differences between the treatment group and the control group. Similarly, there were no statistically significant increases in the economic index. In fact, there was actually a statistically significant decrease for the non-CARE/FERA customers in the cool climate region on Rate 1.

When excluding the hot climate region, non-CARE/FERA customers had the highest percent reduction in peak period energy use, the highest percent reduction in annual kWh usage on Rate 1, and second highest on Rate 2. They also had the highest bill reduction due to behavior change in three out of the four segments. Non-CARE/FERA customers understood the rates better than the CARE/FERA customers (as indicated by the low percent that couldn’t identify at least some hours that fell into the peak period). All non-CARE/FERA segments had statistically significantly higher satisfaction ratings for the rate plan compared to the control group. These metrics paint an internally consistent picture of a customer segment that understood the rate features relatively well, worked to reduce usage which resulted in bills similar or less than what they would have experienced on the OAT, and were ultimately more satisfied with their rate than control group customers.

CARE/FERA Customers

As discussed above, CARE/FERA customers tended to have load reductions that were smaller than non-CARE/FERA customers overall and in the cool climate region on both rates. In the moderate climate region, the difference in load impacts between the two segments was not statistically significant. CARE/FERA customers on average produced behavioral bill reductions significantly smaller than non-

CARE/FERA customers in the cool climate region on both rates and produced a mix of higher and lower impacts in the moderate climate region.

One potentially important finding related to the rates that could affect performance of CARE/FERA customers is the lower understanding of the timing of the peak period, as evidenced by the much higher percent of customers who could not identify any hours that fell during the high priced period. Taking a simple average across the climate regions and rates for this metric, only about 10% of non-CARE/FERA customers were unable to correctly identify any peak-period hours, whereas twice as many (20%) CARE/FERA customers fell into this category. An additional point of interest on this topic is that Rate 1 customers improved on this metric, whereas Rate 2 CARE/FERA customers experienced an increase of ten percentage points, meaning that far more customers couldn't identify any of the peak period hours. The related question regarding identifying 50% or more of the peak hours correctly saw improvements in every customer segment. However, the improvements were fairly negligible, between 1 and 2 percentage points, for the CARE/FERA customers on Rate 2 who experienced the 10 percentage point increase on the answering none correct question. This points to a general decline in understanding of the peak periods for Rate 2 customers, but a moderate improvement for Rate 1 customers.

Turning to other metrics of interest, in stark contrast to the bill impacts at PG&E and SCE, the average structural bill increase for CARE/FERA customers at SDG&E was less than $4 per year in the moderate climate region, and customers in the cool climate region actually saw a bill reduction of a dollar or more on average. On average, customers experienced a $2 per year structural loss, but ultimately didn't experience a statistically significant change in total annual cost. It may be possible that the underlying distribution of customers has some customers who benefit significantly, but a large portion of customers who are worse off. This could result in the bill impacts appearing to be negligible, while enough customers are struggling to affect the economic index.

Most CARE/FERA customers produced behavioral bill reductions, although only behavioral bill reductions from the moderate climate region segment on Rate 2 were statistically significant. This resulted in all CARE/FERA segments either experiencing total bill impacts that weren't statistically significant—on Rate 1— or were in the range of $4 to $13 savings per year on Rate 2.

CARE/FERA customers in both climate regions on both rates reported higher difficulty in paying bills compared to non-CARE/FERA customers, but the difference was not statistically different compared to the control group. CARE/FERA customers in the moderate climate region on Rate 1 had the highest economic index score of 4.2, and it was statistically significantly higher for the treatment group compared to the control group. This group also had the highest percentage of customers with difficulty paying bills at 68%. Interestingly, this segment produced among the largest impacts in the summer, but negligible impacts in the winter.

CARE/FERA customers tended to be more satisfied with the rate and with SDG&E compared to non-CARE/FERA customers. In the cool climate region, CARE/FERA customers had statistically significantly higher levels of satisfaction with the rate compared to the control group. On Rate 2, these customers also had a statistically significantly higher level of satisfaction with SDG&E compared to the control group as well.

Hot Climate Region General Population

General population households in the hot climate region on Rate 2 had load reductions in the peak period equal to 3.9%, which was larger than any of the other customer segment/climate region groups. The next closest comparable impact was from non-CARE/FERA customers on Rate 1 in the cool climate region with peak period reductions equal to 2.9%. Net annual kWh reductions for general population customers in the hot climate region, at negative 1.2%, were the largest increases in total energy use, and with the relatively large peak period reduction, suggest that these customers are shifting use to the off peak hours, or actually increasing off peak hour energy use.

Structural bill impacts for the hot region were slightly higher than those for non-CARE/FERA customers in the moderate region, and the highest across all segments. Due to the increase in net annual kWh, customers weren't able to produce behavioral bill impacts large enough to offset these structural increases, resulting in total annual bill increases of approximately $20.

Customer surveys were not administered to the control group in the hot region due to implementation decisions made by SDG&E, so several of the survey related metrics that make comparisons between the treatment and control group, such as being uncomfortably hot or cold, higher bill than expected, difficulty of paying bills, and the economic index, could not be calculated. 14% of treatment households in the hot region could not correctly identify any of the peak period hours, which was a similar to the other non-CARE/FERA segments on Rate 2. Finally, the satisfaction scores for the Rate 2 customers in the hot climate region are the lowest across all other segments, at 5.8 and 6.5 for satisfaction with the rate and the utility, respectively. This is reasonable given these customers also have the highest structural bill impacts, and the highest overall bills. These scores are lower than the scores from the non-CARE/FERA customers on both rates in the moderate climate region, which were 6.4 and 6.8 for the rate and utility satisfaction, respectively.

5.5.2 Key Findings

Key findings pertaining to load impacts from the SDG&E pilots include:

1. Customers can and will respond to TOU rates with peak periods that extend well into the evening hours during the winter – peak period load reductions averaged roughly 2.3% for Rate 1 and 1.7% for Rate 2 across the service territory as a whole.
2. The average winter impact of 2.0% is slightly less than half the size of the load impact from the first summer of approximately 5.0%. However, there was significant variation in the relationship between summer and winter impacts across rates and customer segments.
3. For Rate 2, which has the same prices in effect on weekends as on weekdays, the pattern of load impacts across rate periods on weekends was very similar to weekdays for all climate regions combined– that is, customers can and will reduce loads on weekends in the winter.
4. There was a small but statistically reduction in net annual electricity use for both rates – for Rate 1, the average reduction was 1.0% for the moderate/cool regions combined while for Rate 2, it was 0.8% for all three climate regions combined.[68]

[68] Note that the hot region in SDG&E's service territory has a very low population weight and does not materially impact this average.

5. For Rate 2, load impacts, in both absolute and percentage terms, were largest in the hot climate region, and there was not a statistically significant difference between the moderate and cool climate regions.
6. CARE/FERA customers generally had lower peak period load reductions compared with non-CARE/FERA customers—although not all differences were statistically significant.
7. Load impacts are not available for senior households or households with incomes below 100% of FPG because the sample sizes (and population) in SDG&E's hot region are too small.
8. Customers who received Weekly Alert Emails in the moderate climate region had incremental impact improvements of approximately 0.01 kW, whereas customers in the cool climate region had impacts decline by approximately 0.01 kW. In both cases, the difference was negligible due to the small impacts in general.

Key findings pertaining to bill impacts include:

1. Average winter monthly structural bill differences were negligible and ranged from a bill decrease of $0.70 to an increase of $0.05.
2. In stark contrast to the findings for PG&E and SCE, bill impacts for SDG&E's pilot rates were quite small, both before and after behavioral adjustments. For some customer segments and climate regions, customers could fully offset the structural increases in annual bills by shifting usage so that the total bills were slightly lower than they would have been on the OAT.
3. Over the course of a year, most customers experienced a slight decrease in total annual cost in the moderate and cool regions of up to $28—for non-CARE/FERA customers in the cool climate region on Rate 2. Customers in the hot climate region on Rate 2 experienced total annual bill increases of approximately $20.

Key findings from the survey research include the following:

1. **Economic Hardship:** Rate 1 CARE/FERA customers in the hot region had a higher economic index score when compared to the Control group. This increase in economic index scores is equivalent to a customer noting difficulty paying one additional bill during the previous six months. In contrast, Rate 1 non-CARE/FERA customers in the cool region had a lower economic index score compared to the Control group. Corroborating this finding, non-CARE/FERA customers in the cool region also reported less difficulty paying their bills than control customers.
2. **Health Hardship:** Rate 2 CARE/FERA customers in the moderate region had a higher health index score compared to the Control Group, which is the equivalent to a customer noting a slightly higher frequency of being in poor health and/or having their poor health limit their usual activities during the previous six months. In addition, about 5% more Rate 1 and Rate 2 CARE/FERA customers in the moderate climate region sought medical attention due to excessive heat when compared to their Control groups.69 In contrast, about 3% fewer Rate 1 non-CARE/FERA customers in the cool region and Rate 2 non-CARE/FERA customers in the moderate region sought medical attention due to excessive heat compared to the Control groups.70 About 14% fewer Rate 2 non-CARE/FERA customers in the moderate region with a disabled

[69] These customers all had air conditioning.

[70] These customers all had air conditioning.

household member sought medical attention due to excessive cold71 or heat72 compared to the Control groups.

3. **Satisfaction:** Except for Rate 2 CARE/FERA customers in the cool climate region, customer satisfaction ratings for SDG&E did not differ between the TOU rate and control groups. Most Rate customers, however, reported slightly higher satisfaction with their rate compared to Control groups. The differences in ratings for both the rate and SDG&E for CARE/FERA moderate region customers, while statistically significant are very small, 0.3 differences between control and treatment groups on an 11-point scale. In addition, compared to results from the first survey, Rate 2 customers' satisfaction with SDG&E improved, and Control and Rate 1 customers' satisfaction levels slightly declined; satisfaction levels with the rate, however, slightly improved most customer segments.
4. **Bill protection, understanding of rates, and actions taken:**
   - More than one-third of customers reported receiving a letter from SDG&E mentioning their bill protection and about half reported knowing when their bill protection ends. When customers were asked if they understand bill protection, 87% or more reported they did.
   - Though agreement ratings for "rate is easy to understand" were high (generally between 7.0 and 7.4), customer's understanding of their rates indicate a disconnect between customer's rating of understandability and actual understanding (with 5% to 25% of customers unable to identify peak hours). Non-CARE/FERA customers were more likely to answer correctly than CARE/FERA customers. In addition, compared to results from the first survey, Rate 1 customers' understanding of their rate slightly improved and the percentage of Rate 2 customers who selected half or more peak hours also slightly improved, but the percentage of Rate 2 customers who did not select any correct answer slightly worsened.
   - When asked if customers agreed that peak and off-peak times were easy to remember, Rate 2 customers provided higher agreement ratings than Rate customers. However, a similar proportion of Rate 1 and 2 customers provided "over half correct" answers to the rate understanding questions and more Rate 2 customers did not select any of the correct answers.[73]
   - Customers on TOU rates were more likely to take time-specific actions than customers in the control condition. For example, while a similar proportion of customers from control and rate groups indicated they turned off their lights to conserve energy, a larger proportion of treatment customers indicated they shifted doing laundry and running the dishwasher during peak hours. This trend suggests that while fewer rate customers understood the nuances of their rates, they did know and take actions that helped them shift use.

[71] These customers all had electric heat, and a household member who requires heating.

[72] These customers all had air conditioning, and a household member who requires cooling.

[73] These survey items were coded much like a test with partial credit; customers would get 50% right if they could identify half of the peak hours for their test rate.

Overall findings and conclusions include:

- Customers continued to respond to the TOU price signals at the end of a full year. As expected, the load impacts were lower during the winter compared to the first summer. Load impact persistence will be examined in the final report once data from the second summer becomes available.
- The majority of customers across both rates experienced slight net annual total bill decreases. However, customers in the hot climate were more likely to experience net annual bill increases.
- Evidence from the second survey still suggests that the education and outreach to low income customers did not generate the same level of understanding of TOU rates as it did for non-low income customers. This could partly result from the fact that more CARE/FERA customers have English as a second language but there may be other reasons. In some cases the level of understanding between the first and second survey went down, such as with Rate 2. The level of understanding went up for Rate 1. Nexant continues to recommend that this issue be carefully addressed and studied further in the upcoming default pilots where there is a much greater emphasis on and opportunity to test ME&O alternatives for all segments.

6 Overall Summary

This section begins with a comparison of load impacts and bill impacts across utility service territories. Although the experiment was not designed to make cross-utility comparisons, such comparisons are likely to be made nonetheless, and it's important that any observed differences be put into the proper perspective so that they are not misinterpreted. Following that discussion is a brief summary of the key conclusions that can be drawn from looking across all treatments statewide.

6.1 Cross Utility Comparisons of Load and Bill Impacts

When comparing rate impacts or bill impacts across utility service territories, it is very important to keep in mind that any observed differences across service territories could easily be due to differences in the populations or climate regions across the service territories rather than due to differences in the tariffs themselves. Another possible explanation for any observed differences is variation in the months included in the analysis – recall that average impacts for PG&E and SCE's Rate 1 and Rate 2 span October through May. Their Rate 3 winter periods cover October through February, and SDG&E's winter period is October through April. Finally, as discussed in each utility section, when comparing peak period load impacts across rates, even within a service territory, differences could be due to variation in the timing and length of the peak periods rather than to differences in price ratios, for example.

Some of the above factors can be controlled for by limiting the cross-utility comparisons to only the hours that all utility tariffs have in common and only the months that are common across all rates and service territories. As such, in the discussion below, peak period load impacts are presented only for the hours from 6 to 8 PM and peak period and daily load impacts and bill impacts are presented only for the months of November through February[74]. For all of the figures below, the following legend applies:

PG&E, Rate 1	SCE, Rate 1	SDG&E, Rate 1
PG&E, Rate 2	SCE, Rate 2	SDG&E, Rate 2
PG&E, Rate 3	SCE, Rate 3	

6.1.1 Load Impacts

Figure 6.1-1 shows the load reduction from 6 to 8 PM on the average weekday in November, December, January, and February for each service territory as a whole and for each climate region for the eight different tariffs tested across the three utilities. The load impacts are also shown for CARE/FERA and non-CARE/FERA customers within each region. The bar graphs show the percent reduction across these hours while absolute reductions are shown below the graph. Table 6.1-1 shows the marginal price for

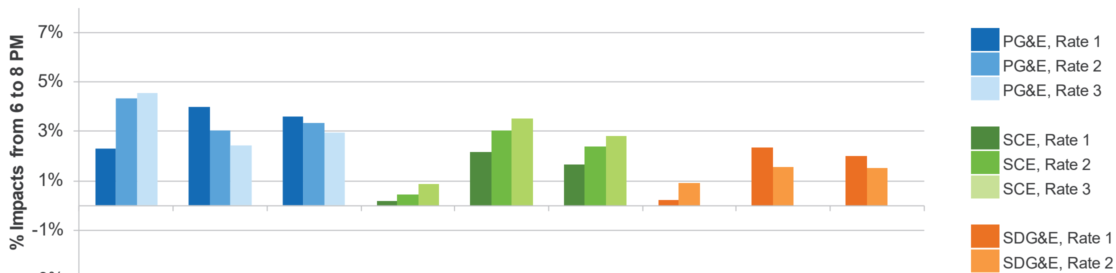
[74] Because the impacts presented her cover only the hours from 6 to 8 PM and are only for the months of November through February, they will differ from the load reductions reported in prior sections of the report, which represent the average across the full peak period and different months for the winter period.

the hours from 6 to 8 PM for each tariff and also for the OAT. The TOU prices represent the price for usage above the baseline allocation.

All rates in all service territories showed reductions for these early evening hours, ranging from a low of 1.5% for SDG&E's Rate 2 to a high of 3.6% for PG&E's Rate 1 for the "All" customer category. The average percent load reduction across all three rates for PG&E was 3.3%, while SCE's average was 2.3%. SDG&E's average reduction across its two rates was 1.7%.

For non-CARE/FERA customers, the largest load reduction, 4.0%, occurred for PG&E's Rate 1 and the smallest, 1.6%, was for SDG&E's Rate 2.[75] The average reduction across the multiple rate treatments in each service territory for non-CARE/FERA customers was 3.2% for PG&E, 2.9% for SCE and 1.9% for SDG&E. For CARE/FERA customers, the average reductions were 3.7%, 0.5%, and 0.6% for PG&E, SCE, and SDG&E, respectively. On average, CARE/FERA customers had lower percent reductions in peak period usage than non-CARE/FERA customers. This difference could explain, in part, why SCE's average reduction for all customers in its service territory is lower than PG&E as SCE has a greater percent of CARE/FERA customers among the pilot eligible population (31%) compared with PG&E (27%).

Figure 6.1-1: Load Reductions Between 6 and 8 PM by Rate and Service Territory, Average Winter Weekday



		CARE	Non-CARE	All	CARE	Non-CARE	All	CARE	Non-CARE	All
		PG&E			SCE			SDG&E		
		Territory Wide								
Rate 1	% Impact	2.3%	4.0%	3.6%	0.2%	2.2%	1.7%	0.2%	2.3%	2.0%
	kW Impact	0.02	0.04	0.03	0.00	0.02	0.02	0.00	0.02	0.02
Rate 2	% Impact	4.3%	3.0%	3.3%	0.4%	3.0%	2.4%	0.9%	1.6%	1.5%
	kW Impact	0.04	0.03	0.03	0.00	0.03	0.02	0.01	0.01	0.01
Rate 3	% Impact	4.6%	2.5%	3.0%	0.9%	3.5%	2.8%			
	kW Impact	0.04	0.02	0.03	0.01	0.03	0.03			

Table 6.1-1shows the peak period prices for each pilot rate as well as the Tier 2 and 3 prices for the otherwise applicable tariff faced by the control group. As indicated in the title to the table, the treatment group prices represent the marginal price excluding the baseline discount. The most comparable OAT price is the price that applies between 100% and 200% of the baseline quantity. As

[75] The comparisons are primarily described in percentage terms due to the level differences in average customer energy usage across utilities. The percentage results help to normalize the level differences and show the proportion of load being curtailed. The average kW impacts are provided; however, caution should be used when making any sort of direct comparison.

seen in the table, there is not much variation in the marginal price that applies to the peak period hours across rates within a service territory as well as across service territories, with the exception of notably higher prices for SDG&E.

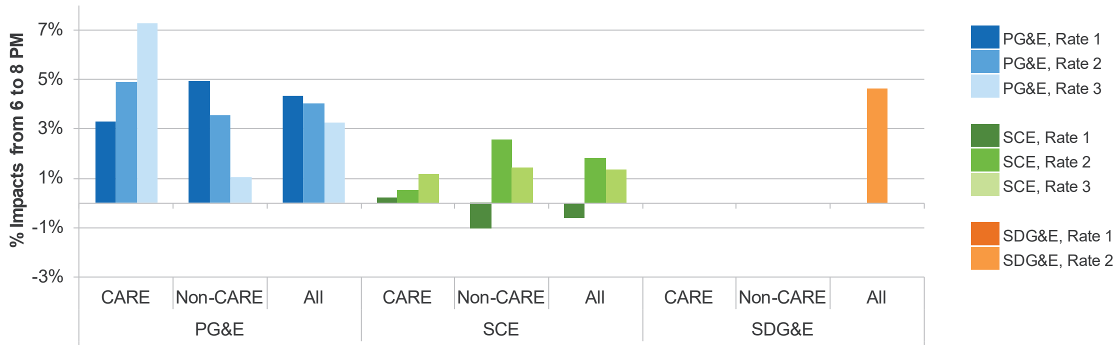
Table 6.1-1: Peak Period Price Above Baseline Quantity (¢/kWh)

Utility	Customer Segment	Rate 1	Rate 2	Rate 3	Control Group Tariff (OAT)	
					101 – 200% of Baseline	>200% of Baseline
PG&E	Non-CARE	29.0	29.6	29.0	24.1	40.0
	CARE	16.1	16.5	16.1	14.7	21.7
	Total	25.5	26.1	25.5	21.6	35.0
SCE	Non-CARE	27.5	27.9	21.0[76]	22.9	29.2
	CARE	19.9	20.2	15.2	15.7	21.8
	Total	25.2	25.5	19.2	20.7	26.9
SDG&E	Non-CARE	37.3	37.3	n/a	36.2	n/a
	CARE	24.1	24.1	n/a	40	n/a
	Total	34.8	24.8	n/a	36.9	n/a

Figure 6.1-2 shows the average load reduction for each rate for the hours from 6 to 8 PM in the hot climate region for the population as a whole as well as for CARE/FERA and non-CARE/FERA segments. Customers in PG&E's hot climate region had larger load reductions for both customer segments compared to SCE. In fact, non-CARE/FERA customers in SCE's hot climate region had load increases of 1% during the common winter period. The greatest percent impacts came from CARE/FERA customers in PG&E's hot climate region on Rate 3 (7.3% or 0.07 kW).

[76] There is no baseline allowance for SCE's Rate 3.

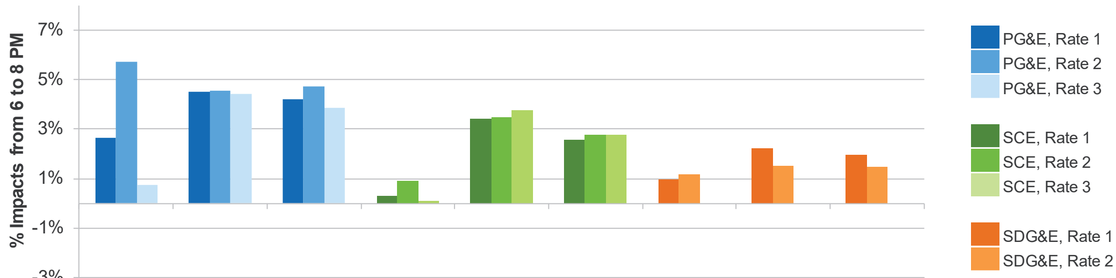
Figure 6.1-2: Load Reductions Between 6 and 8 PM for Hot Climate Regions by Customer Segment, Average Winter Weekday



		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
		Hot								
Rate 1	% Impact	3.3%	4.9%	4.3%	0.2%	-1.0%	-0.6%			
	kW Impact	0.03	0.05	0.04	0.00	-0.01	-0.01			
Rate 2	% Impact	4.9%	3.5%	4.0%	0.5%	2.5%	1.8%			4.6%
	kW Impact	0.04	0.04	0.04	0.00	0.03	0.02			0.06
Rate 3	% Impact	7.3%	1.0%	3.3%	1.2%	1.5%	1.4%			
	kW Impact	0.07	0.01	0.03	0.01	0.01	0.01			

Figure 6.1-3 shows the average load reductions from 6 to 8 PM for CARE/FERA and non-CARE/FERA customers and for the population as a whole in the moderate climate regions in each service territory. As in the hot climate region, PG&E customers had greater load impacts than their counterparts at SCE. Load impacts were consistent for non-CARE/FERA customers across all rates within each utility; about 4.5% at PG&E, 3.6% at SCE, and 1.9% at SDG&E. CARE/FERA customers at SCE provided the smallest load impacts, about 0.4% on average. It is notable that SCE impacts across rates were consistent in the moderate climate zone, but there was no clear pattern in the hot climate region.

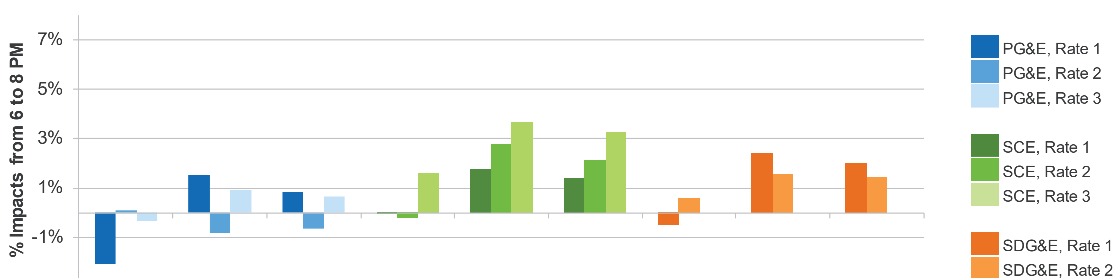
Figure 6.1-3: Load Reductions Between 6 and 8 PM for Moderate Climate Regions by Customer Segment, Average Winter Weekday



Moderate		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
Rate 1	% Impact	2.7%	4.5%	4.2%	0.3%	3.4%	2.6%	1.0%	2.2%	1.9%
	kW Impact	0.02	0.05	0.04	0.00	0.04	0.02	0.01	0.02	0.02
Rate 2	% Impact	5.7%	4.5%	4.7%	0.9%	3.5%	2.8%	1.2%	1.5%	1.5%
	kW Impact	0.05	0.05	0.05	0.01	0.04	0.03	0.01	0.01	0.01
Rate 3	% Impact	0.7%	4.4%	3.9%	0.1%	3.8%	2.8%			
	kW Impact	0.01	0.04	0.04	0.00	0.04	0.03			

Figure 6.1-4 shows the load reductions from 6 to 8 PM for CARE/FERA and non-CARE/FERA customers and for the population as a whole in the cool climate region for each service territory. The cool climate region is the only area where PG&E saw negative load impacts during the common winter period, with no clear pattern across rates. Average impacts between 6 and 8 PM for PG&E, SCE, and SDG&E were 0.3%, 2.3%, and 1.7%, respectively. Non-CARE/FERA customers in SCE's cool climate region had the greatest load impacts, about 2.8% on average.

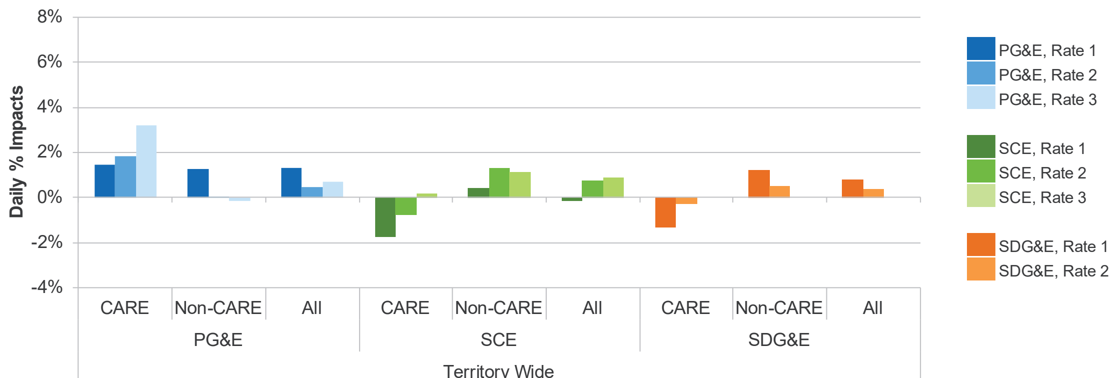
Figure 6.1-4: Load Reductions Between 6 and 8 PM for Cool Climate Regions by Customer Segment, Average Winter Weekday



Cool		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
Rate 1	% Impact	-2.1%	1.5%	0.8%	0.0%	1.8%	1.4%	-0.5%	2.4%	2.0%
	kW Impact	-0.01	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.02
Rate 2	% Impact	0.1%	-0.8%	-0.6%	-0.2%	2.8%	2.1%	0.6%	1.6%	1.4%
	kW Impact	0.00	-0.01	0.00	0.00	0.03	0.02	0.00	0.01	0.01
Rate 3	% Impact	-0.4%	0.9%	0.7%	1.6%	3.7%	3.3%			
	kW Impact	0.00	0.01	0.01	0.01	0.04	0.03			

Figure 6.1-5 shows the average reduction in daily electricity use for each of the 8 rate treatments tested across the three utilities. With the exception of PG&E's Rate 3, daily load reductions fell between about negative 1.5% and positive 1.5%, indicating that customers may have shifted their energy use to off peak periods rather than reducing usage overall. In SCE and SDG&E's territory, non-CARE/FERA customers reduced consumption on a daily basis more than their CARE/FERA counterparts. The opposite is true for PG&E.

Figure 6.1-5: Daily Load Reductions by Rate and Service Territory, Average Winter Weekday



		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
Rate 1	% Impact	1.5%	1.3%	1.3%	-1.7%	0.4%	-0.2%	-1.3%	1.2%	0.8%
	kW Impact	0.01	0.01	0.01	-0.01	0.00	0.00	-0.01	0.01	0.00
Rate 2	% Impact	1.8%	0.0%	0.5%	-0.8%	1.3%	0.8%	-0.3%	0.5%	0.4%
	kW Impact	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Rate 3	% Impact	3.2%	-0.2%	0.7%	0.2%	1.1%	0.9%			
	kW Impact	0.02	0.00	0.00	0.00	0.01	0.01			

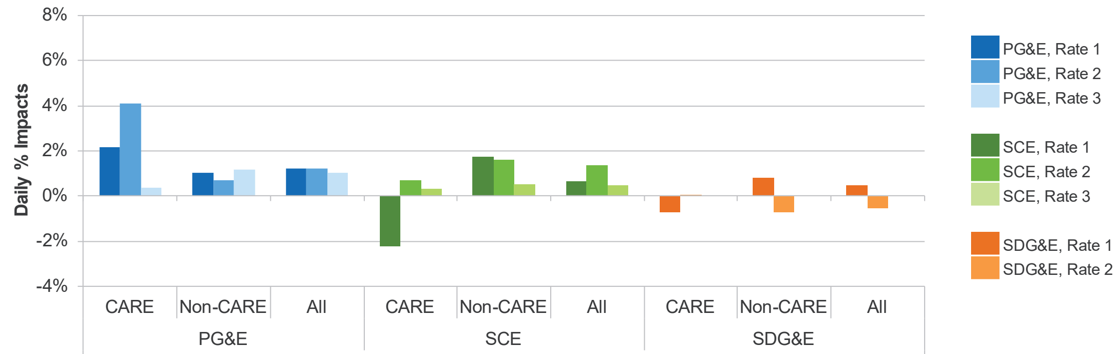
Figure 6.1-6 shows the variation in daily load impacts across tariffs, segments, and service territories for selected customer segments in the hot climate region. Recall that the sample sizes in SDG&E's hot region are not large enough to support segmentation for reasons discussed previously. Like the service territory as whole, CARE/FERA customers on PG&E's Rate 3 had the greatest daily load reductions (5.4%) compared with the other rates and segments in the hot climate region. Customers on SCE's Rate 1 showed daily load increases for both customer segments in the hot climate region (about 1.9%). This could be due to the longer peak period on Rate 1 versus the other two rates – perhaps customers tried to shift more of their usage to the off-peak period. Customers in SDG&E's hot climate region also showed daily load increases of about 1.3% or 0.01 kW.

Figure 6.1-6: Daily Load Reductions for Hot Climate Regions by Customer Segment, Average Winter Weekday

		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
Rate 1	% Impact	2.3%	1.8%	2.0%	-1.0%	-2.5%	-1.9%			
	kW Impact	0.01	0.01	0.01	-0.01	-0.02	-0.01			
Rate 2	% Impact	2.1%	-0.5%	0.4%	0.1%	1.5%	1.1%			-1.3%
	kW Impact	0.01	0.00	0.00	0.00	0.01	0.01			-0.01
Rate 3	% Impact	5.4%	-1.6%	0.9%	0.9%	0.6%	0.7%			
	kW Impact	0.03	-0.01	0.01	0.01	0.00	0.01			

Figure 6.1-7 shows the variation in daily load impacts across tariffs, segments, and service territories for selected customer segments in the moderate climate region on the average winter weekday. Customers in the moderate climate region in SDG&E's territory did not provide meaningful daily load reductions, but most customer segments in PG&E and SCE's moderate climate regions did. CARE/FERA customers on PG&E's Rate 2 had the greatest daily load reductions (4.1% or 0.2 kW)

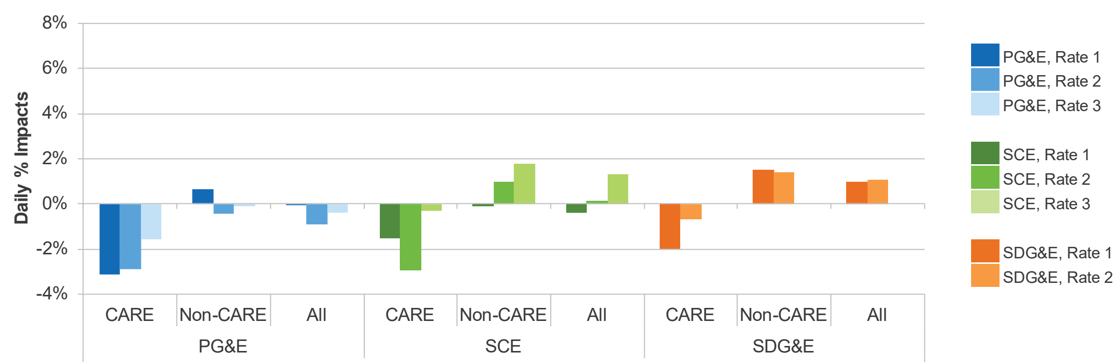
Figure 6.1-7: Daily Load Reductions for Moderate Climate Regions by Customer Segment, Average Winter Weekday



Moderate		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
Rate 1	% Impact	2.2%	1.0%	1.2%	-2.2%	1.8%	0.6%	-0.7%	0.8%	0.5%
	kW Impact	0.01	0.01	0.01	-0.01	0.01	0.00	0.00	0.00	0.00
Rate 2	% Impact	4.1%	0.7%	1.2%	0.7%	1.6%	1.4%	0.1%	-0.7%	-0.5%
	kW Impact	0.02	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00
Rate 3	% Impact	0.4%	1.2%	1.0%	0.3%	0.5%	0.5%			
	kW Impact	0.00	0.01	0.01	0.00	0.00	0.00			

Finally, Figure 6.1-8 shows the average reduction in daily electricity use in the cool climate regions for each rate, segment, and service territory. The average reduction across the three rates for the population as a whole equaled negative 0.4%, positive 0.4%, and 1.0% for PG&E, SCE, and SDG&E respectively. CARE/FERA customers in all three IOUs had an average increase in daily electricity use while non-CARE/FERA customers did not follow a clear pattern.

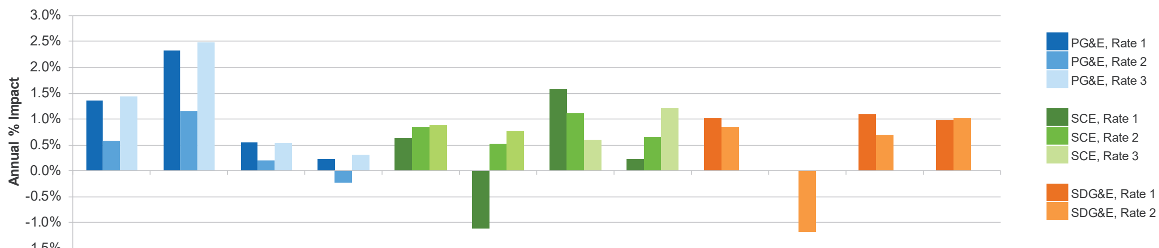
Figure 6.1-8: Daily Load Reductions for Cool Climate Regions by Customer Segment, Average Winter Weekday



Cool		PG&E CARE	PG&E Non-CARE	PG&E All	SCE CARE	SCE Non-CARE	SCE All	SDG&E CARE	SDG&E Non-CARE	SDG&E All
Rate 1	% Impact	-3.1%	0.7%	-0.1%	-1.5%	-0.1%	-0.4%	-2.0%	1.5%	1.0%
	kW Impact	-0.01	0.00	0.00	-0.01	0.00	0.00	-0.01	0.01	0.00
Rate 2	% Impact	-2.9%	-0.4%	-0.9%	-2.9%	1.0%	0.1%	-0.7%	1.4%	1.1%
	kW Impact	-0.01	0.00	0.00	-0.01	0.01	0.00	0.00	0.01	0.01
Rate 3	% Impact	-1.6%	-0.1%	-0.4%	-0.3%	1.8%	1.3%			
	kW Impact	-0.01	0.00	0.00	0.00	0.01	0.01			

Figure 6.1-9 presents the annual conservation effects for each rate for PG&E, SCE, and SDG&E. Effects are shown for the territory as a whole and for each climate region individually. Estimates for SCE's Rate 3 do not include July 2016 due to the late start in enrollment for this group. As such, the total kWh only represents 11 months. For each service territory, customers on every rate were able to conserve energy throughout the first year of the pilot. For PG&E, SCE, and SDG&E the annual conservation effects were 1.1%, 0.8%, and 0.9% on average, respectively. In PG&E's territory, customers in the hot climate region conserved the most energy (about 2.0% on average), but this was not the case in SCE's and SDG&E's territories where customers in the moderate (1.1%) and cool (1.0%) regions had the greatest effects, respectively.

Figure 6.1-9: Annual Conservation Effects by Climate Region

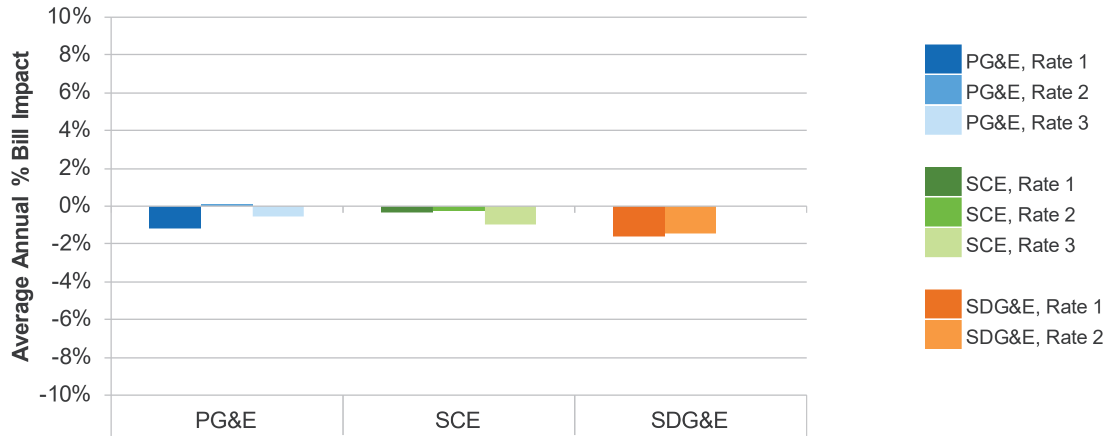


		PG&E				SCE				SDG&E			
		All	Hot	Moderate	Cool	All	Hot	Moderate	Cool	All	Hot	Moderate	Cool
Rate 1	% Impact	1.4%	2.3%	0.6%	0.2%	0.6%	-1.1%	1.6%	0.2%	1.0%		1.1%	1.0%
	kWh Impact	75.17	159.71	29.35	8.39	38.71	-87.45	107.60	11.60	47.54		55.89	41.96
Rate 2	% Impact	0.6%	1.2%	0.2%	-0.2%	0.8%	0.5%	1.1%	0.7%	0.8%	-1.2%	0.7%	1.0%
	kWh Impact	32.62	79.26	10.43	-8.66	51.55	41.00	75.44	34.21	39.10	-86.03	35.95	43.60
Rate 3	% Impact	1.4%	2.5%	0.5%	0.3%	0.9%	0.8%	0.6%	1.2%				
	kWh Impact	80.02	170.21	28.72	12.26	47.93	52.73	35.72	56.93				

6.1.2 Bill Impacts

Figure 6.1-10 shows the average percentage bill impacts by rate and utility for the service territory as a whole for the first year of the pilot. Keep in mind once again that the values below do not include July for SCE's Rate 3. As discussed previously, total bill impacts over the course of the year were small, which is a good indicator that the rates are indeed revenue neutral. For the PG&E territory, customers experienced average bill increases of $0.11 for the entire year on Rate 2, or bill reductions of $12.87 and $5.78 for Rate 1 and Rate 3, respectively. Customers on SDG&E's Rate 1 and Rate 2 had the largest total cost reductions of $16.38 and $15.21, respectively. There is not much variation between rates within each utility.

Figure 6.1-10: Average Annual Bill Impacts by Rate for Each Utility Service Territory[77]

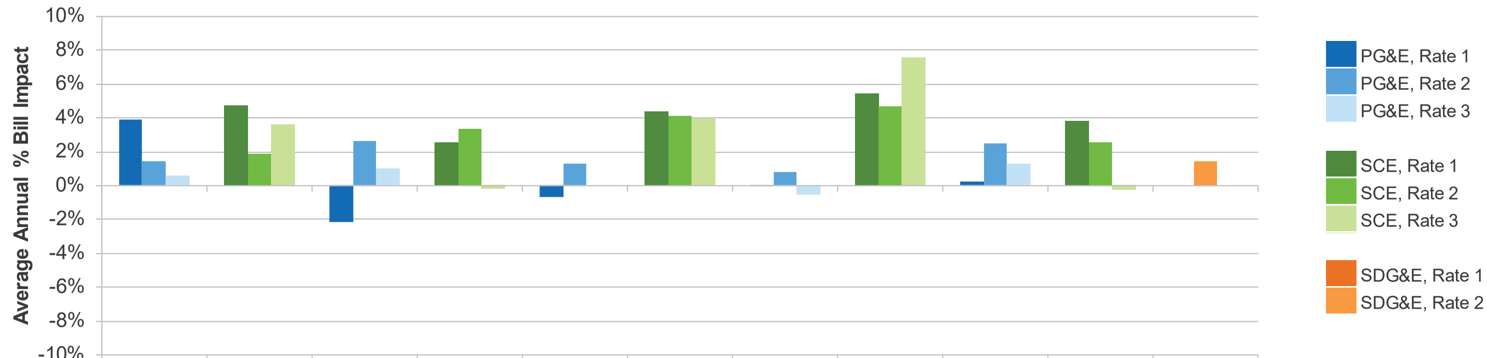


		PG&E	SCE	SDG&E
			Territory Wide	
Rate 1	% Impact	-1.1%	-0.3%	-1.6%
	$ Impact	-$12.87	-$3.17	-$16.38
Rate 2	% Impact	0.0%	-0.2%	-1.5%
	$ Impact	$0.11	-$2.46	-$15.21
Rate 3	% Impact	-0.5%	-1.0%	
	$ Impact	-$5.78	-$9.55	

[77] SCE Rate 3 annual results do not include July 2016

Figure 6.1-11 presents the average bill impacts for the first year of the pilot for each segment in the hot climate region. In general, customers on all three rates at SCE experienced bill increases during the first year of the pilot of approximately $60 (7.6%) or less for the entire year). Percent bill impacts were similar for the targeted customer segments in PG&E's hot climate zone and SDG&E's hot climate zone as a whole, where impacts were generally less than 2% in either direction. The exception was households with incomes below 100% FPG on PG&E's Rate 1, who faced bill increases of nearly 4% throughout the year.

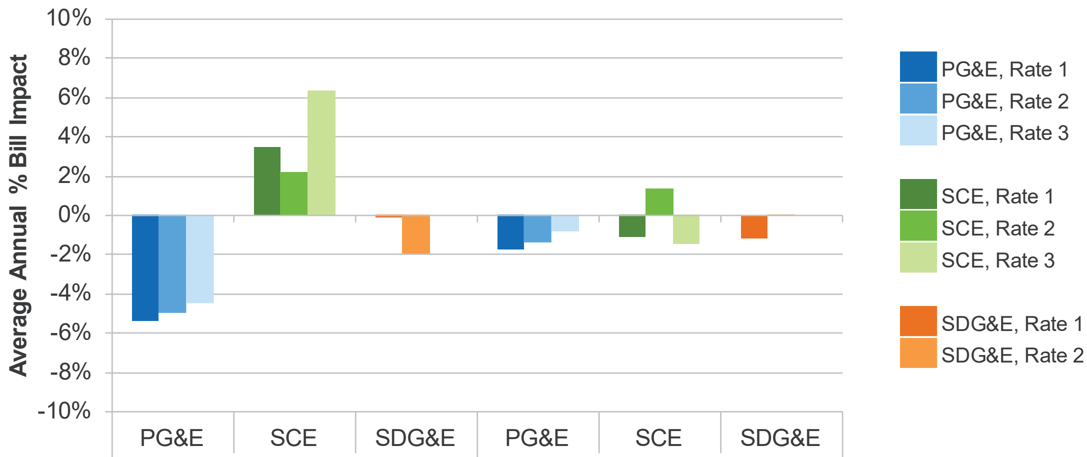
Figure 6.1-11: Average Annual Bill Impacts by Customer Segment for Hot Climate Regions



		Below 100% FPG		100% - 200% FPG		Senior		CARE		Non-CARE		SDG&E
		PG&E	SCE	PG&E	SCE	PG&E	SCE	PG&E	SCE	PG&E	SCE	
Rate 1	% Impact	3.9%	4.7%	-2.1%	2.6%	-0.6%	4.4%	0.0%	5.4%	0.2%	3.8%	
	$ Impact	$36.78	$45.86	-$22.57	$31.58	-$8.11	$62.28	-$0.38	$46.88	$3.70	$63.62	
Rate 2	% Impact	1.5%	1.9%	2.6%	3.4%	1.3%	4.1%	0.8%	4.6%	2.5%	2.6%	1.4%
	$ Impact	$14.33	$18.93	$28.90	$38.24	$16.28	$56.52	$7.04	$40.31	$40.16	$42.22	$20.29
Rate 3	% Impact	0.6%	3.6%	1.0%	-0.2%	-0.1%	4.0%	-0.5%	7.6%	1.3%	-0.3%	
	$ Impact	$5.55	$32.16	$11.62	-$1.99	-$0.87	$45.77	-$4.82	$56.30	$21.07	-$3.65	

Figure 6.1-12 shows the bill impacts in the moderate climate regions for each utility service territory. As in the hot climate region, PG&E customers experienced bill reductions over the first year of the pilot without much variation between rates. CARE/FERA customers at PG&E had greater reductions than non-CARE/FERA customers. The opposite was true at SCE, where CARE/FERA customers on rates experienced bill increases between 2.2% and 6.4% but non-CARE/FERA customers experienced total bill impacts between negative 2% and positive 2%. Customers in SDG&E's moderate climate region experienced small total bill impacts as well.

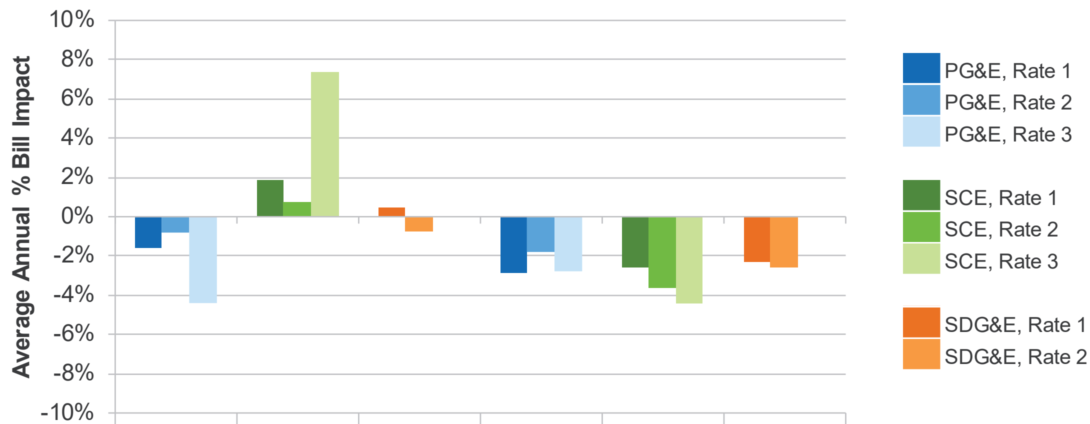
Figure 6.1-12: Average Annual Bill Impacts by Customer Segment for Moderate Climate Regions



		CARE			Non-CARE		
		PG&E	SCE	SDG&E	PG&E	SCE	SDG&E
Rate 1	% Impact	-5.4%	3.4%	-0.1%	-1.7%	-1.1%	-1.1%
	$ Impact	-$35.79	$24.17	-$0.65	-$20.34	-$16.06	-$14.30
Rate 2	% Impact	-5.0%	2.2%	-2.0%	-1.4%	1.3%	0.0%
	$ Impact	-$31.38	$16.20	-$12.75	-$17.75	$18.66	-$0.34
Rate 3	% Impact	-4.5%	6.4%		-0.8%	-1.4%	
	$ Impact	-$27.87	$39.38		-$8.50	-$18.35	

Figure 6.1-13 shows the bill impacts in the cool climate regions within each utility's territory. Unlike the other climate regions, the cool climate region shows greater variation between rates for CARE/FERA customers, but bill impacts for these customers were still relatively small over the course of the year. Non-CARE/FERA customers at all three utilities and on all rates experienced bill reductions, on average.

Figure 6.1-13: Average Annual Bill Impacts by Customer Segment for Cool Climate Regions



		PG&E	SCE	SDG&E	PG&E	SCE	SDG&E
			CARE			Non-CARE	
Rate 1	% Impact	-1.6%	1.8%	0.4%	-2.8%	-2.6%	-2.3%
	$ Impact	-$7.97	$9.61	$2.03	-$25.59	-$28.01	-$24.29
Rate 2	% Impact	-0.8%	0.8%	-0.8%	-1.8%	-3.6%	-2.6%
	$ Impact	-$3.80	$4.07	-$3.78	-$15.94	-$42.08	-$27.85
Rate 3	% Impact	-4.4%	7.3%		-2.8%	-4.4%	
	$ Impact	-$21.84	$35.38		-$23.65	-$47.04	

6.2 Overall Key Findings

The first year of the TOU pilots summarized above has produced a large amount of information that will be useful in guiding California's pricing strategy over the coming years. The first year has provided insights regarding changes in customers' energy use in response to TOU rates during the summer, winter, spring, and for the full year, along with a variety of bill impact metrics on an equivalent seasonal and annual basis. One of the final research objectives for the pilot, to evaluate impact persistence, will follow in the final report after data from the second summer is available for analysis. Also, as mentioned numerous times above, when interpreting results to date, policymakers must keep in mind that statistically significant differences do not necessarily translate into material differences, especially for survey findings, since the large number of customers participating in the pilots (which was driven largely by the desire to estimate load impacts with reasonable precision) combined with the decision to survey all participants means that even very small differences in survey metrics can be found to be statistically significant. With these cautions in mind, the remainder of this section provides a high level summary of key findings.

6.2.1 Load Impacts

Key findings for load impacts include the following:

- While many pricing pilots and programs have been evaluated in the electricity industry nationwide and in California, few if any have tested tariffs that have peak pricing periods that extend well into the evening hours when many residential households have occupants arriving home from work and engaging in evening activities. This second interim report now evaluates how customers responded to the Time-Of-Use rates during the winter and spring seasons. All eight tariffs tested in these pilots had a substantial portion of the peak period covering key evening hours, which include more hours after the sun has set, compared to the summer season. Indeed, the common hours across all eight tariffs are from 6 to 8 PM. Some tariffs had peak periods extending until 9 PM and some had shoulder periods extending until midnight. As such, a key finding from the pilots in the winter season is that statistically significant load reductions were found for all rates tested for the service territory as a whole and for nearly all climate regions. Table 6.2-1 summarizes the percentage and absolute peak period load reductions for each rate and service territory. As seen, the lowest load impact occurred for SCE's Rate 1, showing an average reduction of 1.4% and 0.01 kW, and the highest occurred for PG&E's Rate 1 and Rate 2, which had average percentage reductions of 3.6% and 0.03 kW.

Table 6.2-1: Peak Period Load Reductions

Utility	Metric	Rate 1	Rate 2	Rate 3
PG&E	Peak Period Hours	4-9 PM	6-9 PM	4-9 PM
	% Impact	3.6%	3.6%	3.5%
	Absolute Impact (kW)	0.03 kW	0.03 kW	0.03 kW
SCE	Peak Period Hours	2-8 PM	5-8 PM	4-9 PM
	% Impact	1.4%	2.0%	3.2%
	Absolute Impact (kW)	0.01 kW	0.02 kW	0.03 kW
SDG&E	Peak Period Hours	4-9 PM	4-9 PM	N/A
	% Impact	2.3%	1.7%	N/A
	Absolute Impact (kW)	0.02 kW	0.01 kW	N/A

- Another important policy question given shifting load patterns at some utilities is the magnitude of peak period load reductions on weekends. Peak period load reductions on weekends and the pattern of load reductions across rate periods on weekends were generally similar to weekday impacts.
- Also often of interest when examining TOU rates is whether peak period reductions consist primarily of load shifting, in which case daily usage would remain roughly the same, load reductions that are not completely offset by increases in other rate periods, which would reduce usage overall, or whether customers actually take advantage of lower off-peak prices by consuming more in lower priced periods than is reduced during high priced periods in which case overall usage would increase. For the majority of rates, climate regions and customer segments, there was a small but statistically significant overall reduction in electricity use. The reduction in total annual usage ranged from very small negative values (e.g., an increase) to as high as 2.5%.
- For PG&E, winter load impacts in both absolute and percentage terms, were largest in the hot climate region, second largest in the moderate region, and lowest in the cool region for Rates 1 and 3 (although the differences were not always statistically significant). PG&E load impacts were slightly larger in the moderate climate region than the hot region for Rate 2, though the

difference is not statistically significant. At SDG&E, load impacts for Rate 2 in both absolute and percentage terms, were largest in the hot climate region, and there was not a statistically significant difference between the moderate and cool climate regions. However, at SCE, the pattern of load reductions was not the same. In general, the differences across regions were smaller and in some cases, the largest load reductions were found in the moderate or cool climate region and the smallest in the hot region. It is noteworthy that SCE's hot region experiences some of the most extreme temperature swings both seasonally and daily. In fact, SCE's hot region is generally SCE's coldest region in the winter.

- Load impacts in the winter are slightly smaller than in the summer even though, according to survey results, customers mostly persisted in taking several actions to shift or reduce their usage during the summer and the winter. This is likely due to customers having fewer opportunities to take actions in the winter that have a large impact on their electricity load, such as reducing or turning off their air-conditioning. Customers did report reducing or turning off their heat during the winter, for example, but most customers use natural gas for heating their homes, which would have little to no impact on electricity usage.
- For the service territory as a whole for all three utilities, CARE/FERA customers had lower average percent and absolute peak period load reductions than non-CARE/FERA customers for all rates. This pattern was typically (although not universally) true at PG&E, SCE, and SDG&E for all rates and climate regions.
- Senior households in both PG&E's and SCE's hot climate region had load reductions generally similar to those for the general population in the hot climate region. However, SCE Senior households had slightly lower load reductions than the general population in the hot climate region, and PG&E Seniors had slightly larger load reductions than the general hot climate region.
- Households with incomes below 100% of the Federal Poverty Guidelines (FPG) in hot climate regions did not reduce peak period loads in PG&E's service territory but had load reductions slightly larger compared to the general population in SCE's hot climate region.
- Households who had previously purchased smart thermostats reduced winter peak period usage by approximately 4.87%, which was significantly higher compared to non-CARE/FERA population weighted load reductions of 1.8%. Nest offered its "Time of Savings" support service for the second summer, which could affect second summer impacts in the final report.
- SDG&E customers who received Weekly Alert Emails in the moderate climate region had incremental impact improvements of approximately 0.01 kW, whereas customers in the cool climate region had impacts decline by approximately 0.01 kW. In both cases, the difference was negligible due to the small impacts in general.
- SDG&E offered rebates for smart thermostats to customers through the Whenergy program. 2,214 customers were reached out to via direct mail and 4,889 customers were contacted via email for the $100 rebate offer. A similar number of customers were offered the $200 rebate (2,201 direct mail and 4,920 email).[78] 349 applications were received, and of those, 246 were deemed eligible and ultimately accepted. Of the 246 applications accepted, 95 were for the $100 rebate offer, and 151 were for the $200 rebate offer.

[78] It isn't currently known if there was any overlap between the email and direct mail channels. This will be clarified and additional details regarding acceptance rates by incentive level and treatment versus control group will be included in the final report. Load impacts were not estimated for the customers who received the rebates due the sample size being too small to yield statistically significant impacts.

- PG&E continued to offer a smart phone app that would provide a variety of information to those who downloaded it that might help them to manage their energy use. The number of customers who successfully downloaded the app was quite low and there were not enough users to determine whether the app had an impact.

6.2.2 Bill Impacts

Key findings concerning bill impacts include the following:

- Annual bill impacts were very small at all three utilities, with total bill impacts between a reduction of 2% and an increase of 2% at the territory-level. The 12-month bill impacts varied by climate region and CARE/FERA status. At SCE, CARE/FERA customers faced greater bill increases than non-CARE/FERA customers.
- At both PG&E and SCE, average monthly winter bills were lower for all TOU rates than they would have been on the OAT for nearly all customer segments and all climate regions. The exception was CARE/FERA customers on Rate 3 in SCE's cool climate region. Average monthly bill reductions over the winter months ranged from a low of roughly $1 to as much as $12. Most segments on average were only able to save a small amount more in addition to the structural bill reduction by reducing or shifting usage. It is important to keep in mind that customers generally faced bill increases during the summer months of the pilot.
- Bill impacts at SDG&E were quite different from those at PG&E and SCE, with very small structural impacts in the winter months. Customers faced winter bill impacts that were generally less than 1% in either direction, at the territory level and at the CARE/FERA and non-CARE/FERA level.
- Average annual total bill impacts varied significantly by utility, rate, and climate region. The average customer at PG&E across all three rates either had no change in the total annual cost of energy or a slight reduction of up to $6. The largest decrease was $36 for CARE/FERA customers in the moderate climate region on Rate 1, and the largest annual bill increase was $40 for non-CARE/FERA customers on Rate 2 in the hot climate region. At SCE, the average customer across all three rates either had no change in the total annual cost of energy or a slight reduction of up to $10. The largest decrease was $47 for SCE non-CARE/FERA customers in the cool climate region on Rate 3, and the largest annual bill increase was $64 for non-CARE/FERA customers on Rate 1 in the hot climate region. At SDG&E, the average customer across both rates had a slight reduction of up to $10 in the total annual cost of energy. The largest decrease was $28 for SDG&E non-CARE/FERA customers in the cool climate region on Rate 2, and the largest annual bill increase was $20 for general population on Rate 2 in the hot climate region.

Overall, the average customer across all utilities experienced a slight decrease in the annual cost of electricity. The findings varied significantly by utility, rate, climate region, and customer segment ranging from an increase of $64 to a decrease of $47 per year. While this is the net difference in total bills for the year, it's important to keep in mind that lower winter prices offset the higher summer prices. Many customers experienced summertime bill increases of $20 to $35 a month on average. While bill volatility is a legitimate concern in light of the relatively large bill increases experienced by many pilot participants over the few summer months covered the initial evaluation period, this is not an indication that a good solution to this problem is to mute the TOU price signal.

Seasonal bill volatility exists even under the OAT in California due to tiered pricing and variation in usage over seasons. Importantly, SDG&E's pilot tariffs had TOU price signals higher than some of the PG&E and SCE pilot rates that were associated with much higher bill volatility. Designing TOU tariffs that account for the seasonal differentiation in the OAT (or lack thereof), and offering balanced payment programs, which allow customers to pay the same bill each month based on historical usage and current rates (with periodic true-ups), combined with first year bill protection, may be better solutions that will protect customers while improving economic efficiency through TOU prices that more accurately reflect cost causation. The extent to which this option might mute TOU price signals is subject to debate but will be examined in the default pilots that the IOUs will implement in 2018.

A final point to keep in mind as default tariff options are designed is that all customers who will be defaulted onto TOU rates in 2019 will receive bill protection for the first full year on the new tariff. As such, while summer bills may be higher than under the OAT, customers who stay for a full year will not pay a higher bill than they would under the OAT.

6.2.3 Customer Attrition

Customer attrition is driven by three very different factors. One is customers who move, referred to as customer churn. Another is customers who become ineligible as a result of factors such as installing solar, going onto medical baseline, or switching to service from a Community Choice Aggregator (CCA). The final factor is customers who consciously opt out of the rate because they are unhappy being on a TOU rate. Key findings concerning customer attrition include the following:

- **Cumulative opt-out rates between enrollment and the end of June 2017 have been quite low for nearly all rates and customer segments.** For PG&E, the cumulative percent of treatment customers who dropped off the rate was between 1% and 7% and at SCE it was between 0.5% and 12%. For SDG&E, opt-out rates were between 1% and 3.5%.
- At PG&E and SCE, there are small differences in the cumulative percent of opt outs between tariffs at each utility. Cumulative opt-out rates are greatest for PG&E and SCE's Rate 3 (about 4.5%). At SDG&E, the greatest cumulative opt-out rates, about 3.5%, are among customers in the hot climate region on Rate 2.
- The number of customers dropping off the TOU rates was highest in the hot region, second in the moderate and lowest in the cool climate region for all tariffs.
- Opt-out rates were slightly lower for CARE/FERA customers in PG&E and SDGE's service territory compared with non-CARE/FERA customers. In SCE's territory, the differences between CARE/FERA and non-CARE/FERA were small. Opt-out rates leveled off over the course of the winter.
- Overall attrition ranged from as low as 10% to as high as 33% with the highest being for CARE/FERA customers in SCE's hot climate region on Rate 3. Given that the pilot planning assumption was that total attrition would be roughly 25% over the course of the two summer periods, this segment may be at risk of having sample sizes that are lower than ideal by summer 2017.

- Attrition has also been high in PG&E's moderate and cool climate regions for some segments due primarily to customers switching to CCAs, which are quite active in PG&E's service territory.

6.2.4 Survey Findings

Key findings from the surveys that were administered include the following:

- **There were no statistically significant increases in the economic hardship of treatment customers, as measured by the economic index, compared to control customers for segments of interest at SCE. PG&E Rate 3 CARE/FERA customers in the hot region** (and SDG&E Rate 1 CARE/FERA customers in the moderate region) **had higher economic index scores, or greater economic hardship, compared to control group customers.** For context, the size of the difference in the economic index score is equivalent to the difference in the value of the index from using one additional non-income based method to pay bills or from having difficulty paying one additional bill over the summer. An important policy question is whether TOU rates might increase economic hardship for selected customer segments in the hot climate region for PG&E and SCE. The surveys included questions pertaining to economic hardship and responses to several questions were combined to produce an economic index. The value of this index was compared between treatment and control customers to determine whether the TOU rates increase the value of the index.
- **There were no statistically significant increases in health hardship of treatment customers, as measured by the health index, compared to control customers for segments of interest at PG&E and SCE.** SDG&E Rate 2 CARE/FERA customers in the moderate climate region had a higher health index score, or greater health hardship, compared to control group customers. For context, the size of the difference in the health index score is equivalent to the difference in the value of the index from having a slightly higher frequency of experiencing poor health or having poor health limit usual activities (e.g. from rarely to sometimes, sometimes to often, etc.) since December 2016. Another important policy question is whether TOU rates might increase health hardship for selected customer segments in the hot climate region for PG&E and SCE. The surveys included questions pertaining to health hardship and responses to two questions were combined to produce a health index. The value of this index was compared between treatment and control customers to determine whether the TOU rates increase the value of the index.
- **There were no significant increases in the health metrics, measuring whether customers sought medical attention for being too hot or cold in their home, for treatment customers, compared to control customers in segments of interest at PG&E. About 6% more SCE Rate 1 CARE/FERA customers and Rate 1 and 2 customers on or eligible for CARE/FERA, who have electric heat, reported seeking medical attention due to excessive cold compared to control customers; there were no significant increases regarding excessive heat for SCE customers.** About 5% more SDG&E Rate 1 and Rate 2 CARE/FERA customers in the moderate climate region, who have air conditioning, sought medical attention due to excessive heat compared to the control customers; there were no significant increases regarding excessive cold for SDG&E customers. The surveys asked customers whether they had sought medical attention due to excessive heat or cold in their home (health metrics), and these responses were compared between treatment and control customers. The comparisons regarding excessive heat were made only for customers who reported having air conditioning, and for those who require air conditioning due to a medical condition. The comparisons regarding excessive cold were made

only for customers who reported having electric heat, and for those who require heating due to a medical condition.

- At PG&E and SCE, satisfaction ratings with the TOU rate and with the utility were typically slightly higher for TOU rate customers than for control customers, which is a reversal of trends from the first survey, and these differences were sometimes statistically significant but they were always less than 1 point on an 11-point scale. Put another way, none of these differences are likely to be judged as material.
- The surveys revealed that a much smaller percent of customers on TOU rates received bills during the previous six months that were higher than expected compared to the results from the first survey, which asked about bills during the summer months. The percentage difference on this metric between treatment and control customers was significant lower for the majority of rates and customer segments in the hot and moderate climate regions at PG&E, and for one SCE and two SDG&E segments. This is an important finding that should influence not only the timing of enrollment for customers on TOU rates (e.g., enrolling customers during winter or spring, not in summer or early-fall) but also the content of ME&O materials, which should be designed to prepare customers for higher than expected bills in the summer period (while reminding them about lower bills at other times of the year).
- The surveys showed that about half to two-thirds of customers reported knowing when bill protection ends, but that customers' understanding of bill protection may depend on how the question is asked. SCE and SDG&E customers were provided a brief explanation of bill protection and asked if they understand what it means. Over 86% reported they did understand. PG&E customers, however, were provided the same brief explanation but were asked to choose what bill protection means among four possible choices. Between 28% and 59% selected the correct meaning while 25% to 51% reported they did not know. Net of each IOU's outreach to customers about bill protection, customers may overwhelmingly understand bill protection generally, but many do not understand the specifics when presented with other possible meanings.
- The surveys also showed a significant disparity in understanding of the timing of the peak period between CARE/FERA and non-CARE/FERA customers. For some rates and climate regions, between 14% and 44% of CARE/FERA customers could not identify a single hour that fell in the peak period rate window, while the percent of non-CARE/FERA customers that had the same level of misunderstanding was often significantly lower or even in the single digits. While many customers' understanding of rates improved compared to results from the first survey, particularly for PG&E, the level of understanding for some customers worsened. This issue should be carefully addressed and studied further in the upcoming default pilots where there is a much greater emphasis on and opportunity to develop and test ME&O options and content for all segments.
- For all three utilities, customers on TOU rates were more likely to 'often' take time-specific actions than customers on the OAT. For example, while a similar proportion of customers from control and treatment groups indicated they often turned off their lights to conserve energy, a larger proportion of treatment customers indicated they often shifted doing laundry and running the dishwasher during peak hours. In addition, substantial percentages of customer reported taking several of actions often to shift or reduce usage. Trends in the actions taken results suggest that many treatment customers did know about and take several actions that helped them shift usage even though fewer of them understood the nuances of their rates.

- Overall, the opt-in TOU pilot customer survey answered the research questions it was designed to address, including TOU rates' effects on customers' economic and health statuses, satisfaction, bill expectations, understanding of rates, actions taken to shift and/or reduce usage, and attitudes toward smart technologies, demand response and energy efficiency, and TOU outreach materials. However, the results also revealed some questions to begin or to continue exploring, such as how to improve customers' understanding of TOU rates (particularly their on-peak hours) and bill protection, their satisfaction with different aspects of the rates, and their persistence in taking actions to shift and/or reduce usage.

Appendix A Listing of Electronic Tables

The following Microsoft Excel files have been filed as electronic tables in conjunction with the primary report. Given the large volume of different rates and customer segments across utilities, electronic tables are the most efficient medium to present this data. Within these tables, users are able to select options such as the rate or customer segment of interest. The numbering of the tables corresponds to the section of the report containing the corresponding static figures and tables. In cases where more than one table corresponds to a section, each electronic table is labeled as X.X-1 and X.X-2. The file names for the electronic tables do not directly tie to any particular figure or table numbers, even though the naming convention is similar. These electronic tables allow the reader to access the underlying data that created the figures, and to determine actual values for data points within figures.

E-Table 3.3-1 - PG&E Load Impacts by Hour

E-Table 3.3-2 - PG&E Load Impact Tables & Figures

E-Table 3.3-3 – PG&E Annual kWh Impacts

E-Table 3.4 - PG&E Bill Impacts

E-Table 4.3-1 - SCE Load Impacts by Hour

E-Table 4.3-2 - SCE Load Impact Tables & Figures

E-Table 4.3-3 - SCE Annual kWh Impacts

E-Table 4.4 - SCE Bill Impacts

E-Table 5.3-1 - SDG&E Load Impacts by Hour

E-Table 5.3-2 - SDG&E Load Impact Tables & Figures

E-Table 5.3-3 - SDG&E Annual kWh Impacts

E-Table 5.4 - SDG&E Bill Impacts

E-Table 6.1 - Cross Utility Comparison

Appendix B Comparison of Original and Updated Tariffs

Table B-1: PG&E Tariff Summary

Rate	Season	Period/Percent of Baseline	Non-CARE		CARE	
			June 2016	March 2017	June 2016	March 2017
Rate 1	Summer	Off Peak	31.7	30.7	17.8	17.8
		Peak	42.0	41.0	24.3	24.3
	Winter	Off Peak	27.1	26.1	14.9	14.8
		Peak	29.0	28.0	16.1	16.0
	Baseline Credit		-11.7	-8.8	-4.7	-4.8
Rate 2	Summer	Off Peak	29.6	28.6	16.5	16.5
		Partial Peak	39.3	38.3	21.9	21.9
		Peak	44.5	43.5	24.9	24.8
	Winter	Off Peak	27.0	26.0	15.0	15.0
		Peak	29.6	28.6	16.5	16.5
	Baseline Credit		-11.7	-8.8	-4.7	-4.8
Rate 3	Spring	Off Peak	26.7	25.8	14.9	14.8
		Peak	36.0	34.7	20.1	20.0
		Super Off Peak	18.0	17.4	10.0	10.0
	Summer	Off Peak	28.6	27.8	16.0	15.9
		Peak	57.2	55.6	31.9	31.8
	Winter	Off Peak	27.1	26.1	15.1	15.0
		Peak	29.0	28.0	16.1	16.1
	Baseline Credit		-11.7	-8.8	-4.7	-4.8
OAT	Spring	0%-100%	18.2	20.0	11.9	12.6
		101%-200%	24.1	27.6	14.7	17.3
		200-400%	40.0	27.6	21.7	17.3
		Over 400%	40.0	40.1	21.7	24.0
	Summer	0%-100%	18.2	20.0	11.9	12.6
		101%-200%	24.1	27.6	14.7	17.3
		200-400%	40.0	27.6	21.7	17.3
		Over 400%	40.0	40.1	21.7	24.0
	Winter	0%-100%	18.2	20.0	11.9	12.6
		101%-200%	24.1	27.6	14.7	17.3
		200-400%	40.0	27.6	21.7	17.3
		Over 400%	40.0	40.1	21.7	24.0
Delivery Minimum Bill Amount			32.9	32.9	16.4	16.4
FERA Discount			12% discount on bill			

Table B-2: SCE Tariff Summary

Rate	Season	Period/Percent of Baseline	Non-CARE June 2016	Non-CARE January 2017	CARE June 2016	CARE January 2017
Rate 1	Summer	On Peak	34.5	34.8	24.2	24.3
		Off Peak	27.6	27.8	19.2	19.3
		Super Off Peak	23.0	23.2	15.9	16.0
	Winter	On Peak	27.5	27.3	19.1	18.9
		Off Peak	22.9	22.7	15.8	15.6
		Super Off Peak	22.9	22.7	15.8	15.6
	Baseline Credit		-9.9	-9.1	-6.9	-6.4
Rate 2	Summer	On Peak	53.3	55.2	37.8	39.0
		Off Peak	29.3	29.1	20.5	20.3
		Super Off Peak	17.3	17.6	11.8	12.0
	Winter	On Peak	27.9	27.6	19.4	19.1
		Off Peak	26.0	25.5	18.1	17.7
		Super Off Peak	17.4	17.7	11.9	12.0
	Baseline Credit		-9.9	-9.1	-6.9	-6.4
Rate 3	Spring	On Peak	24.9	25.0	17.2	17.3
		Mid Peak	21.0	21.1	14.4	14.4
		Off Peak	18.2	18.3	12.5	12.5
		Super Off Peak	9.9	10.0	6.5	6.5
	Summer	Super On Peak	37.0	37.0	26.0	25.9
		On Peak	22.6	22.6	15.6	15.5
		Mid Peak	18.8	18.7	12.8	12.7
		Off Peak	16.4	16.3	11.1	11.0
	Winter	Mid Peak	21.0	21.1	14.4	14.4
		Off Peak	18.2	18.3	12.5	12.5
		Super Off Peak	10.4	10.2	6.8	6.6
	All Seasons	0%-100%	15.7	16.3	10.2	11.0
		101%-200%	22.9	24.9	15.7	16.7
		200%- 400%	29.2	24.9	21.7	16.7
		400%+	29.2	31.4	21.7	21.1
Single Family Basic Charge/day			3.1	3.1	2.4	2.4
Multi Family Basic Charge/day			2.4	2.4	1.8	1.8
Min Charge/day			32.9	32.9	16.4	16.4
FERA Discount			12% discount on bill			

Table B-3: SDG&E Tariff Summary

Rate	Season	Period/Percent of Baseline	Non-CARE		CARE	
			August 2016	March 2017	August 2016	March 2017
Rate 1	Summer	Off Peak	34.9	38.0	22.1	23.5
		Peak	56.6	62.0	36.4	38.7
		Super Off Peak	29.7	32.0	18.9	20.3
		Baseline Credit	-20.3	-22.0	-13.0	-13.9
	Winter	Off Peak	36.2	40.0	22.8	24.7
		Peak	37.3	41.0	24.1	25.4
		Super Off Peak	35.1	39.0	22.1	24.1
		Baseline Credit	-18.6	-20.0	-12.4	-12.7
Rate 2	Summer	Off Peak	32.9	36.0	20.8	22.2
		Peak	56.6	62.0	36.4	38.7
		Baseline Credit	-20.3	-22.0	-13.0	-13.9
	Winter	Off Peak	35.8	39.0	22.8	24.7
		Peak	37.3	41.0	24.1	25.4
		Baseline Credit	-18.6	-20.0	-12.4	-12.7
OAT	Summer	130	19.1	21.0	11.7	12.7
		Over 130%	40.0	43.0	25.4	26.6
	Winter	130	17.5	20.0	11.1	12.0
		Over 130%	36.2	40.0	22.8	24.7
FERA Discount			12% discount on bill			

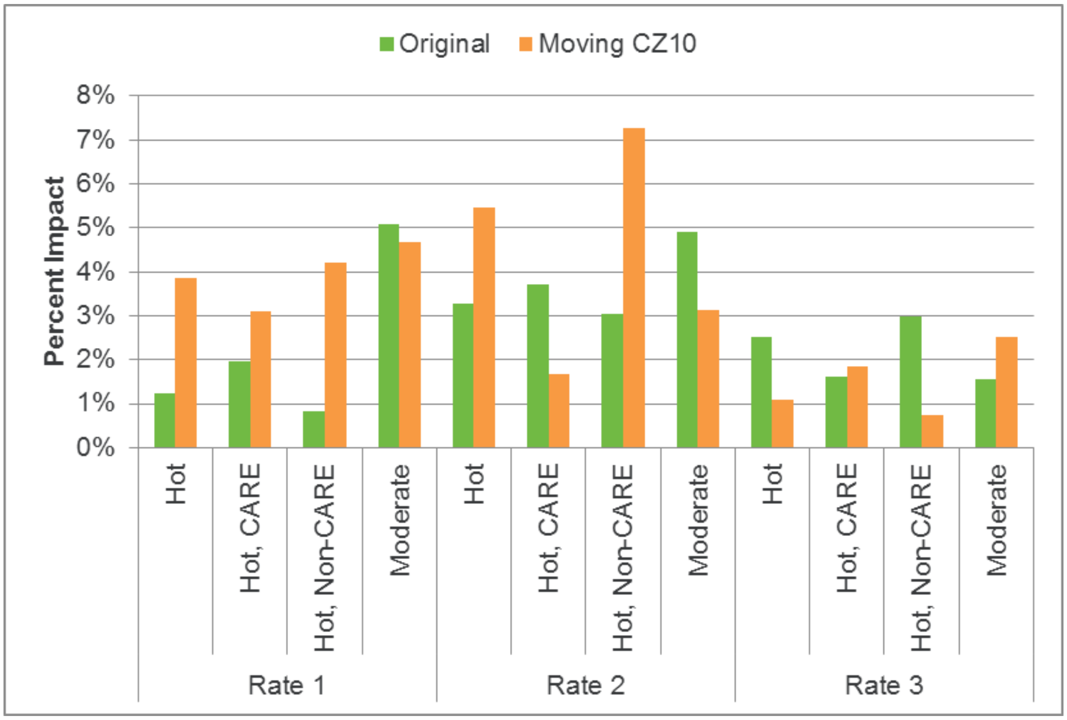
Appendix C Climate Zone 10 – Additional Analysis

At the request of the TOU Working Group, Nexant estimated SCE summer peak-period load impacts from the first summer with an alternative segmentation in which customers in SCE's Climate Zone 10 were included in the hot climate region rather than the moderate climate region. These customers made up a large portion of the moderate climate region, and as such, the "alternative" moderate climate region could not be split into CARE/FERA and non-CARE/FERA for load impact estimation purposes. The table and figure included below summarize the changes in peak period load impacts from moving Climate Zone 10 customers to the hot climate region. There doesn't appear to be a universal pattern to the outcome across all of the rates.

Table C-1: Comparison of Summer Peak Percent Impacts

Rate	Segment	Original	Moving CZ10	Effect on Impact
Rate 1	Hot	1.2%	3.9%	▲
	Hot, CARE	2.0%	3.1%	▲
	Hot, Non-CARE	0.8%	4.2%	▲
	Moderate	5.1%	4.7%	▼
Rate 2	Hot	3.3%	5.5%	▲
	Hot, CARE	3.7%	1.7%	▼
	Hot, Non-CARE	3.1%	7.3%	▲
	Moderate	4.9%	3.1%	▼
Rate 3	Hot	2.5%	1.1%	▼
	Hot, CARE	1.6%	1.8%	▲
	Hot, Non-CARE	3.0%	0.7%	▼
	Moderate	1.5%	2.5%	▲

Figure C-1: Comparison of Summer Peak Percent Impacts



For Rate 1, moving the Climate Zone 10 customers from the moderate region to the hot region made the percent impacts very similar between the two regions. This could imply that the Climate Zone 10 customers behave more like the moderate region customers than the original customers in the hot climate region given the major difference in percent impacts. The impacts for CARE/FERA customers in the hot region increased slightly, whereas those for non-CARE/FERA increased by quite a bit.

The results of this analysis were similar for Rate 2. The impacts in the moderate climate region decreased, while the impacts in the hot climate region increased. It appears that the Climate Zone 10 customers have greater impacts than the other two regions (without Climate Zone 10 included).

Rate 3 had very different results. After moving customers in Climate Zone 10, impacts in the moderate region increased while those in the hot region decreased. This was especially noticeable among non-CARE/FERA customers in the hot region. This implies that customers in Climate Zone 10 had small impacts on Rate 3.

ATTACHMENT C

SMARTPRICING OPTIONS FINAL EVALUATION

SEPTEMBER 5TH 2014

September 5, 2014

SmartPricing Options Final Evaluation

The final report on pilot design, implementation, and evaluation of the Sacramento Municipal Utility District's Consumer Behavior Study

Prepared For:
U.S. Department of Energy

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Powering forward. Together.

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Contents

1.0 Pilot Project Continuation

The Department of Energy's Smart Grid Investment Grant (SGIG) offered SMUD the opportunity to test the impacts of dynamic pricing and enabling smart grid technology on peak load shaving, energy conservation, and customer satisfaction using rigorous experimental research methods. SMUD implemented the first year of the SmartPricing Options (SPO) pilot in June 2012 and second year of the pilot in June 2013. SMUD is one of eleven utilities conducting a Consumer Behavior Study (CBS), a dynamic pricing trial, funded in part by the SGIG. This report examines the implementation, operations, and load impacts of the SPO pilot after the completion of the second year.

1.1 About SMUD

SMUD is a publicly-owned electric utility governed by a seven-member Board of Directors. Serving approximately 600,000 customers and a total population of about 1.4 million, SMUD is the sixth-largest public utility in the United States. SMUD's 900-square-mile service territory encompasses Sacramento County and a small portion of Placer County.

SMUD has been providing public power to the Sacramento region since 1946, and our energy efficiency and renewable energy programs are recognized nationally for leadership and innovation. For each of the last eight years, SMUD has received the highest customer satisfaction ratings of any utility in California in the J.D. Power and Associates survey and received the second-highest score in the United States for commercial customer satisfaction in 2010.

1.2 Consumer Behavior Study Background

SMUD was awarded a $127M grant toward a $308M smart grid project from the U.S. Department of Energy (DOE) as part of the American Recovery and Reinvestment Act of 2009 (ARRA). SMUD's SmartSacramento®[1] project is a result of an effective and strategic partnership between SMUD, California State University Sacramento, State of California's Department of General Services, County of Sacramento, Los Rios Community College District, Elk Grove Unified School District, and the Sacramento City Unified School District. Together with our partners, SMUD is implementing a smart grid in Sacramento that can serve as a model for California and the rest of the United States.

[1] ®A registered service mark of the Sacramento Municipal Utility District.

Included in SMUD's proposal to DOE was an agreement to participate in a cross-utility research effort to study the impacts of dynamic pricing in various regions. This study accounted for approximately 4% of SMUD's proposed smart grid project budget. Utility participants who conducted a consumer behavior study would not only benefit from the research opportunity within their own service territory, but the findings would be publicly available as individual utility analyses as well as an aggregate assessment across consumer behavior studies to be conducted by Lawrence Berkeley National Laboratory. Eleven utilities participated in the research effort and many studies have been completed. The research results are anticipated to be referenced by strategic planners within utilities, policy makers, technology developers and manufactures, and others in the utility space with an interest in pricing design, behavior change, and enabling technology development.

Please refer to the Interim Evaluation report of SMUD's Smart Pricing Options for a detailed description of the study background, objectives, planning and design. The interim report can be found at:

https://www.smartgrid.gov/sites/default/files/MASTER_SMUD%20CBS%20Interim%20Evaluation_Final_SUBMITTED%20TO%20TAG%2020131023.pdf

1.3 How This Report Is Organized

This report is divided into two sections and an appendix.

> *Section I: Project Operations* discusses the logistics of putting the project plan and research design into action for the second year of the pilot. Details on recruitment and first year implementation can be found in the interim evaluation report at the above link. Section 1 focuses on additional lessons learned and key takeaways in terms of pilot operations.

> *Section II: The Final Evaluation* is a comprehensive load impact report covering the load impacts, average impacts over the two summers, customer attrition, impact persistence, customer satisfaction, and customer choice analysis from the second summer conducted by Nexant.[2] The report is included in its entirety as it was prepared for SMUD. This section was written in a manner in which it can be extracted from this report and stand alone as an independent document. As such, it contains some brief areas of redundancy with *Section I* of this report, providing high level details for contextual value within the impact discussion.

[2] The interim report was produced by Freeman, Sullivan & Co., (FSC), which was acquired by Nexant in January 2014.

From this point forward, when referring to SMUD's consumer behavior study, we use the pilot's marketing name, "SmartPricing Options." We also use the terms "study" or "pilot" to refer to the SmartPricing Options. The term "Consumer Behavior Study" or "CBS" refers to the overall consumer behavior study data being collected by the DOE in consultation with Lawrence Berkeley National Lab.

SECTION I: PROJECT OPERATIONS

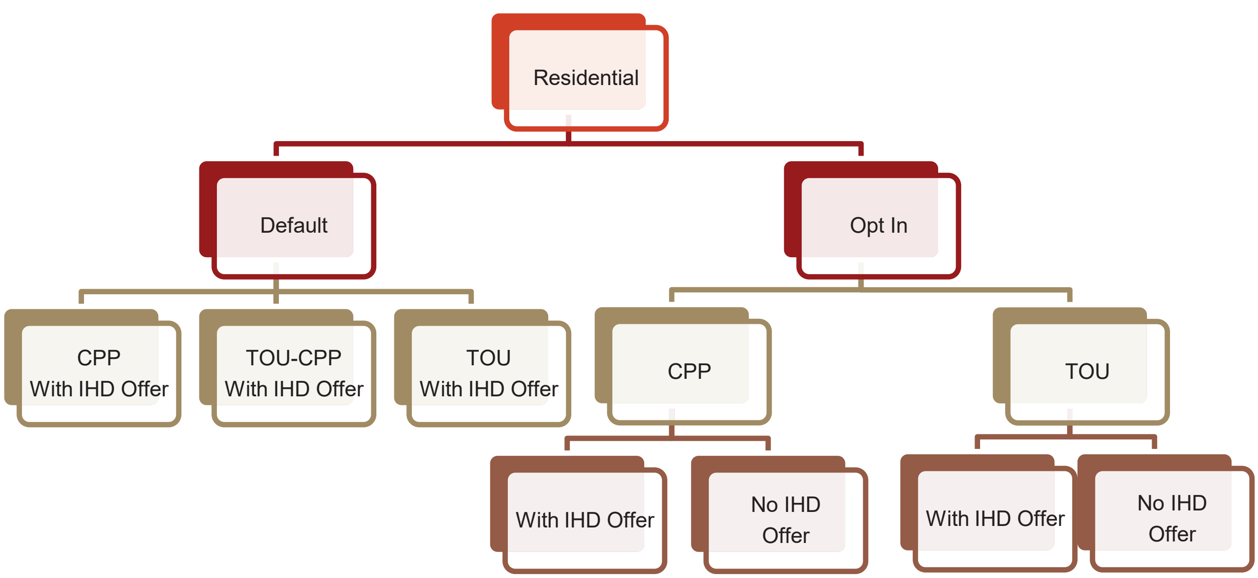
2.0 The Second Summer of SmartPricing Options

The second year of the pilot focused on operational process improvements, customer retention, and application of lessons learned from the first summer.

In early 2013, the second year of the pilot, SMUD staff began planning for improvements in the operational processes for the pilot's Conservation Days, customer services, and customer retention. From the research completed, the experiences gained and lessons learned from the first year of operations, SMUD was able to refocus on what could be done to improve communication to pilot participants and ensure customer retention.

The seven treatment groups for the pilot included a representative sample of SMUD's customer base except for the following exclusions: photovoltaic customers, air conditioning load management customers, and medical rate customers. Low income customers were included in the study population and represented 33% of study participant. The SPO treatment groups are detailed below.

Figure 1: SmartPricing Options Treatment Groups



The experimental rate options were offered to the sample population beginning in October, 2011 and were in effect from June through September, in both 2012 and 2013. The research objectives were to determine:

1. Electric energy and demand impacts for each treatment;
2. Customer characteristics related to energy usage behaviors;
3. The role of IHDs in customers' daily electricity management;
4. Program impacts on customer bills and satisfaction;
5. Expected value of rate and IHD programs;
6. Expected market penetration for rate and enabling technology programs; and
7. Effective educational and marketing strategies for customers.

It is not uncommon in utility research to rely on quasi-experimental methods and limited sample sizes due to resource constraints, technology limitations, and concerns about negative impacts on customer satisfaction. The Technical Assistance Group (TAG) that was under contract to DOE to provide guidance for the consumer behavior studies had a much higher standard for implementation of the consumer behavior studies for all SGIG recipients. In SMUD's case, the resulting research plan included three methodologies: Randomized Control Trials (RCT), Random Encouragement Design (RED), and Within Subjects.[3]

It was important to SMUD to manage the size of the study, and the RCT and RED designs with the agreed upon statistical power required much larger sample sizes than the methods typically employed by SMUD. In an effort to manage the study's footprint on our service territory, we assigned research rigor and associated sample sizes based on the priority of the research questions that could be answered by the treatment group. This resulted in the following design:

- RED: CPP with technology offer (opt-in and default) and TOU with technology offer (default)
- RCT: TOU with and without technology offer (opt-in)
- Within Subjects: CPP without technology offer (opt-in) and TOU-CPP with technology offer (default)

[3] These terms are defined in detail in the appendix of this report on page 136.

Ultimately, sample sizes were larger than expected after the first summer due to much higher than expected recruitment and retention rates, which allowed Nexant to conduct the evaluation using RED and RCT methods for all treatments.

SMUD had predicted that approximately 20% of pilot participants would leave before the end of the study period on October 1, 2014. It became clear in early 2013 that attrition would be greater than 20%, primarily due to customers moving from premises that were in the study. If a customer moved from a home included in the study, they were dropped from the evaluation. During the course of the two year pilot, approximately 25% of customers in the study moved, exceeding SMUD's forecasted attrition levels. These move-out rates, upon further investigation, were only slightly higher than average, which was most likely a result of the economic recession. However, dropout rates, that is, customers that elected to leave the pricing pilot, were very low across all treatment plans, ranging from 4%-9%. Because SMUD had overenrolled customers in each of the treatment groups, this attrition did not compromise the validity of the study.

SMUD focused significant attention on customer retention and improved communications regarding the pilot goals and objectives. The shift in marketing from a recruitment campaign to an educational and retention campaign allowed for a deeper dive into customer preferences and targeted marketing. Market research conducted in the first year allowed the team to identify improvements that could be made to communications. The team applied this customer feedback to marketing collateral and produced higher customer satisfaction ratings among pilot participants than during the first year. Additional information on Marketing and Market Research can be found in Section III.

By the second year of the pilot, experience was on the side of the operations team. We had learned a great deal from the challenges during the first summer and the team implemented new operational processes that improved CPP event execution, reporting, and customer service. More on these efforts can be found in Section 5, which discusses pilot operations.

3.0 Project Administration: Budget and Schedule

3.1 Overview

The SmartPricing Options pilot was one of the larger SGIG funded pilot projects in terms of scope, schedule and budget. The two-year pricing pilot required a seven month recruitment period and over a year and a half of planning and implementation before the pricing plans went into effect.

The project schedule included over 1260 tasks with start and finish dates for each task of the project. This schedule was critical for the project team to stay on task and recover from delays and surprises that are inevitable in any project.

3.2 Details

3.2.1 Budget

The budget process at SMUD is completed annually for the upcoming year and includes a three year planning budget. The SmartPricing Budget was created in 2010-2011 and updated annually for the pilot covering 2010 through 2014.

Total Project Budget

The initial projected total costs for the pilot totaled $12.8 million. All budget figures discussed in this section include the cost of product, services, and internal labor to administer the pilot, as well as the surcharge rate used to account for organizational overhead[4]. The costs reported here are total budgets, not just SMUD's cost share of the pilot. Due to some efficiencies and overestimated support requirements, project expenditures equaled approximately $9.9 million.

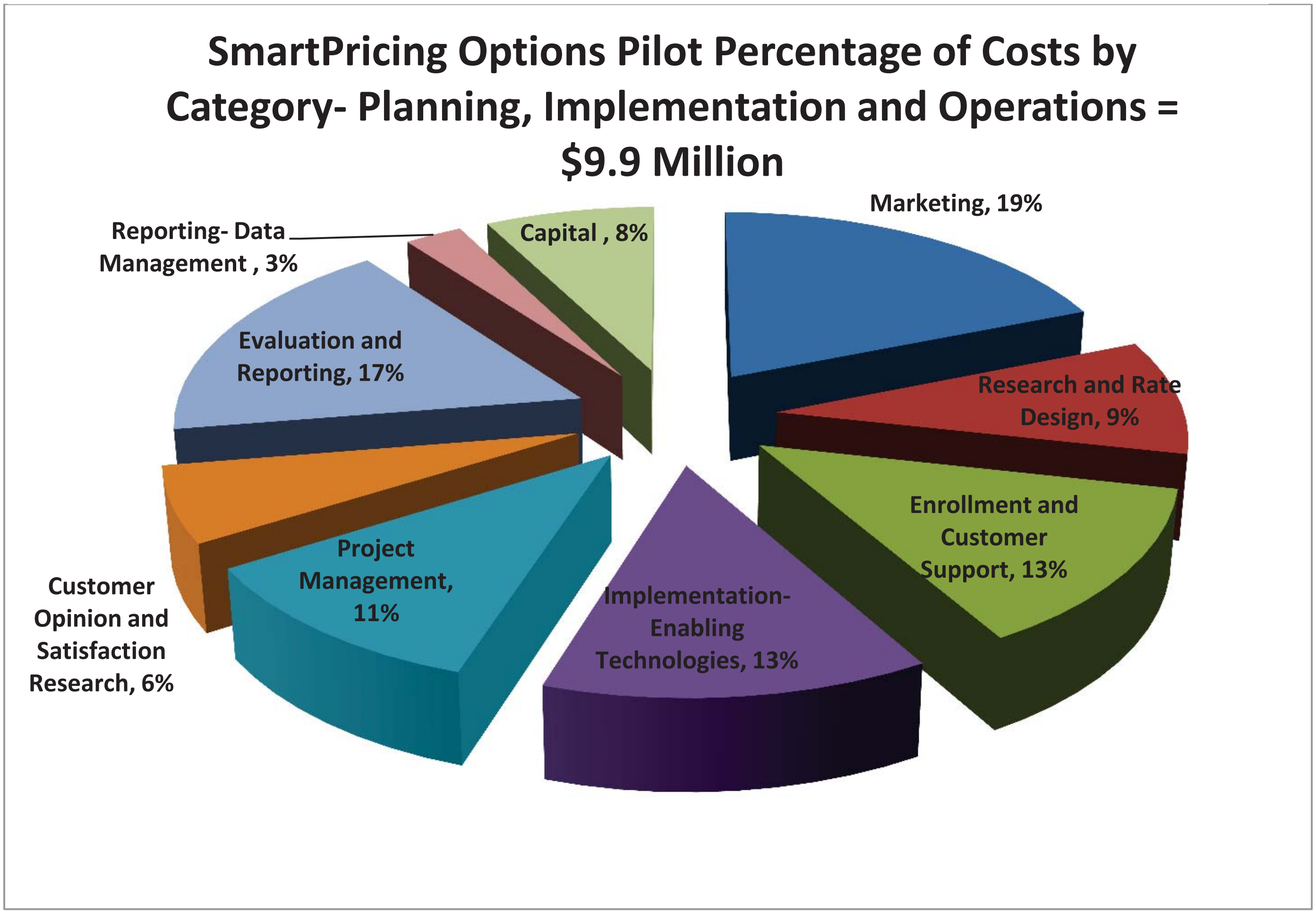
As depicted in Figure 2, the two largest costs were the implementation of IHDs and the marketing activities, followed closely by evaluation and reporting. This is an interesting

[4] All budget figures reflect allowable expenses allocated in accordance with guidelines dictated by the U.S Department of Energy. Figures presented in this report do not replace or supersede any reports provided to DOE and should be considered estimates.

point for rate implementation planning, since many of the costs associated with the evaluation and offer-specific communications may not be applicable in a standard program deployment, and it is common for the price of enabling technology to be reduced for customers by offering a rebate or incentive rather than giving the device to customers for free. While these allocated expenses were appropriate in the research study environment, they may not be applicable for actual program deployment.

The initial stages of the project were heavy in design, recruitment, technology and project management costs, some of which would not be applicable to a system-wide implementation since they concern research design, study set up, and DOE reporting. Also, the complexity of managing seven treatment groups and the redundant efforts required to support each task for each of the treatment groups would be eliminated if the program manager could market the offers without mutual exclusivity. Alternatively, much of the infrastructure that was developed to support time-variant rates and pilot oversight would be leveraged if a system-wide program rollout was deployed after the pilot period. For example, billing validation and bill presentment could be leveraged indefinitely, and project management tasks to oversee the pilot would be absorbed by program staff.

Figure 2: Actual Budget for SmartPricing Options, through May 2014



The following descriptions provide a summary of the expense types in each category and provide additional details.

Marketing

The marketing costs for recruitment and retention through May 2014 totaled $1.9M, or 19% of the total project costs through the end of the study period. The pilot study design coupled with the diverse and comprehensive marketing effort required that the marketing team create seven versions of most marketing pieces, which was very labor intensive. The team worked with several local marketing firms to design materials that would resonate with customers and give them the tools that would help them be successful on the new pilot pricing plans.

The marketing total also includes a full time, dedicated marketing professional for 35 months during this period. Of note is the reduction in expenses for outside services relative to the initial budget plan (total planned marketing budget was $2.8M). This reduction resulted from a change in strategy from our marketing team to exclude radio spots, billboard advertisements, and other mass marketing strategies for recruitment that were originally planned but not implemented.

A full description of the marketing plan and the components that make up these costs can be found in Section I, 7.0 Marketing, in the Interim Evaluation Report, and in Section 1, 4.0 of this Final Evaluation report.

Enrollment and Customer Support

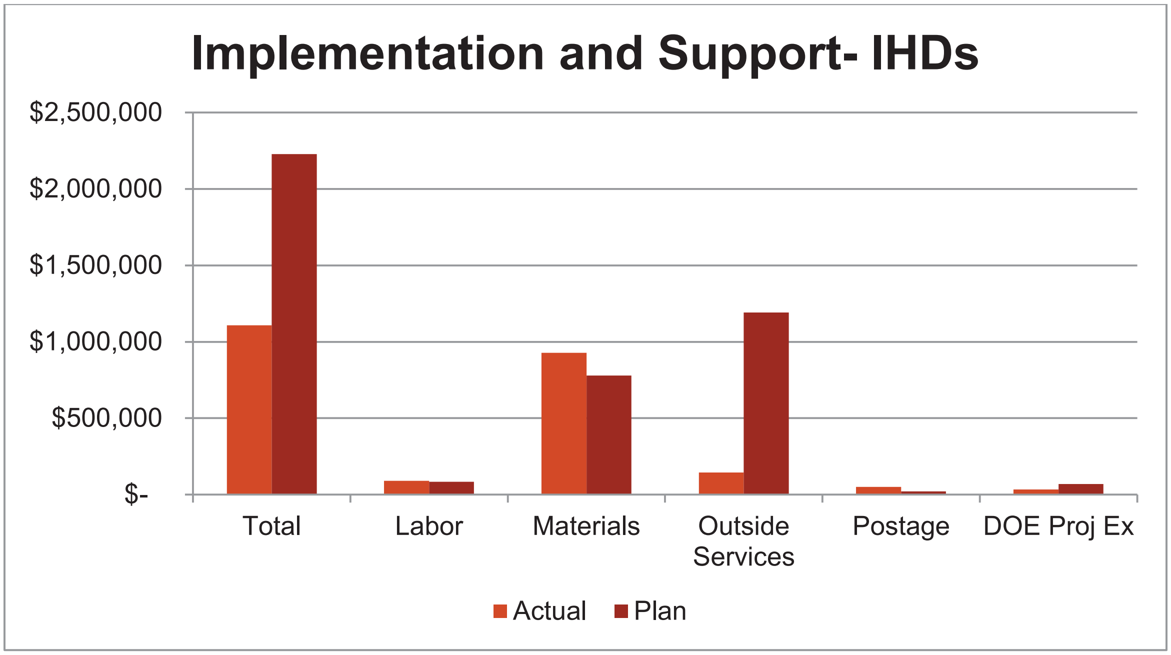
Enrollment and customer support costs for the pilot account for approximately 13% of the total costs for the duration of the pilot, for a total of $1.3M. These costs include tasks such as customer service, billing, enrollment, un-enrollment, support for the enabling technology, and deployment of customer notifications related to the daily operations of the pilot, such as reminder postcards to call with questions or informational notifications provided for billing clarification.

The original plan had estimated hours for customer support very conservatively. However, call volumes were much lower than the original estimate and customer support labor hours were about half of what was originally planned. In addition, we were able to achieve efficiencies in the enrollment process due to automation of several transactions for enrolling customers.

Implementation and support: In Home Displays

Figure 3 compares planned costs in the original budget to the actual expenditures for the implementation of IHDs through December 2014. Significant reduction in the expenses for outside services was due to providing internal technical support for IHDs rather than utilizing outside services for that role. After careful evaluation of the proposed support services provided from an external party, we decided to keep all support for the devices in house, which resulted in large costs savings for those services, since added labor costs were offset by efficiencies in other areas.

Figure 3: Implementation - IHD Costs



Implementation: Project Management

Project management includes all tasks associated with keeping the project planned and implemented within scope, on schedule, and within budget. Many tasks that might otherwise be handled by a program manager in a program environment, such as running reports and validating mail lists, were also handled by the project manager, since no program manager was planned for this research project. The costs for these tasks were approximately $1.1M from the planning stages to the completion of the pilot. There were several team members billing to the project under project management based on the nature of their tasks. These tasks include development of requests for proposals for support services; development of schedules, scope, and budgets; review of all marketing materials; and data management for reporting and evaluation, among other tasks.

Customer Opinion and Satisfaction Research

Market research costs, totaling 6% of the total project budget, include research conducted prior to recruitment and customer opinion and satisfaction research performed before, during and after the pilot. This includes the portfolio of research projects presented in Section I, 6.0 Market Research, in the interim evaluation report and in Section 1, 4.0 of this report.

Evaluation and Reporting

When conducting a pilot, the costs of evaluating the results and answering the research questions are a major consideration when scoping the project. During the planning period, SMUD had considered both quantitative and qualitative research questions and looked at how to best plan for the expenditures throughout the pilot period. SMUD agreed to produce an interim evaluation report at the end of the first summer and a final evaluation report at the end of the second summer that looked at results from across both summers that the rates were on effect. In order to accommodate these costs across multiple years, several different budgets were established for each of the broad research areas under the pilot. The interim and final evaluations were grouped together with reporting metrics and data, and the funding was budgeted across three years, 2012 through 2014, in the Evaluation and Reporting category.

The total expenditures for the evaluation and reporting category were17% of the total budget across the three year study period and were primarily spent on outside services for consulting work completed to evaluate the pricing pilot. The detailed final evaluation report is included in Section two of this report and the interim evaluation report can be found at: https://www.smartgrid.gov/sites/default/files/MASTER_SMUD%20CBS%20Interim%20Evaluation_Final_SUBMITTED%20TO%20TAG%2020131023.pdf.

Reporting: Data Management

Although data management is not a large part of the overall budget, it is an important task operationally and strategically. Data management and reporting accounted for 3% of the total budget. The majority of these costs included data analytics and statistical software (SAS) and labor expenses.

Capital

Capital expenses include those costs required to upgrade system infrastructure to support time based rates through the Customer Information System (SAP), Meter Data Management systems, and the HAN Communication Manager. These expenditures accounted for approximately 8% of the costs through May 2014.

3.2.2 Schedule

The SmartPricing Options project schedule was developed to accommodate implementation of a large study that included the integration of smart grid technology. The outside boundaries of the schedule were dictated by the two-year study period allowed by DOE and the start date of the grant award. DOE reportable milestones and deliverables are noted in Table 2. Customer recruitment began in late October 2011 and customers were placed on the new pricing plans on June 1, 2012.

Table 2 represents the milestone schedule covering some of the primary activities associated with the SmartPricing Options pilot.

Table 1: SmartPricing Options Schedule of Milestones

Milestone	Completion Date
White Paper summary submitted to TAG	08/09/2010
Rate Development	12/31/2010
Final Plan Submitted to DOE	03/30/2011
SMUD Board Rate Approval	03/31/2011
Development of Marketing and Educational Materials	08/01/2011
Sample Selection	09/20/2011
Begin Recruiting	10/24/2011
Select IHD	12/31/2011
Deliver IHDs	05/01/2012
New Rates In Effect	06/01/2012
Interim Evaluation	09/01/2013
Market Research – Conjoint Study	12/31/2013
Residential Attributes and Consumer Behavior Survey	10/31/2013
Market Research – End of Pilot Satisfaction Survey	1/31/2014
Final Evaluation	06/30/2014

3.3 Quality Assurance

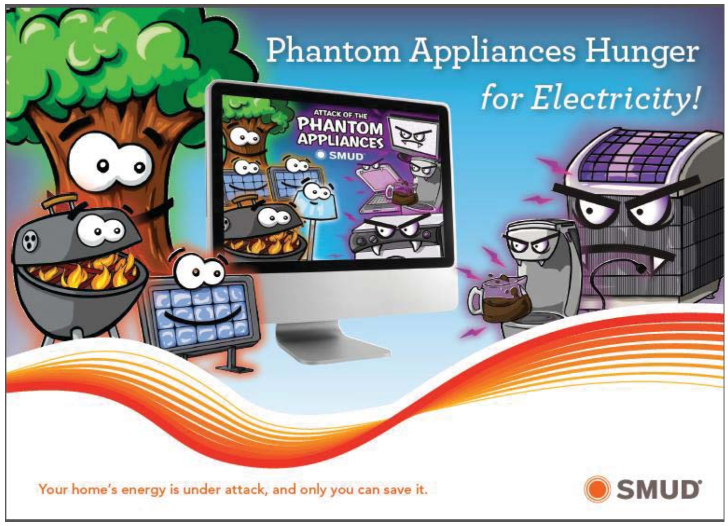
The project manager and business unit leads created a detailed task-level schedule for the SPO using Microsoft Project. The project schedule included over 1,360 tasks with start and finish dates for each. Because the project team included representatives from each of the Customer business units and a number of middle/back office business units, the schedule was critical for the project team to stay on task and recover through delays and surprises that are inevitable in any project. During core team meetings, team members stepped through the project schedule so that each individual was accountable for their assigned tasks. In this way, the team identified any issues or delays and worked collaboratively to find solutions to overcome them. The project schedule was stored as a protected document on SharePoint so that all team members could view it, and it was distributed to the team each month after it was updated.

In addition to regularly managing the schedule at the team level, monthly reporting to the SmartSacramento Project Management Office was required to sync up DOE milestones from the SmartPricing Options schedule with the entire SmartSacramento schedule that is used to report to DOE. This multilevel reporting process was more work than the standard approach, but it was a valuable process in terms of accountability and forecasting due to the number of reviewers included in the process and the need to seamlessly synchronize multiple tools.

3.4 Lessons Learned and Key Takeaways

The SmartPricing Options pilot was a huge undertaking for the team to implement and manage on a very tight timeline. Managing the tasks of more than 140 contributors over the course of several years requires strict schedule oversight. It is not uncommon for project schedules to be less detailed than the schedule used for this project, but having a highly detailed schedule with a corresponding line item in the budget using the same naming conventions was extremely useful in managing tasks, budget, and resources. Using a dynamic project management scheduling software (MS Project) and budget reporting system (SAP) provided access to information that allowed for schedule and budget recovery, variance explanation, sound forecasting and on-time and under-budget delivery.

4.0 Marketing and Market Research



4.1 Overview

SMUD worked diligently to engage customers through a variety of channels and to maintain communications with pilot participants. This dedication to the customer experience not only paid off in terms of very low attrition from the pilot, but also helped customers understand pilot goals and maintain load reductions across both summers.

4.2 Details

SMUD's marketing strategy included education and retention components and leveraged multiple channels of communication with customers. The campaigns focused on four specific messages highlighting the benefits of participating in a SmartPricing Options pricing plan.

1. Get a discount on your electricity during off-peak hours;
2. Take control of your summer electricity costs;
3. Manage your energy use; and
4. Contribute to a cleaner environment.

Materials and messaging were developed based on findings from market research efforts that continued throughout the planning and implementation periods. The focus group research indicated that customers preferred images and content that were local and reflected real-life, residential activities. The marketing strategy included several dedicated photo shoots to capture the intention and feeling of SmartPricing Options. The resulting photographs, (example below), showed local families engaging in summertime activities, including family barbeques, children playing in sprinklers, and families relaxing outside. The photos also demonstrated energy-saving actions such as installing weather stripping, CFLs and using smart strips.


French's

Table 2 summarizes the communication channel schedule, including a summary of the target audience and objectives for each channel. SMUD's marketing team was aware that some channels were likely to be more effective than others; however, the team felt that it was important to optimize communications by providing access to information through a variety of channels spanning customers' personal preferences.

The mass media campaign, "Little Things, Big Potential", was conducted in the summer of 2011 and focused on increasing general awareness of energy usage, saving energy, and reducing peak load. This larger campaign allowed SMUD to test the language and images that would be used for SmartPricing Options, but also reinforced the SmartSacramento initiative to the entire SMUD population. Mass marketing for "Little Things, Big Potential" was discontinued after recruitment for the pilot began, largely because mass marketing can not be used in a RCT and RED quasi-experimental designs, since you are offering the rate plan to only a sample of the population. By discontinuing the campaign, we focused on targeted marketing for SPO to only the sample of study participants.

Table 2: Schedule of Marketing Activities by Channel

Channel	Start Date	End Date	Target Audience	Objectives
MASS MEDIA	Jun-11	Sep-11	All residential customers	Education
DIRECT MAIL	Oct-11	Oct-14	All eligible customers	Recruitment, Education, Retention
EMAIL[5]	Mar-12	Oct-14	Opt-in and Default customers	Education, Retention
OUTBOUND CALLING	Apr-12	May-12	Eligible opt-in customers	Recruitment
DOOR HANGERS	Mar-12	Apr-12	Eligible opt-in customers	Recruitment
MICROSITES	Oct-12	Oct-14	All eligible customers	Education, Retention
FACEBOOK GROUPS	Jul-12	Oct-14	All enrolled participants	Education, Retention
PINTEREST	Jul-12	Oct-14	All enrolled participants	Education, Retention
YOUTUBE	Jul-12	Oct-14	All enrolled participants	Education, Retention

In preparing for the second summer of the pilot, SMUD's marketing team utilized information that was collected through customer feedback and surveys in developing ongoing communication materials. Although some of the customer feedback requests were items that we could not provide due to the research design constraints, such as rate comparison tools and shadow billing, we were able to provide customers with general feedback. We included average savings for SPO customers and total kWh reductions for all participants in correspondence with the customers. From customer feedback, we learned that customers wanted to know what the collective energy savings from all participants amount to in kWh and carbon offset equivalents. Customers valued information about how they were impacting the community as a whole.

Since the SmartPricing Options pilot participants only face time-based rates in the summer months, (June through September), there was a 6 month hiatus from SMUD communications regarding the pilot. In late April 2013, SmartPricing Options pilot participants were sent a reminder letter, stating that the pricing plans would go into effect again starting in a few short weeks. As a result of this letter, we had approximately 100 customers call in to de-enroll for the second summer. Drop outs had been lower up to that point and the initial up-tick in response to the letter was a concern. In retrospect, SMUD probably should have not sent the letter and only sent the "Welcome Back Kit", which provided more incentive for customers to stay in the pilot.

[5] Only enrolled customers with an email address on file received email communication. Email messages were consistent with the direct mail messages. The email notifications did not replace direct mail, rather they were sent in addition to direct mail.

For the second summer, the marketing team prepared a “Welcome Back Kit”, which closely resembled the “Welcome Kit” distributed prior to the first summer of the pilot. The kit included magnets, recipe cards, energy saving tips, information about the pricing plan, and a discount card to local restaurants and venues. The purpose of the kit was to provide engaging materials for pilot participants and to remind them that the pilot was continuing for the 2013 summer. Since marketing and communications were limited during the winter and spring months, the marketing team created a folder of marketing materials that would stand out from other mail and encourage customers to open the envelope and read the materials. The same concept was used the year before, with success; customers reported remembering receiving the welcome kits at a higher rate than any other marketing materials that were sent through direct mail.

For the second summer, the contents of the “Welcome Back Kit” were modified to encourage retention and increase customers’ understanding of the pilot objectives. Customers were reminded about the pilot objectives - “SMUD is offering these time based pricing programs to reduce peak demand hot summer hours. SMUD is hoping to learn how customers use energy when on time based rates and how it impacts peak demand and energy use. During last summer, with your help, we reduced peak demand by 4 MW and reduced electricity use by 476 MWh.”

4.3 Additional retention activities

For the SmartPricing Options pilot, SMUD’s marketing team created the most robust retention campaign that SMUD has deployed to date. The retention campaign focused on engaging customers through various channels, including social networks, online games, infographics, email, direct mail, you-tube videos, and dedicated websites loaded with information and interactive graphics on energy use.

An example of the retention campaign is highlighted in SMUD’s online game, Attack of the Phantom Appliances, which is available at http://phantomappliances.com/

The tower defense game is peppered with quizzes that test the customer's knowledge on what it costs to operate electric appliances. The game is packed with energy saving information and energy saving heroes, such as Watson the floor lamp, who slings CFL bulbs to stop the phantom appliances as they approach your home and kitchen. If you do not place enough energy saving devices in the path of the phantom appliances, your home is overrun and you must restart the game.

SMUD created plan specific microsites that served as an auxiliary website with independent links and address that was accessed mainly from a SMUD.org, or by directly typing the URL into a web browser. Microsites were provided for each treatment group to encourage participants to stay engaged and learn strategies to help reduce peak period usage. At the beginning of the summer of 2013, SMUD launched a sweepstakes for SPO customers to win a new grill. This effort helped drive customers to the websites to register for the sweepstakes and also provided educational information. Each microsite, a total of seven (see links below), has pricing plan specific information, but all sites are identical in content, (e.g. cost to run charts are available on all microsites, although the prices vary by treatment plan.)

Opt-In Treatment Group Sites

- Summer Weekday Value Plan w/ technology: https://www.smud.org/smartvalue
- Summer Weekday Value Plan w/o technology: https://www.smud.org/valuepricing
- Off-Peak Discount Plan w/technology: https://www.smud.org/smartdiscount
- Off-Peak Discount Plan w/o technology: https://www.smud.org/discountpricing

Default Treatment Group Sites

- Summer Weekday Value Plan w/technology: https://www.smud.org/valueoption
- Off-Peak Discount Plan w/technology: https://www.smud.org/discountoption
- Optimum Off-Peak Plan: https://www.smud.org/optimumoption

The microsites were a platform where customers could access several other social networking sites, including Facebook, Pinterest, and YouTube. SMUD created a number of videos that were published on YouTube and focused on cooking tips during peak hours. This complimented the recipe cards that were included in the Welcome Back Kit, that provided easy and energy efficient recipes for customers to create during peak hours. The SMUD team focused on ways to make behavioral changes convenient and on providing actionable marketing materials that resonated with customers. The Pinterest page focused on activities, pet care, recipes, fun facts, and safety tips. The links below can be used to access this content.

Peak Hour Kitchen Tips:
http://www.youtube.com/watch?v=NznL9JhD6Bs&list=PL9C25A4626E0E7668&index=4

Pinterest: http://www.pinterest.com/smartpricing/

The numerous platforms that SMUD utilized to reach out and engage customers helped improve understanding of the pricing plans and the program goals of reducing peak usage. By utilizing a multifaceted campaign that employed everything from direct mail to social networks, SMUD successfully engaged customers to reduce peak demand throughout the two year pilot. As SMUD continues to roll this program out to new customers in 2014, while successfully retaining pilot participants, the marketing team will continue to use this multifaceted approach.

4.4 Market Research

The project team understood the importance of market research of customer choice and satisfaction and conducted numerous surveys over the pilot period to better understand customer preferences and satisfaction. As mentioned previously, the objectives of the pilot included understanding the customer characteristics associated with behavior, program impacts on customer satisfaction, effective educational and marketing strategies for customers, and the role of enabling technology in customers daily electricity management. As such, SMUD partnered with Nexant to conduct the End of pilot survey and a Conjoint Survey that focused on dynamic pricing. The results from those research efforts are discussed in detail in Sections 9 and 11 of the Nexant report.

5.0 Pilot Operations and Customer Support

5.1 Overview

By the end of the first summer of the pilot, SMUD staff had gained a tremendous amount of operational knowledge and useful insights about pilot operations. This knowledge and insight were applied in the second year of operations to make improvements to conservation day (CPP event) execution and support for customers with In-home displays. The focus of this section will be on the operational improvements made to the pilot in the second summer.

5.2 Details

Conservation Day Execution (CPP Events)

One of the most challenging components of operations was notifying customers about CPP event days (referred to as Conservation Days). The notification options available to participants included email, phone call, and text messaging. SMUD continued to work with a third party vendor on the messaging campaigns for the second summer and designed a new business process and Core team to facilitate the implementation of the Conservation Days. At the beginning of the second summer, SMUD implemented several new demand response pilots to its portfolio and they all leveraged the same processes as the SPO pilot. Events across the pilots used the same "conservation days" and leveraged the same messaging vendor and settlement processes for all residential participants. This increase in volume of customers as well as the complexity of the different pilots made it critical for SMUD to make changes to the operations team responsible for the successful dispatch of these events.

Staff created a conservation day core team from across various departments that would be responsible 7 days a week for the conservation day efforts. This team was required to be available each morning throughout the summer months to execute conservation days if necessary. Each pilot project manager was responsible for messaging to their pilot's participants 24 hours prior to events and for same day execution of price messaging and temperature offsets to enabling technology in customer's homes. In addition, the Conservation Day Core team included individuals from Information technology that were tasked with monitoring the progress of messages and signals across SMUD's systems and at vendor platforms. This allowed IT staff to step in at anytime the systems were not executing properly.

The entire Core team held webinars with shared computer monitors for several hours during each event to ensure that all steps were properly executed and that systems were handling the dispatch. This differed from the first summer when there was no formal Core team and events were executed by one individual and tested for accuracy after the dispatch had occurred.

This new Core team ensured that quality assurance was happening during the dispatch and all processes had a set of eyes watching to ensure accuracy. The SMUD IT staff had direct contact with vendors in the event that messages were not properly deployed by vendor systems, which did occur during the second summer on a Sunday afternoon. Because of this new team structure, the IT team contacted the vendor and ensured that the messages were dispatched within minutes, thus avoiding another messaging mishap, like one that had occurred during the first summer. This new Core team process, although resource intensive, ultimately resulted in a successful second summer of CPP messaging to all customers.

Supporting the In-home Displays

SMUD continued to provide comprehensive support for In-home displays, (IHDs) and formalized a group in Customer Operations that was in charge of inventory, troubleshooting, and device provisioning for the IHDs. This group worked as tier 2 support, with SMUD's CSRs serving as tier 1 support. SMUD recognized the importance of having a dedicated Home Area Network (HAN) group in operations that could manage the support of HAN devices over the long term. HAN devices and enabling technology are viewed as a permanent item in SMUD's portfolio of energy information tools that will continue to become more popular.

A reminder postcard was sent to SPO participants that had elected to receive an IHD from SMUD during enrollment in the first year of the pilot. The postcard reminded customers to use the IHD again in the second summer to discover energy saving opportunities and patterns. Although SMUD had experienced a significant connectivity drop-off of devices during the winter months, the off season for the pilot, we had hoped that a reminder postcard would encourage customers to reactivate their devices for the second summer. In fact, a significant increase was observed in the number of devices that connected to the HAN network following the delivery of the postcard and the "Welcome Back Kit".

After the first year of supporting IHDs, the second year was relatively quiet. The majority of connectivity issues were addressed in the first summer. However, only 30% of the customers with IHDs actually had the devices connected to the network, during the second summer, or approximately 1,200 devices. Most of the issues that our support team addressed concerned replacing the rechargeable battery in the devices and re-activating the HAN radio in the meter.

It is interesting to note that there is a population of SPO participants that have maintained connectivity of their IHD for the duration of three years now, year round, and we have named them “super users.” These folks account for approximately 12% of all the IHD users.

5.3 Lessons Learned

SMUD has learned that messaging for CPP events is much more complex and requires more resources than was originally planned. A core team was created for implementing CPP events that had multi-departmental representation tasked with ensuring operational success. The accuracy of messaging is critical since it involves direct contact with customers and involves a call to action. In the first summer, there were instances of the wrong date being included in messages and wrong event numbers, all of which caused customer confusion and resulted in increased call volumes to the contact center. By ensuring that staff resources were available at every step of the execution, SMUD was able to improve the customer notification process.

Additional lessons include:

- ✓ Messaging for CPP events is complex and requires adequate staff resources to deal with quality control
- ✓ Customers were interested not only in their own savings, but also in how much everyone in the group saved (e.g., they care about the social benefits of the program)
- ✓ SMUD used pricing plan specific recruitment marketing materials, rather than mass marketing materials. This cost less, and also resulted in higher than expected enrollment rates.

SMUD SmartPricing Options Pilot Evaluation

Submitted to Sacramento Municipal Utility

Submitted By Nexant

Final Report: August 6, 2014

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Table of Contents

1 Executive Summary

This report documents the final evaluation results for Sacramento Municipal Utility District's (SMUD) SmartPricing Options (SPO) pilot. SPO is a multi-year pricing pilot that tested three time-variant pricing plans (e.g., time-of-use, critical peak pricing and the combination of the two) and two different recruitment strategies (opt-in and default). To our knowledge, this is the first pilot in the industry that compared enrollment and load impacts on a side-by-side basis for identical customer segments based on both opt-in and default recruitment. The SPO also tested the impact of the offer of an in-home display (IHD) on customer enrollment for opt-in recruitment. The pilot research design involved both randomized control trials (recruit and delay) and randomized encouragement designs.

Opt-in recruitment began in October 2011 and marketing continued until June 1, 2012, when the new pricing plans went into effect. Default treatment groups were notified in early April 2012 that they would be placed on a new, time-variant pricing plan by June 1 unless they contacted SMUD indicating that they did not wish to be placed on the new plan. Time-variant rates were effective from June 1 through September 30 for the summers of 2012 and 2013. In between the two summers, customers reverted to their otherwise applicable SMUD tariff.

In addition to analyzing customer enrollment and load impacts, this report summarizes the results from two surveys. A conjoint survey was conducted to examine the likely impact of changes in rate attributes (e.g., price ratios, the number of rate periods, the number of event days for CPP pricing plans, etc.) on customer enrollment for opt-in pricing plans. An end-of-pilot survey was conducted to assess customer satisfaction, awareness of the attributes of each pricing plan, customer perceptions, reasons that customers stayed on the new pricing plans, IHD use and other topics of interest. The cost-effectiveness of various pricing plans under the assumption that SMUD would offer the plan to the entire residential population is also reported.

1.1 Customer Acceptance and Attrition

Customer acceptance rates for opt-in pricing plans were high by industry standards and much higher than expected for default plans, and opt-out rates were low for all plans. Table 1-1 shows the number of offers made to customers for each pricing plan, the number of customers who accepted each offer and enrollment at various points during the two year pilot. Figures 1-1 and 1-2 show the acceptance and attrition rates for each pricing plan.

As seen in Figure 1-1, acceptance rates across the four opt-in treatment groups were between 16% and 19%, which is quite high when compared with most other utility rate programs and pilots (especially considering that all recruitment was done over roughly an 8 month period, not over multiple years). Differences in acceptance rates across the four pricing plans are small. The offer of an IHD has no apparent influence on acceptance rates for CPP plans and only a slight impact for TOU plans.[1] Acceptance rates for CPP plans are slightly higher than for TOU plans and the difference for the CPP and TOU plans that did not include the offer of an IHD was statistically significant at the 95% confidence

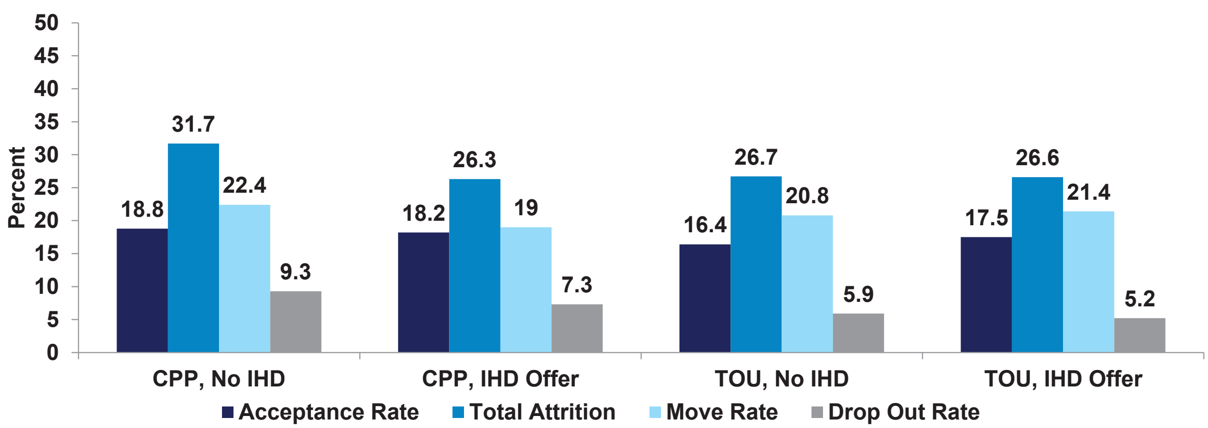
[1] The difference in acceptance rates between the TOU plan with and without the IHD offer is statistically significant at the 95% confidence level. However, when choice models were estimated that included other explanatory variables, the offer of an IHD was not statistically significant.

level. However, customers were not given a choice of multiple time-variant pricing plans, so this difference should not be interpreted as a preference for one plan over the other. Indeed, the conjoint survey that was done included choice exercises where both pricing plans were offered simultaneously. Results from this survey show that, when given a choice of both plans, customers prefer TOU to CPP by a factor of roughly 2 to 1.

Table 1-1: Offers Made and Customers Enrolled by Pricing Plan

Recruitment Approach	Rate	IHD Offer	# of Offers Made	# of Customers Accepting	# of Customers Enrolled on Date		
					6/1/12	6/1/13	9/30/13
Opt-in	CPP	No	1,187	223	212	161	147
		Yes	9,060	1,651	1,569	1,265	1,172
	TOU	No	7,500	1,229	1,157	941	877
		Yes	12,554	2,199	2,092	1,664	1,554
Default	CPP	Yes	846	701	701	566	536
	TOU	Yes	2,410	208	2,018	1,628	1,508
	TOU-CPP	Yes	729	588	588	465	431

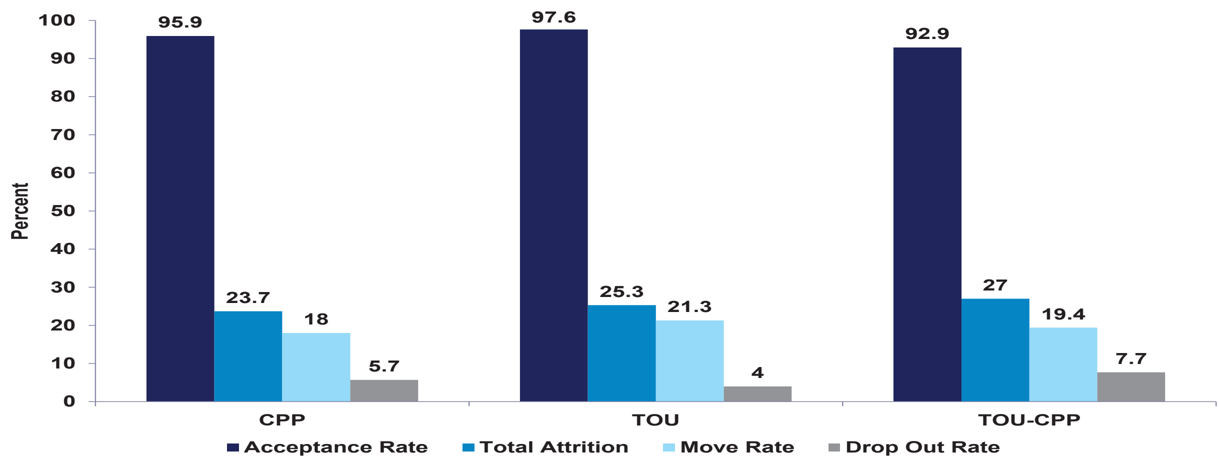
Figure 1-1: Customer Acceptance and Attrition for Opt-in Pricing Plans



The attrition, move rates and dropout rates shown in the figure cover the period from June 1, 2012 to September 30, 2013. Total attrition ranged from roughly 21% to 27%. However, the majority of this attrition was due to customers moving. Dropout rates represent the percent of customers who actively de-enrolled over the two summers and range from a low of 5.2% for the TOU plan that included an IHD offer to a high of 9.3% for the CPP plan with no IHD offer.

Figure 1-2 summarizes the acceptance and attrition rates for the default pricing plans. The acceptance rate equals the percent of customers who were notified that they would be placed on the new pricing plan and who did not notify SMUD that they wished to opt-out prior to being placed on the plan. As seen, only roughly 3% to 7% of customers chose not to go on the new pricing plan. This acceptance rate was much higher than the 50% rate that SMUD had planned for. Over the next two summers, an additional 4% to 8% of enrolled customers dropped out, and between 18% and 22% moved. The dropout rates for opt-in plans were actually higher than for the default plans. This likely reflects a lower level of awareness and engagement by default customers compared with opt-in customers, as evidenced by findings from the end-of-pilot survey reported later.

Figure 1-2: Customer Acceptance and Attrition for Default Pricing Plans



Choice models were estimated to determine whether opt-in and opt-out rates were correlated with customer characteristics. The primary variables examined were participation in other SMUD programs, the magnitude of the reduction in customers' bills from going on the rate without changing usage (e.g., the magnitude of the "structural win" from going on the rate) and participation in SMUD's low income tariff, known as the Energy Assistance Program Rate (EAPR). In general, opt-in rates were higher and dropout rates were lower for EAPR customers, structural winners and customers enrolled in other SMUD programs for most pricing plans.

1.2 Load Impacts

Table 1-2 summarizes the average peak-period load reductions across the two summers for each pricing plan. The first three numerical columns show the impacts averaged across the 23 days on which critical peak prices were in effect. Values for CPP days are shown for both CPP and TOU pricing plans so that an apples-to-apples comparison can be made for those two rate options under the same set of weather conditions. The last three columns in the table show the peak period load reductions across the average weekday for both summers for the TOU pricing plans. These values include impacts on days when events were and were not called for the CPP pricing plans.

Table 1-2: Peak Period Load Reductions for All Pricing Plans

Group	CPP Day Impacts			Average Weekday Impacts		
	Impact	Reference Load	% Impact	Impact	Reference Load	% Impact
Opt in TOU, IHD Offer	0.32	2.38	13.3%	0.21	1.79	11.9%
Opt in TOU, No IHD Offer	0.23	2.24	10.1%	0.16	1.72	9.4%
Opt-in CPP, IHD Offer	0.64	2.53	25.1%	n/a	n/a	n/a
Opt-in CPP, No IHD Offer	0.49	2.33	20.9%	n/a	n/a	n/a
Default TOU, IHD Offer	0.15	2.47	5.9%	0.11	1.86	5.8%
Default CPP, IHD Offer	0.36	2.56	14.0%	n/a	n/a	n/a
Default TOU-CPP, IHD Offer	0.31	2.54	12.3%	0.17	1.91	8.7%

A key conclusion is that the absolute and percent impacts per customer are roughly half as large for default plans compared with the same opt-in pricing plans. Another key conclusion is that, under CPP event-day weather conditions, average load reductions for CPP pricing plans are roughly twice as large as for TOU pricing plans. Importantly, the fact that average impacts are roughly half as much under default plans compared with opt-in plans does not mean that aggregate impacts would be smaller under default plans. Indeed, quite the opposite is true. When the differential enrollment rates are factored into the equation, default plans offered to the same population of customers as opt-in plans are likely to produce much higher aggregate load reductions. For example, the aggregate load reduction in the initial summer of an opt-in CPP pricing plan that included the offer of an IHD would equal 11.6 MW if offered to 100,000 customers.[2] The same plan offered on a default basis would produce 34.5 MW of load reduction, nearly three times more than for the opt-in plan. Similarly, if the TOU plan with an IHD offer was marketed to 100,000 customers on an opt-in basis, the load reduction on the average weekday would be 3.7 MW (and 14.7 MW on the average CPP day). When offered on a default basis, the estimated load reduction is 10.8 MW, once again roughly three times as large as for the opt-in plan.

Other key findings from the load impact analysis include the following:

- For 6 of the 8 pricing plans, average load reductions per customer were not statistically significantly different across the two summers – that is, load impacts persisted over two years – after controlling for movers. For the opt-in TOU plan with the IHD offer, impacts fell from 0.26 kW in the first summer to 0.20 kW in the second and this difference was statistically significant. For the default CPP pricing plan, impacts increased from 0.31 kW to 0.42 kW, and this difference was statistically significant.
- For default TOU pricing plans, EAPR and non-EAPR customers produced very similar absolute and percent reductions. For default CPP and for all opt-in pricing plans, average load reductions for EAPR customers were less than for non-EAPR customers.
- Absolute load reductions increase by as much as a factor of 10 across customers segmented into quartiles based on summer usage. This suggests that any opt-in program will likely be much more cost-effective if focuses its marketing resources primarily on large users.

[2] 11.6 MW = (100,000x.18.2x.64kW)/1,000

- Energy savings were small or statistically insignificant for all pricing plans. Three pricing plans showed statistically significant energy savings across the summer. Savings for the default TOU plan equaled 1.3%, for the opt-in CPP plan (with IHD offer) savings equaled 3.5% and for the default CPP plan, savings equaled 2.6%.
- A structural economic model of demand was estimated so that load impacts could be predicted for prices other than those tested in the SPO. The estimated price elasticities were comparable to those found through other pricing pilots, including California's Statewide Pricing Pilot.[3] Based on the estimated demand model, increasing critical peak prices by roughly 60% over SPO price levels (from $0.75/kWh to $1.20/kWh) would increase the percent load reduction during the peak period by roughly 20% for both opt-in and default CPP pricing plans. For TOU pricing plans, a 55% increase in peak period prices, all other things equal, would increase the percent load reduction by 30 to 40%.

1.3 The Influence of IHDs

The SPO was designed to assess the impact of the offer of an IHD on customer acceptance of opt-in pricing plans. As discussed above, the offer of an IHD did not have a material impact on acceptance rates.

Another useful investigation concerns the acceptance of and connection rates for IHDs among treatment groups that received an IHD offer. What percent of customers who received an IHD offer accepted it and what percent of those customers receiving an IHD connected the device with their meter?

Two of the opt-in treatment groups were offered a free IHD if they enrolled on the rate. Acceptance of the IHD was not a condition of going on the pricing plan. Opt-in customers could indicate at the time of enrollment whether or not they wanted an IHD. If they did, the IHD was mailed to them pre-commissioned, so that when they unpacked it and turned it on, it was supposed to automatically connect with their meter and start displaying information. All customers in the default treatment groups were offered a free IHD. Because customers were automatically enrolled unless they opted-out, there was not the same opportunity to simply "check a box" at the time of enrollment to indicate whether or not they wanted an IHD. Instead, those who wanted an IHD had to take a proactive step to request it

In summer 2012, SMUD was able to determine from the meter data management system the number of IHD devices that were connected to meters at any point in time but was not able to link those devices to individual customer accounts. However, in summer 2013, data became available that provided a daily log for each customer indicating whether or not their IHD was connected to the customer's meter.[4] As such, for the second year of the pilot, it was possible to identify customers who had their IHDs

[3] Stephen S. George and Ahmad Faruqui, *Impact Evaluation of California's Statewide Pricing Pilot*. Final Report, March 16, 2005.

[4] Reporting functionality from the HAN Communication Manager (HCM) had not been established prior to the launch of the technology and took approximately a year after go-live to established automated reporting out of HCM. However, it should be noted that the functionality was available in HCM, but SMUD had not created business requirements to set-up that functionality before the program launch, primarily because reporting on IHD connectivity had not been part of the critical path for program launch or reporting to the DOE.

connected during the entire summer, those who never had it connected during summer 2013, and those who were connected on some days and not others.

For each treatment group, Table 1-3 shows the number of customers who requested an IHD at the beginning of the pilot, the IHD acceptance rate (the number accepting divided by the number offered), the number of customers who accepted the IHD that were still enrolled at the beginning of the summer period in 2013 and, of those, the percent that had their device connected with their meter during the entire summer, the percent that were connected at some point in time during summer 2013 and the percent that were never connected in 2013. As seen in the table, roughly 96% of opt-in customers requested an IHD whereas fewer than 25% of default customers did so.

Table 1-3: IHD Acceptance and Connection Rates

Group	Enrolled 6/1/12	# That Accept IHD	Acceptance Rate	# of Customers With IHDs Still Enrolled as of 6/1/13	% Connected All the Time	% Connected Some of the Time	% Never Connected
Opt-in CPP, IHD Offer	1,569	1,498	95%	1,195	11.6%	27.4%	61.0%
Opt-in TOU, IHD Offer	2,092	2,017	96%	1,597	11.6%	22.8%	65.6%
Default TOU-CPP, IHD Offer	588	136	23%	112	18.8%	39.3%	42.0%
Default CPP, IHD Offer	701	167	24%	140	14.3%	42.9%	42.9%
Default TOU, IHD Offer	2,018	418	21%	363	18.2%	23.1%	58.7%

As seen in the last three columns in the table, roughly two thirds of opt-in customers who accepted the IHD and who were still enrolled at the beginning of the 2013 summer never had their device connected in 2013. This "never connected rate" was much lower for two of the three default groups, equal to roughly 42% for the default TOU-CPP and CPP groups. The higher connection rate for default customers compared with opt-in customers is consistent with a hypothesis that, since default customers had to take a proactive step to request the device compared with the passive "check the box" approach for opt-in customers, they were more invested in using the device once it arrived. Why the "never connected rate" for default TOU customers is closer to that of opt-in customers than it is to that of the other default groups is unclear.

The SPO was not designed to assess the impact of an IHD on demand response. However, careful observers will note in Table 1-2 that load impacts for opt-in treatments that include an IHD offer are larger than for those that don't include an IHD offer. However, it is not appropriate to attribute these differences to the offer or use of the IHD. After correcting for pre-treatment differences across treatment groups, the load impact differences are not statistically significant. Put another way, there is no evidence from the SPO indicating that IHDs significantly increase load impacts associated with time-variant pricing plans.

1.4 The Impact of Rate Attributes on Customer Acceptance

A conjoint survey was conducted to assess the impact of changes in rate attributes on customer acceptance. A conjoint survey asks respondents to select their preferred choice from among several options that vary according to selected attributes, such as peak to off-peak price ratios, the length and number of rate periods, the number of event days for CPP plans, and others. Because most rate plans implemented by utilities are revenue neutral for the average customer, when selected attributes were changed across options, prices also changed. For example, as the length of the peak period increased, the average peak period price fell since the avoided capacity costs underlying peak period prices are spread over more hours.

In order to avoid survey fatigue and so as not to influence customer behavior, the conjoint survey was not administered to SPO treatment customers. Rather, it was administered to SPO control group customers, to those who were ineligible for the SPO because they were participants in SMUD's balanced billing or direct load control programs, and to customers who were eligible for the SPO but were not included in the study. These groups were segmented and analyzed separately. 1,142 surveys were completed and the survey response rate was almost 40%. Each respondent was given 9 groups of 3 choices, for a total of 27 observations per respondent that could be used for analysis purposes. Key findings from the survey included the following:

- Acceptance rates fall as the length of the peak period increases. The percent of customers who opt-in falls by 25% to 50% as the peak period length goes from 3 to 6 hours.
- Acceptance rates are essentially the same for pricing plans that are based on 6 and 12 event days, but increasing the number of events days beyond 12 decreases acceptance rates.
- Increasing the peak-to-off-peak price ratio has only a modest impact on acceptance rates for TOU plans but has a stronger, negative impact on acceptance rates for CPP plans.
- Respondents prefer time-variant rates that do not also have a tiered structure in which prices increase as usage increases.
- Customers prefer TOU plans over CPP plans by a factor of nearly 2 to 1.
- Almost 60% of respondents said they preferred some type of time-variant rate over the standard tiered rate.
- Almost 30% of respondents would take any time-variant rate over the standard rate and another 30% would choose one time-variant option over the standard rate but not another.

1.5 Cost Effectiveness Analysis

The cost-effectiveness of each of the 7 pricing plans tested in the SPO was estimated based on the assumption that the plans were offered to SMUD's entire residential population (about 540,00 customers) and the two-year average enrollment rates and load impacts found in the SPO were observed for this larger population. Recruitment, notification and other variable costs from the SPO were used and startup and other costs were adjusted where appropriate to reflect changes that might be needed to support a larger scale operation. The primary benefit included in the analysis was avoided capacity costs resulting from lower peak period usage. Estimates were also developed for three non-SPO scenarios in which customers were defaulted onto the CPP, TOU or TOU-CPP rates but without the offer of an IHD. Given the fact that there were no measurable incremental load reductions associated with an IHD for opt-in treatments, we assumed that enrollment rates and load reductions would be the same with and without the IHD offer. The present value of net benefits was calculated over a 10 year period.

Table 1-4 shows the NPV of benefits, costs and net benefits over a ten year period for each pricing plan. It also shows the benefit-cost ratio for each plan, based on the inputs and methods described above. The values in the table are for overall cost-effectiveness, which includes both start-up and ongoing costs, and addresses the policy question of which plan would be most cost effective if it were to be implemented from scratch. Marginal cost effectiveness estimates, which address the question of whether it is cost effective to continue to enroll more customers onto a plan once it is up and running, are discussed in Section 10.

As seen in the table, all but one of the pricing plans, opt-in TOU with an IHD offer, are cost effective, but the magnitude of net benefits vary by almost a factor of 60 between the plans with the lowest and highest positive net benefits. Of the 7 pricing plans tested in the SPO, if they were to be extended to SMUD's entire residential population, the net benefits over 10 years would range from a low of roughly -$5.5 million for the opt-in TOU plan with the IHD offer to more than $86 million for the default TOU-CPP plan with an IHD offer. Default plans are significantly more cost effective than opt-in plans and pricing plans that include the offer of an IHD are all much less cost effective than the equivalent plan that does not offer an IHD. For simulated default plans without an IHD offer, the TOU plan has the lowest net benefits but still exceeds $50 million. The TOU-CPP plan is estimated to deliver net benefits that are more than twice as large as the TOU plan. In general, all CPP plans deliver net benefits that are roughly twice as large as the equivalent TOU plan.

Table 1-4: NPV of Benefits and Costs by Pricing Plan ($ millions)

Scenario Type	Scenario	Benefit/Cost Ratio	10 Year NPV for SMUD Territory		
			Benefits	Costs	Net Benefits
Opt-in Tested	TOU, No IHD Offer	1.19	$12.1	$10.2	$2.0
	TOU, IHD Offer	0.74	$15.5	$21.0	-$5.5
	CPP, No IHD Offer	2.05	$29.7	$14.4	$15.2
	CPP, IHD Offer	1.30	$34.3	$26.3	$7.9
Default Tested	TOU, IHD Offer	2.04	$66.9	$32.8	$34.1
	CPP, IHD Offer	2.22	$142.1	$63.9	$78.2
	TOU-CPP, IHD Offer	2.49	$144.8	$58.1	$86.7
Default Simulated	TOU, no IHD Offer	4.48	$66.9	$15.0	$52.0
	CPP, no IHD Offer	4.28	$142.1	$33.2	$109.0
	TOU-CPP, no IHD Offer	4.53	$144.8	$32.0	$112.9

1.6 End-of-Pilot Survey Summary

A survey was conducted in the fall of 2013, after the end of the second summer period, to obtain input among pilot participants on the following topics:

- Customer satisfaction with SMUD and with the pricing plan customers were on;
- Awareness of the attributes of each pricing plan;
- Perceptions about the pricing plan;
- Reasons for staying on the pricing plan;
- Awareness of events for the CPP pricing plans; and
- IHD use.

The survey was sent to all customers who were enrolled on a pricing plan (including those who actively dropped out but not those who moved) as well as a sample of control group and deferred customers. The survey was conducted using both online and hard copy questionnaires. The overall response rate was 40%. Key survey findings include the following:

- Satisfaction ratings for respondents in all treatment cells, including the deferred treatment cell, were equal to or greater than satisfaction levels in the control group. Put another way, defaulting customers onto time-variant rates or using recruit and delay research methods in some cases did not negatively impact satisfaction with SMUD services.
- Customers on time variant pricing plans, including default plans, report greater agreement with the statement, “My current pricing plan is easy to understand” than do customers on the standard rate. Opt-in customers showed greater actual (not perceived) understanding of rate attributes than did customers on the standard rate and default customers showed about the same level of understanding as customers on the standard rate.
- Significantly more customers on time-variant pricing plans agreed with the statement, “My current pricing plan provides me with opportunities to save money” than did customers on the standard rate. More time-variant pricing plan customers also felt that their pricing plan was fair than did customers on the standard rate.
- Roughly 40% of customers on default time-variant pricing plans and about 57% of those on opt-in plans strongly or somewhat agreed with the statement, “My current pricing plan is better than my old pricing plan” and roughly half of all default respondents and three quarters of opt-in respondents strongly or somewhat agreed with the statement, “I want to stay on my pricing plan.”
- Almost half of default and roughly two thirds of opt-in respondents strongly or somewhat agreed with the statement, “I think the Sacramento community would be better off if everybody was on my pricing plan.”
- Almost 60% of default and 80% of opt-in respondents strongly or somewhat agreed with the statement, “I believe that I did something good for Sacramento by participating in my pricing plan.”

2 Introduction and Pilot Overview

SMUD is located in California's Central Valley where hot summer temperatures and a very high saturation of air conditioning equipment result in peak load requirements concentrated over a relatively short number of hours. SMUD has approximately 540,000 residential customers and a peak load of roughly 3,000 MW. The top 42 hours of system load each year account for approximately 400 MW of incremental load on the system.

The primary objective of SPO is to investigate the effectiveness of AMI-enabled, time-variant pricing and enhanced information to induce behavior change in electricity consumers. Of particular interest is reduction in peak-period electricity use. By implementing time-variant pricing, SMUD seeks to:

- Provide a clear high price signal to consumers during SMUD's summer peak period;
- Encourage customers to shift loads by lowering prices during non-peak periods; and
- Assure that customers who choose not to shift, or cannot shift load, are not penalized with bills that are significantly higher than they would be on SMUD's otherwise applicable rate.

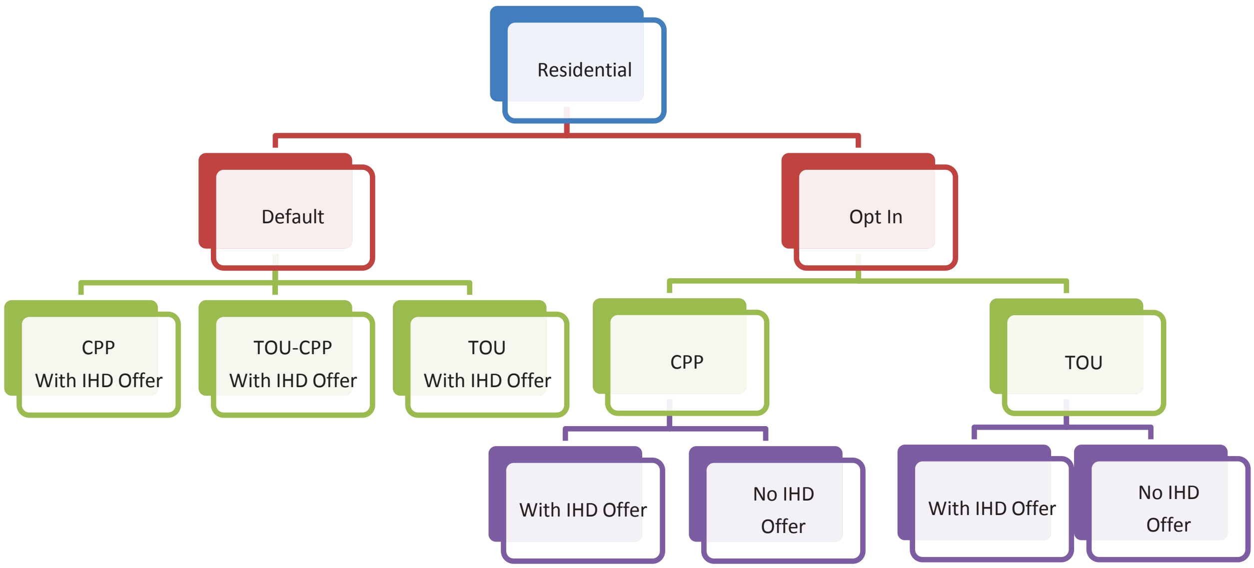
SMUD's SPO is 1 of 11 Consumer Behavior Studies funded by the U.S. Department of Energy (DOE) in an effort to assess customers' response to time-variant rates and increased access to information about electricity consumption. SPO is also one of the major components of SMUD's SmartSacramento®[5] project. The SmartSacramento smart grid project embodies SMUD's public spirit and mission to empower its customers with solutions and options that increase energy efficiency, protect the environment, reduce global warming and lower the cost to serve. When completed, SMUD's comprehensive smart grid will be a customer-centric system designed to enable informed participation by customers as well as the creation of new customer services and solutions. In addition, the project will improve the reliability and efficiency of utility operations, facilitate integration of distributed and intermittent forms of clean and renewable energy, and optimize asset utilization along the entire energy chain—from electricity generation to air conditioning units in customers' homes.

Figure 2-1 summarizes the key features of the SPO pilot, which include:

- Three rate options: time-of-use (TOU), critical peak pricing (CPP) and a TOU-CPP combination;
- Two recruitment strategies: opt-in and default (or opt-out);
- One technology offer: an In Home Display (IHD) that streams usage information to consumers in real time; and
- Three different experimental designs: randomized encouragement design (RED), randomized control trial (RCT) and within-subjects.

[5] A registered service mark of the Sacramento Municipal Utility District.

Figure 2-1: Overview of SPO Treatments



2.1 Pricing Plans

The SMUD Board of Directors approved SPO in August 2011. SPO pricing plans are applicable during the summer months of June through September. Participants revert to their otherwise applicable pricing plan schedule during non-summer months. Participating customers were first placed on the SPO pricing plans on June 1, 2012 and the pilot was scheduled to end on September 30, 2013. Given the success of the pilot and the additional learnings that can be obtained by allowing pilot participants to stay on the SPO pricing plans, SMUD has decided to allow them to do so for at least another year.

The three rate options offered through the SPO pilot include:

- **TOU Rate Option:** Participants were charged an on-peak price of \$0.27/kWh between the hours of 4 PM and 7 PM on weekdays, excluding holidays. For all other hours, participants were charged \$0.0846/kWh for the first 700 kWh in each billing period, with any additional usage billed at \$0.1660/kWh.
- **CPP Rate Option:** Participants were charged a price of \$0.75/kWh during CPP event hours, when temperatures and SMUD's system loads are expected to be unusually high. This rate option was designed under the assumption that 12 CPP events would be called each year, between the hours of 4 PM and 7 PM on weekdays, excluding holidays. Customers were notified 24 hours in advance of an event day. For all other hours, participants were charged \$0.0851/kWh for the first 700 kWh in each billing period, with any additional usage billed at \$0.1665/kWh.
- **TOU-CPP Rate Option:** The third and final SPO rate combines the pricing structures of the TOU and CPP rate options. The TOU-CPP off-peak electricity rate was \$0.0721/kWh for the first 700 kWh in each billing period, with any additional off-peak usage billed at \$0.1411/kWh. Participants were charged an on-peak price of \$0.27/kWh between the hours of 4 PM and 7 PM on weekdays, excluding holidays. A CPP price of \$0.75/kWh was charged to participants between the hours of 4 PM and 7 PM on CPP event days, which were planned to be called 12

times during the summer months. The 12 days are the same as those called for the CPP-only rate.

For all three SPO rate options, customers with domestic wells we given a base usage of 1,000 kWh per billing period (rather than 700 kWh). In addition, customers who were on the Energy Assistance Program Rate (EAPR) received about a 30% discount on the price they paid for all SPO rates, depending on how much energy they used. Table 2-1 summarizes the prices that were in effect by rate period during the two summers. Only the standard rate changed in 2013. All SPO pricing plans had the same prices in both summers.

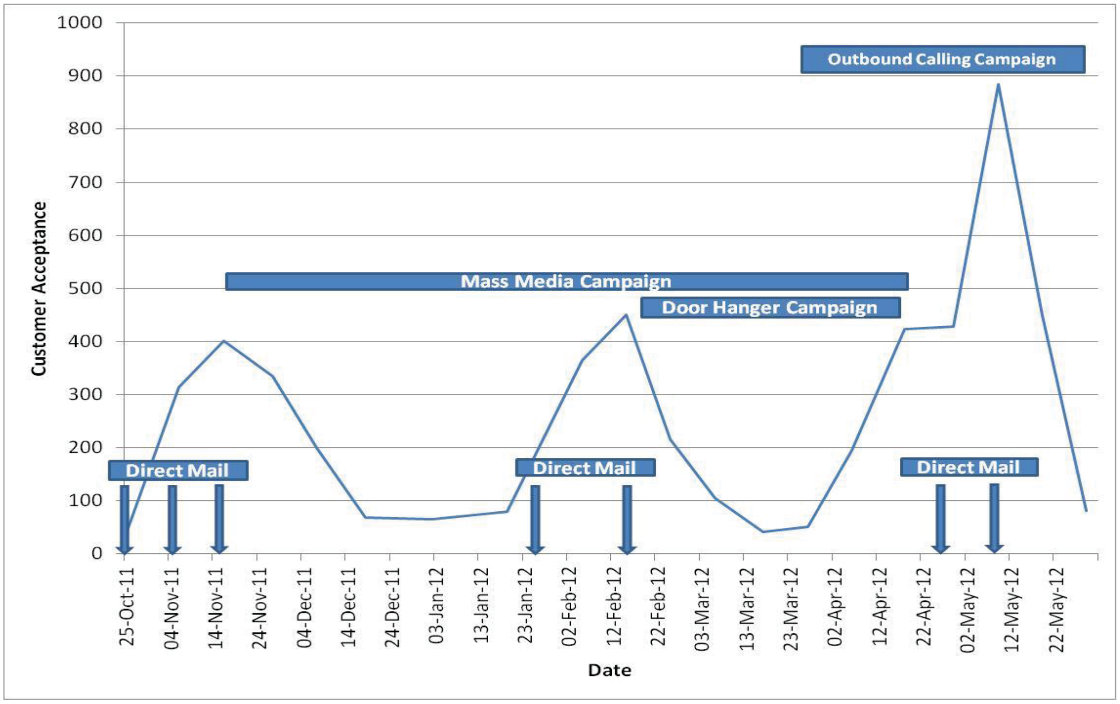
Table 2-1: Electricity Prices by Rate Period and Tariff

Category	Rate	Fixed Charge	Critical Peak	On-peak	Off-peak Base	Off-peak Base Plus	Off-peak Non-discounted Base Plus
2012							
Regular Pricing	Standard	$10.00	–	–	$0.1016	$0.1830	–
	EAPR	$3.50	–	–	$0.0660	$0.1281	$0.1830
SPO Pricing Standard	TOU	$10.00	–	$0.27	$0.0846	$0.1660	–
	CPP	$10.00	$0.75	–	$0.0851	$0.1660	–
	TOU-CPP	$10.00	$0.75	$0.27	$0.0721	$0.1411	–
SPO Pricing EAPR	TOU	$3.50	–	$0.20	$0.0550	$0.1162	$0.1660
	CPP	$3.50	$0.50	–	$0.0553	$0.1165	$0.1665
	TOU-CPP	$3.50	$0.50	$0.20	$0.0468	$0.0987	$0.1411
2013							
Regular Pricing	Standard	$14.00	--	--	$0.0955	$0.1771	--
	EAPR	$5.50	--	--	$0.05921	$0.109802	$0.1803
SPO Pricing	Same as in 2012						

2.2 Marketing and Recruitment Strategies

In the SPO pilot, SMUD examined two recruitment strategies: opt-in and default enrollment.
Each customer chosen for inclusion in the pilot was randomly assigned to a treatment group and was then recruited for that specific rate/IHD offer/recruitment combination. Under the opt-in strategy, participants were invited to enroll in the pricing plan specific to their treatment group. Customers were solicited through a multi-faceted marketing campaign summarized in Figure 2-2.

Figure 2-2: Recruitment Timeline for Opt-in Treatment Cells



For opt-in treatments, the first direct mail solicitation occurred in October 2011. A second letter was sent in January to customers who had not yet enrolled. Because of concerns that some treatment cells might not reach their target enrollment rates through direct mail solicitation alone, starting in March 2012, SMUD implemented a door hanger and outbound calling campaign, which continued into May. Through these various efforts, SMUD exceeded target enrollment for all opt-in treatments prior to June 1, 2012, when customers were placed on the new rate.[6]

For default treatments, customers were placed on either the TOU, CPP or TOU-CPP pricing plan and were told to contact SMUD if they did not wish to participate. Customers were initially notified of the impending change in their pricing plan in early April 2012 and a follow-up notification occurred in early May. Welcome packets were sent to all customers on May 29, just prior to the new rates going into effect. SMUD had based the design and sampling for the SPO on the assumption that half of all default customers would drop out prior to going on the rate. In reality, the opt-out rate prior to June 1 when the default rates went into effect ranged from 3% to 7%.

The two opt-in TOU treatment groups utilized a *recruit and delay* RCT design. Two randomly selected groups of customers were chosen and recruited in the same manner. One group of volunteers was placed on the new rate on June 1 and the other group was told that their rate change would be deferred until summer 2014. The purpose of the deferred enrollment is to create a control group for each treatment group that allows for self-selection but avoids selection bias in the estimated impacts.

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6 A very small number of customers were enrolled after June 1.

Prior to soliciting participants, SMUD spent a significant amount of time and money understanding how to communicate the benefits of, and address concerns about, time-variant pricing programs and how to manage potential dissatisfaction stemming from the fact that some volunteers in selected opt-in treatment cells would have enrollment deferred for two years. From February through August 2011, SMUD conducted 25 focus groups and 4 surveys involving more than 2,000 customers to solicit input on marketing messages, naming conventions and other communication issues as input to development of the marketing and education plan.

Based in part on the above research, SMUD used the following names for the three pricing plans tested in the SPO:

- **Summer Weekday Value Plan** for the opt-in and default TOU treatments;
- **Off-peak Discount Plan** for the opt-in and default CPP treatments; and
- **Optimum Off-peak Plan** for the combination TOU-CPP treatment, which was implemented as a default rate only.

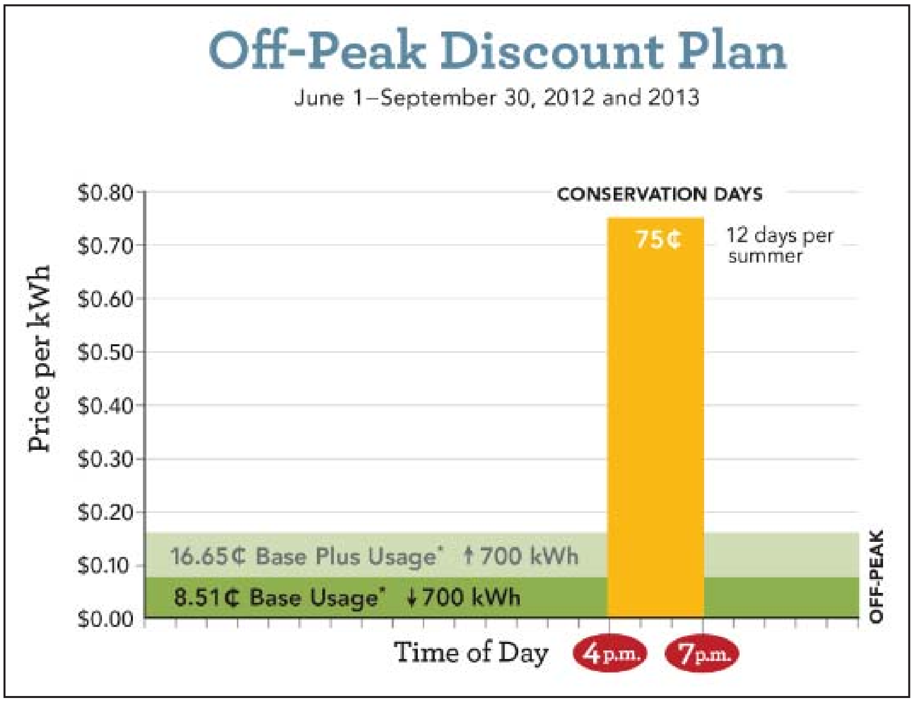
The primary messages and content used the initial solicitation letters included the following:

- The lead marketing message was that customers get a discount off the standard price during non-peak hours, which is most of the time (the amount of time varies across the three rates). The secondary message was that prices are higher for relatively few hours (e.g., only 1% of the time for the CPP rate).
- The primary message concerned "saving money on your summer electricity bills." Secondary messages included taking control and helping the environment.
- Using less electricity during peak hours, shifting usage to before 4 PM or after 7 PM and/or reducing use overall will save money.
- Additional perks include a free countertop electricity use display (for those treatment cells where IHDs are offered), access to an informational graph on My Account that shows hourly and daily usage, access to a website with energy saving tips, and discounts on activities, like movie tickets and water parks that can make using less electricity during peak hours easy and fun.

Many of these same themes were elaborated on in color brochures that were included with the solicitation letter. The cover letter itself did not provide any information about the actual prices but the brochure provided this information in the form of a graphical display. An example of the graph for the CPP Off-peak Discount Plan treatment is shown in Figure 2-3. Examples of selected marketing materials used for customer recruitment can be found in Appendix D of the interim SPO evaluation report submitted to DOE on.[7]

[7] See *SmartPricing Options Interim Evaluation*. Prepared for U.S. Department of Energy, Lawrence Berkeley National Laboratory. October 23, 2013. This report will hereafter be referenced in this document as the SPO Interim Evaluation.

Figure 2-3: Graphical Display of Off-peak Discount Plan Pricing



To help maintain the internal validity of the experiment, SMUD focused significant effort and attention on maintaining consistency in communication and educational content across treatment cells. Keeping messages and content as consistent as possible across treatment cells helps to ensure that differences in enrollment rates and electricity use across rate options and other treatment conditions are due to differences in the treatments themselves and not due to differences in messaging or communication. For example, the only differences in the initial letter sent to customers in the opt-in and default CPP treatment cells are summarized below.

The opening line in the opt-in and default letters is, respectively:

- Sign up today and you could save on your electric bills next summer!
- You're now on a new pricing plan that can help you save on your summer electricity bills!

The next sentence in the two letters, respectively, is as follows:

- You are invited to participate in a two-year SmartPricing Options pilot that can help you manage your energy bills.
- You're among the first SMUD customers to be randomly selected for a two-year SmartPricing Options pilot that can help you better manage your energy use during the summers of 2012 and 2013.

The final paragraph in the default letter indicates that customers who do not want to stay on the new plan can opt out by calling SMUD. Specifically, the letter says:

- If you would like to remain on your standard rate plan, call 1-855-736-7655. However, should you decide not to participate, you won't be able to enroll later and you will miss out on the cost savings and energy management benefits.

The final difference between the opt-in and default treatments concerned the IHD offer. The IHD was offered to some opt-in customers and not others and was offered to all default customers. Opt-in customers receiving the IHD offer could indicate their interest at the time of enrollment and nearly all customers said they would like to receive the IHD. Default customers needed to be more proactive since an enrollment transaction was not needed for the rate itself.

2.3 In Home Displays

As indicated above, IHDs were offered to selected opt-in treatment groups and to all default treatment groups. Figure 2-4 shows the IHD used in the SPO pilot. The purpose of the IHD offer was to examine its effect on customer acceptance and retention rates, program satisfaction and, where possible, electricity use.[8] For default customers, all of whom were offered an IHD, the intent was also to ensure that these customers were given tools to help them manage their energy use. Customers did not need to accept the IHD in order to participate in the pricing plan. The IHDs were preset to communicate with each customer's meter when they were turned on and were sent to customers through the mail.

Figure 2-4: In Home Display Used in SPO Pilot

Customers in the opt-in treatment cells were asked to indicate at the time of enrollment whether or not they wished to receive an IHD and almost everyone indicated they would. Customers in the default treatment cells were also asked to indicate their interest in receiving the IHD. However, default customers had to be more proactive than opt-in customers since they couldn't indicate their interest at the time of enrollment (because default customers didn't have to enroll). As a result, between 20% and 25% of default customers asked for and received an IHD.

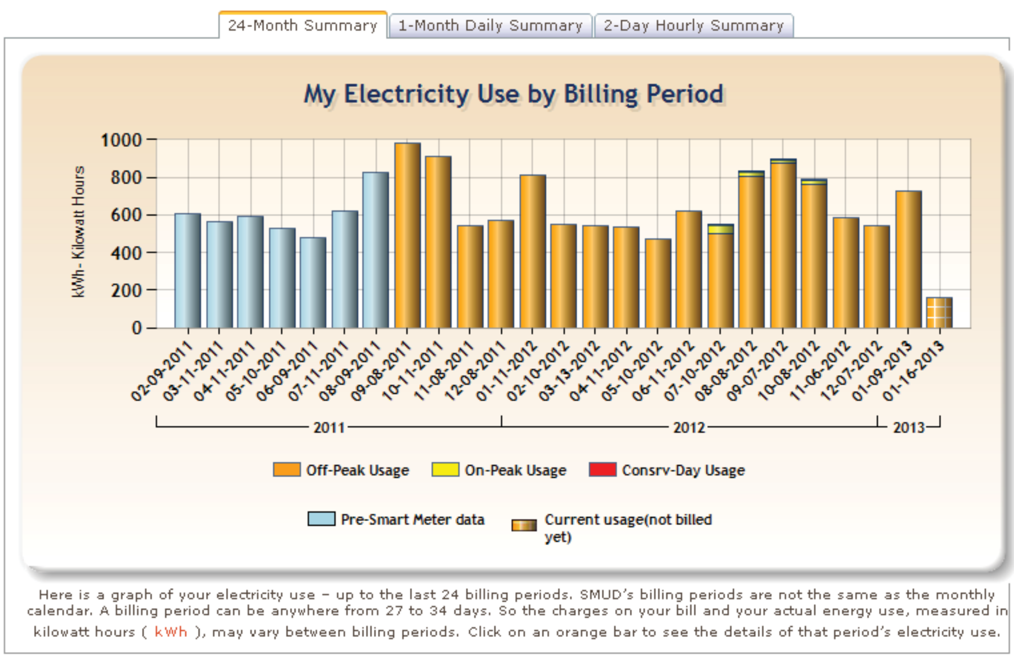
8 As discussed in Section 1 and at greater length in subsequent sections, the SPO was designed to assess the impact of an IHD **offer** on electricity use, which is different from assessing the impact of an IHD on energy use.

Not all customers who received and successfully connected the IHD to their meter. In 2012, it was not possible to track IHD connection rates to individual customer accounts but this functionality became available in 2013. This allowed for a determination of the percent of customers who received an IHD in 2012 that were connected all, some or none of the time during summer 2013. Roughly one third of opt-in customers were connected at least some of the time in 2013 and between 40% and 60% of default customers that had requested an IHD were connected at least some of the time in 2013. When combined with the percent of all default customers who requested an IHD, roughly 10% to 15% of all default customers had their IHD connected at least some of the time.

2.4 Web Portal Information

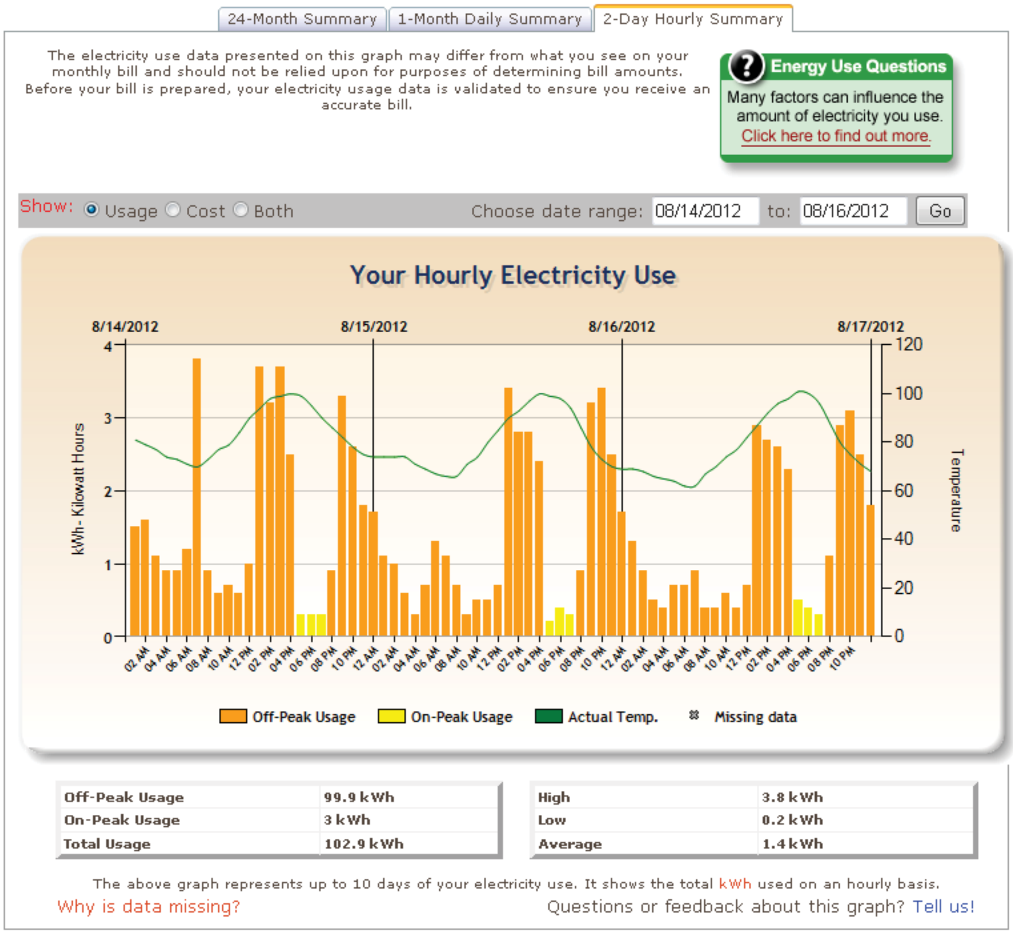
In addition to information provided in real-time through an IHD offered to some treatment groups, all pilot participants could access information about their usage profile through a web portal. Figures 2-5 and 2-6 show the landing page and the more detailed hourly information that are accessible to all pilot participants, respectively.

Figure 2-5: SPO Web Portal Landing Page on My Account[9]



[9] All SMUD residential customers have access to interval data through My Account. Data for customers on time-variant rates is formatted differently to show usage by rate period.

Figure 2-6: Hourly Usage Page for SPO Participants



2.5 Terminology

When evaluating the impact of a pricing pilot, it is important to precisely define the variables of interest. Too often, terminology can be misleading as the same term can mean different things to different people. For example, when examining marketing effectiveness, one could compare the enrollment rate at a point in time (say, on June 1 in this instance, when all customers were placed on the new rate) with the number of customers solicited. However, this ratio would under report marketing effectiveness because some customers may have moved, and therefore become ineligible for the new rate, between the time they responded affirmatively to the marketing solicitation and the time when the new rates went into effect. Similarly, someone might compare enrollment on a rate at the beginning and end of the summers and conclude (incorrectly), for example, that 10% of customers left the new rate because they didn't like it. In reality, many of those customers who left may have done so because they moved, not because they no longer wanted to be on the rate. These examples indicate why it's important to precisely define the impact measures that are reported so that reviewers do not misinterpret their meaning. Below, we define the key output variables that are reported in subsequent sections. A few additional definitions of terms are contained in the glossary in Appendix A.

- **Enrolled Customers**: Enrolled customers are customers who are on a new pricing plan at a given point in time. For opt-in rates, this group consists of customers who accepted the marketing offer, were assigned to the treatment group (rather than the control group), did not change their mind or move prior to the plan going into effect, and are still on the plan (e.g., have not dropped out or moved) at the time that the enrollment snap shot is taken. For default enrollment, enrolled customers at a point in time are customers who did not opt-out prior to or after going on the pricing plan, or did not move or leave the plan for any reason between when they were initially enrolled and when the enrollment is reported.
- **Enrollment Rate:** The enrollment rate consists of all customers who were ever actually on an SPO pricing plan for some period of time (meaning they enrolled at some point in time and did not de-enroll, opt-out or move before June 1, 2012) divided by the number of customers who were offered the plan. This is different from the customer acceptance rate, as defined below.
- **Customer Acceptance Rate:** The customer acceptance rate consists of all customers who agreed to go on a new pricing plan divided by the number of customers who were offered the plan. This value will typically be larger than the enrollment rate (and can't be less than it) as it includes everyone who signed up for a pricing plan even if they never went on the new plan.
    - For opt-in treatments, the *numerator* in the customer acceptance rate includes all customers who agreed to go on the pricing plan but who may have never done so because, for example, they moved before the plan went into effect. It would also include customers who went on the plan but later dropped out. The denominator would include all customers who received the marketing offer. This includes everyone chosen in the original sample less those who moved before the first marketing packets were sent. The customer acceptance rate is the best measure of the effectiveness of a marketing campaign.
    - For default treatments, the *numerator* of the customer acceptance rate consists of all customers who were defaulted onto the pricing plan and did not drop out prior to going on the new plan. If a customer goes on the plan and later drops out off, they would still be included in the numerator of this variable. Only customers who drop out prior to going on the plan are excluded from the numerator. The *denominator* of the customer acceptance rate for default pricing plans equals the number of customers who were defaulted onto the plan. It excludes customers who moved before June 1, 2012.
- **Decliners:** A decliner is a customer who was offered a pricing plan but declined to accept the offer. For opt-in plans, the number of decliners equals the total number of customers marketed to minus the total number of customers who accepted the offer. For default plans, the number of decliners equals the total number of customers defaulted onto the pricing plan minus those who dropped out prior to going on the plan. It does not include customers who were actually placed on the plan and then later drop out.
- **Drop outs:** Drop outs consist of customers who went on a pricing plan at some point in time, but who later requested to be taken off the plan. It does not include customers who drop out due to changing their location (e.g., moving). These are called movers. Customers who went on to MedRate or budget billing are also counted as drop outs although they may not have had a choice to stay in the SPO pilot. However, their numbers are so small that they are categorized with drop outs.
- **Movers:** Movers are customers who were either defaulted onto a new pricing plan or accepted an offer on an opt-in basis, but subsequently moved and, therefore, are no longer enrolled on

the plan. A mover may or may not have ever actually gone on the new pricing plan. For example, some customers may have accepted the new plan several months prior to the new plan going into effect and may have moved before they were placed on the pricing plan. Similarly, default customers may have not consciously declined the default option but may have moved between the time they were notified that a new pricing plan would be going into effect and when the plan actually went into effect.

2.6 Report Organization

The remainder of this report is organized as follows. Section 3 provides a summary of the analytical methods used to estimate load impacts for each pricing plan. Section 4 summarizes the load impact estimates for the four TOU pricing plans and Section 5 does the same for the CPP pricing plans. Section 6 examines the acceptance rate of IHDs for opt-in and default customers and the connection rate among those who accepted an IHD. It also examines the impact of the offer of an IHD on load reduction. The impact of the offer of IHD on acceptance of the rate plan is discussed in Section 8. Section 7 documents the estimation of demand models and price elasticities that can be used to predict the impact of changes in price levels on load reductions. Section 8 examines customer acceptance and retention rates for each pricing plan and summarizes models that were estimated that can be used to predict the likelihood of customers with various characteristics to accept and stay on each pricing plan. Section 9 summarizes the results of a conjoint survey that was conducted to determine how customer acceptance might change with variation in the attributes of opt-in pricing plans. Section 10 compares the relative cost-effectiveness of each pricing plan if it were to be rolled out to the broader SMUD population. Finally, Section 11 summarizes the findings from a detailed survey conducted among all participants after the end of the second summer to assess customer satisfaction with and perspectives on the various pricing plans and the use of IHDs.

3 Analytical Methodology for Load Impact Estimation

SMUD implemented an experimental design that encompasses multiple treatments and multiple methods of evaluation. This design enables a large number of useful analyses to be done that will help SMUD and the industry at large to make more informed decisions about time-variant pricing. Perhaps most importantly, the design allows for estimation of load impacts and acceptance rates without the risk of selection bias; this is quite rare and valuable in the realm of utility program evaluation. The discussion in this section focuses on the methods used to estimate the load impacts reported in Sections 4 and 5. The methods used to develop demand models and choice models for the various pricing plans are discussed in the report sections covering those topics.

3.1 General Approach

The fundamental step in estimating load impacts is to determine what loads would have been for treatment customers if they hadn't been exposed to the treatment; this is referred to as a reference load. SPO relied primarily on two experimental methods for developing reference loads—a randomized control trial (RCT) and a randomized encouragement design (RED). In addition, two treatments, opt-in CPP with and without an IHD offer, were designed to be analyzed using a within-subjects analysis, which constructs reference loads based on treatment customer loads during a time when the treatment is not in effect. The decision to rely on this design was based on an assumption that opt-in rates would be lower than they actually were. Because of the higher opt-in rates obtained in the study, it was possible to develop impact estimates using an RED analysis for these treatments that were originally planned to be analyzed using a within-subjects analysis. Section 9 of the SPO Interim Evaluation report compares load impact estimates developed using RED and within-subjects analysis methods, and also a third method involving the ex post development of control groups using statistical matching methods. This comparison strongly supports the use of RED/RCT methods for impact estimation whenever such methods are feasible.

An RCT refers to a research strategy in which customers who volunteer for a treatment are randomly assigned to treatment and control conditions. This method ensures that the only difference between treatment and control customers, other than small differences due to random sampling variation, is that one group receives the treatment and the other does not. An RCT design ensures that impact estimates are not affected by selection bias or other potential explanations for observed differences between the two groups of customers.

In practice, randomization can be achieved using either a *recruit and deny* process or a *recruit and delay* process. In the former, control customers are never given the treatment whereas in the latter, customers assigned to the control group are placed on the treatment after the end of the trial measurement period. Prior to that time, they act as the control group against which treatment effects are measured. SMUD used the recruit and delay method. Conceptually, the important issue is that because the groups were identical in expectation prior to the start of the experiment, the behavior of the group not on the treatment can be assumed to be an accurate representation of what the behavior of the group on the treatment would have been in the absence of the treatment. This study design was applied to two treatments: opt-in TOU and opt-in TOU plus IHD.

Load impacts can be estimated based on an RCT design by using what is called a difference-in-differences analysis. To estimate load reduction during the peak period, for example, the first difference calculation subtracts average load for the treatment group from the average load for the control group after the treatment goes into effect (in this instance, after June 1, 2012). A second difference value is calculated equal to the difference in peak period loads between treatment and control customers prior to the treatment going into effect (during the summer of 2011 in this instance). This second difference is subtracted from the first, which is why the analysis is called a difference-in-differences. The purpose of this second step is to adjust for any pretreatment differences between the control and treatment groups that might occur due to random variation in the assignment of customers to the treatment and control groups. This difference should be quite small if the treatment and control samples are large, since random error diminishes as sample sizes increase. If sample sizes are small, random error can be more impactful. Section 4 of the SPO Interim Evaluation report shows that adjustments due to random variation are small for all treatments in the SPO.

Figure 3-1 summarizes the design and evaluation of impacts using an RCT design. This approach was used for the two opt-in TOU treatments (with and without an IHD offer). Note that the randomization into either the immediate treatment or deferred treatment groups took place before customers were offered the pricing plan. Offers to customers, however, were exactly the same for both groups. Customers were blind to whether they had been pre-assigned to the immediate or deferred start as were customer service representatives (CSRs). Customers and CSRs only learned which group a customer was in after the customer accepted the plan offer.[10]

The experimental method used for the opt-out TOU treatments and for all CPP treatments is an RED. From the perspective of internal validity, an opt-in RCT and an RED are equivalent—both control equally well for selection bias and both allow one to estimate effects for those who accept the treatment, not just those that are offered the treatment. The analysis required to estimate the treatment effect on the treated using an RED requires an extra step as outlined later in this section.[11] Each requires the assumption that the offer of a treatment not taken or not received has no effect on energy consumption.

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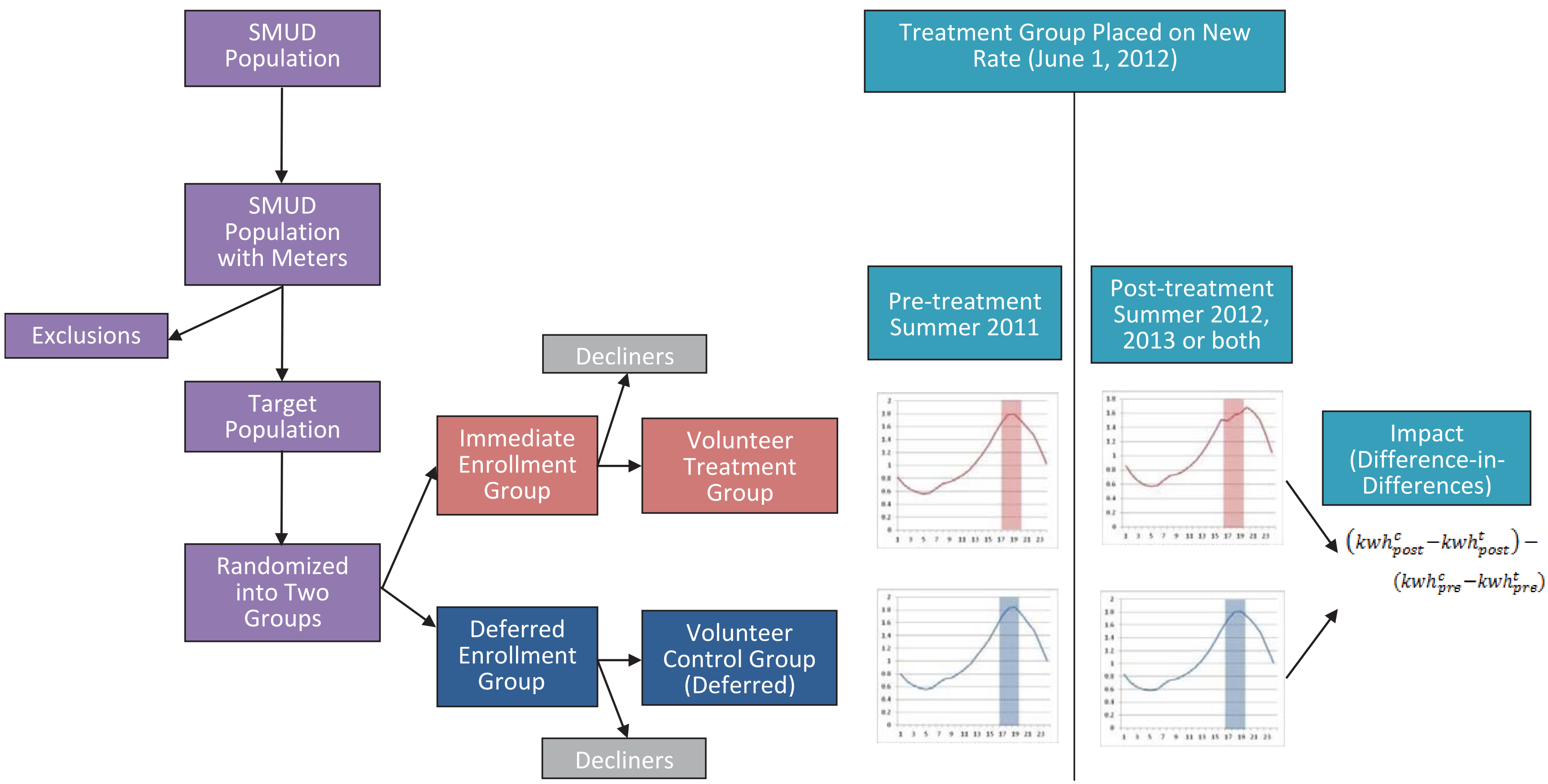
[10] The initial group of customers recruited for opt-in treatments were not told about the delay until after they agreed to participate. Some complaints from customers placed in the delayed group prompted SMUD to modify the recruitment material for all customers, both those pre-assigned to the treatment and delayed groups, to indicate that enrollment for some customers would be delayed. It is possible that a different set of customers would enroll in a program that only 50% of customers will be able to take part in immediately as compared to a program where all people who are interested are immediately enrolled. This could lead to an issue with external validity. However, this issue was unavoidable in designing an internally valid experiment.

[11] For further discussion of RCTs and REDs, see "Using Randomization in Development Economics Research: A Toolkit," by Duflo, Glennerster and Kremer. Handbook of Development Economics.

Figure 3-1: Overview of RCT Implementation and Analysis



In an RED, the behavior of two randomly-chosen groups of customers who were subjected to different levels of encouragement to take up a treatment is observed. For example, one group—the control group—could have received no offer to be on a new plan, while the treatment group could have received an invitation to enroll in a new plan. In a more complicated example, one group could have received an invitation to opt-in, while the other group could have received notification that they would be put on the rate by default unless they chose to opt-out. The key in both situations is that the two groups receive different levels of encouragement to be on the plan. The different levels of encouragement induce different participation rates between two groups that had the same expected characteristics prior to the experiment. This allows one to estimate the effect of the treatment on customers who were affected by the encouragement, as discussed below.

Using an RED design to estimate unbiased treatment effects requires the assumption that customers who are offered the treatment but decline are unaffected by the offer, and the only effect the treatment has is through the price signal (and the offer of the IHD, if applicable). Put another way, it is necessary to assume that customers who decline the offer—either on an opt-in or default basis—behave afterwards in the same way they would if they had never seen the offer. An RED analysis also assumes that customers who are placed on the rate through a default process, but would have opted in if the rate had been offered as voluntary, behave the same way no matter which way the offer was made. Some of the analyses also require the assumption that there are no customers who would accept the offer on an opt-in basis, but decline it on a default basis. Each of these assumptions seem quite reasonable. An RED was used for the following five treatments: default TOU plus IHD; default TOU-CPP plus IHD; opt-in CPP; opt-in CPP plus IHD; and default CPP plus IHD.

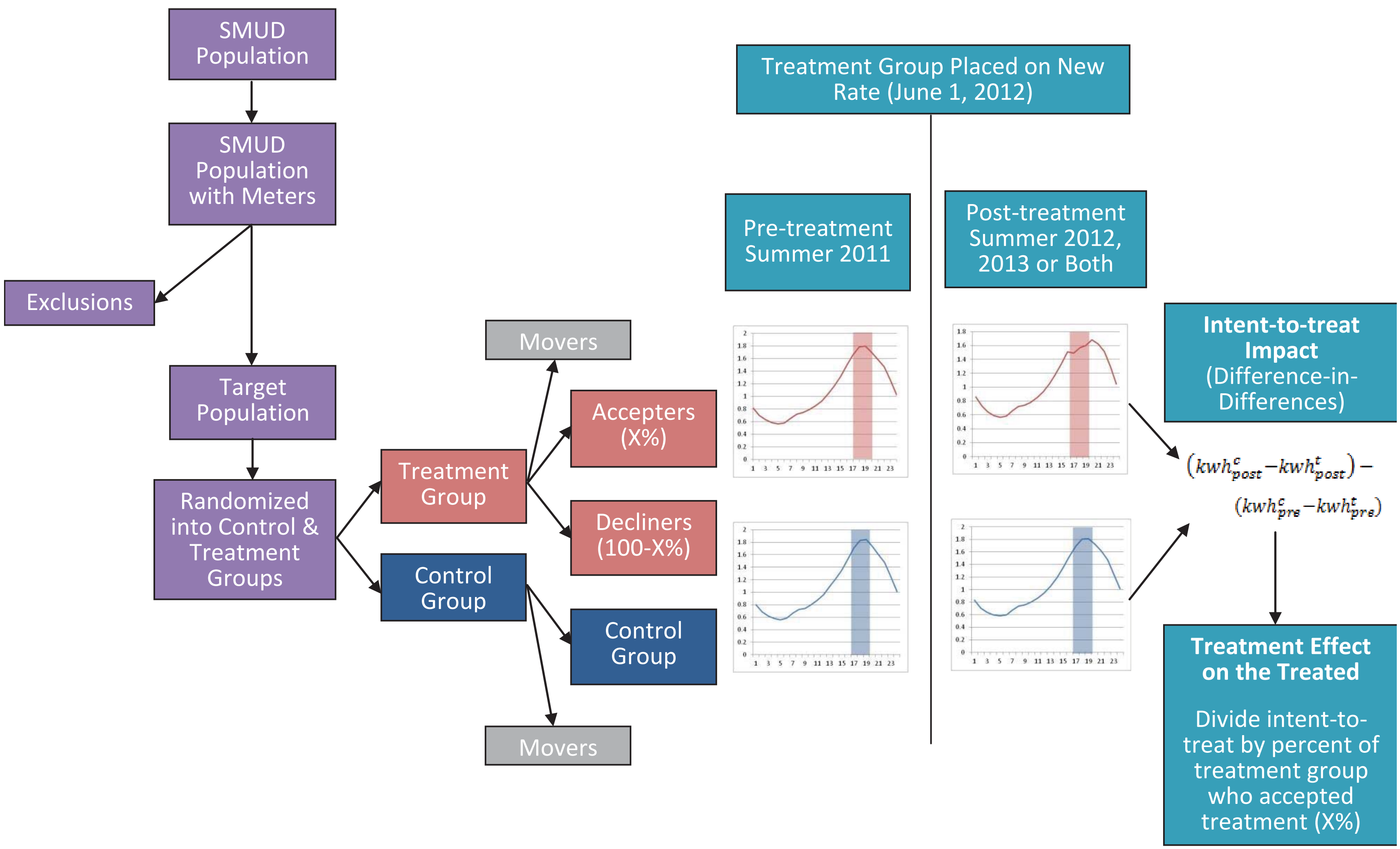
One fundamental difference between the analyses used for RCTs and for REDs is that with RCTs, all customers in the treatment group are enrolled and therefore assumed to be affected by the treatment and none in the control group are affected. In contrast, for REDs, the treatment group consists of all customers who received some form of encouragement toward a treatment and the control group consists of customers who received less encouragement or no encouragement. This means the RED treatment group contains many customers who are assumed to be unaffected by the treatment because they declined. This introduces a potential for confusion in terminology when discussing REDs because it is often convenient to consider the treatment group of an experiment to be the group of all customers who are directly affected by the treatment of interest (e.g., all customers who actually enroll).

For an RED there are two treatments of interest, each vital to producing the final treatment impact estimate. First, there is the encouragement treatment, which gives an RED its name. In this case, that treatment consists of invitations to opt-in to the pricing plan (and for some the additional offer of an IHD) for opt-in cells and default assignment to a pricing plan (plus an IHD offer) for default cells. Second, there is the impact of the pricing plan itself, with or without an IHD offer. That is, the impact for those that enroll on the plan, not those that are offered the plan. In all discussions involving an RED, we adhere to the following terminology: the treatment group is synonymous with the encouraged group and refers to the group of customers who received a higher level of encouragement toward the treatment, including those who decline; takers and compliers are synonymous and refer to customers who accept the plan they are offered or defaulted onto, which does not necessarily mean they also took the IHD offer.[12] Non-complier refers to a customer that has declined the offer, either by not opting in or by requesting not to be defaulted onto the plan. The control group refers to all customers receiving the lower level of encouragement—which typically is no encouragement.

Figure 3-2 summarizes the conceptual design and analysis of an experimental treatment using an RED. As discussed above, there are two load impacts of potential interest. One is the difference in load during, say, the peak period, between the encouraged (treatment) and non-encouraged (control) groups. As with the RCT, this analysis is based on a difference-in-differences calculation. This load impact is primarily of interest in this context because it is a necessary step to obtain the primary effect of interest, namely, the load reduction of compliers—that is, those customers in the encouraged group that actually take up the treatment. This impact is estimated by dividing the impact for the encouraged group by the percent of encouraged customers who accept the treatment offer. This is explained more fully in Section 3.2.

[12] Definitions of treatment group and control group are also included in the glossary in Appendix A.

Figure 3-2: Overview of RED Implementation and Analysis



3.2 Analysis of RCT and RED Treatment Groups

As discussed in Section 3.1, the logic underlying all RCT and RED analysis is that an unbiased reference load can be estimated by taking average loads among a group of customers with the same average pretreatment characteristics as customers who are subject to the treatment or encouragement of interest. The primary impact estimation process is referred to as a difference-in-differences analysis because the impact estimates equal the difference between loads in the treatment and control group at the time of interest (in this case, summer 2012, 2013 or both combined) minus the difference between loads in the treatment and control group during particular times prior to when the treatment goes into effect (e.g., summer 2011).

Difference-in-differences calculations can be done using regression analysis or simple averaging. Regression analysis is used here rather than simple averaging because regression allows each customer's mean usage to be modeled separately, which reduces the standard error of the impact estimates without changing their magnitude. Additionally, standard regression software allows for the calculation of standard errors for load impact estimates that correctly account for the correlation in customer loads over time.[13]

The pretreatment differences adjusted for by the regression should be as close as possible to the differences between the groups that would have been expected if the treatment had not been in place. Therefore, in all cases, the pretreatment loads included in each regression were chosen to be the loads most directly analogous to the loads during the period for which impacts were measured. For example, the pretreatment loads included in the analyses of TOU peak periods were the loads from the same groups during the peak period on weekdays from summer 2011. Similarly, the pretreatment loads used in the regressions for estimating CPP impacts were loads from the 4-7 PM peak period on weekdays with high temperatures above 90°F in summer 2011. Those days were chosen because CPP events are typically only called on hot days. It is important to note, however, that because the sample sizes are fairly large and because treatment and control group pretreatment loads are quite close in all cases, the adjustment for pretreatment differences generally has only a small impact on the results. Repeating all calculations as simple differences without pretreatment adjustments would lead to similar conclusions about the overall effect of each treatment.

The regression specification underlying all the treatment effect estimates reported from RCTs and REDs in this report is:

$$load_{it} = a_i + b_1 T_i I_1 + b_2 I_1 + u_{it} \qquad \text{3-1}$$

The dataset used and the exact definition of each variable and parameter differs across treatment cells, as discussed below.

3.2.1 Opt-in TOU With and Without IHD Offer (RCT)

Two treatment groups were analyzed using the RCT framework—TOU and TOU plus IHD offer—and the dataset and variable definitions are the same for both. The primary analysis of interest for each

13 More accurately, they account for the correlation in regression errors within customers over time.

treatment provides estimates of the peak period demand impact from the TOU pricing plan (or the TOU rate plus IHD plan). In this case, the dataset includes all customers who enrolled in the pricing plan, including deferred customers. The enrolled customers are the treatment group and the deferred customers are the control group. The variable $load_{it}$ in equation 3-1 contains hourly load only during the weekday peak period from 4-7 PM for summer 2011 and either summer 2012, summer 2013 or both, depending on what impacts are of interest,[14] for both treatment and control customers. The index *i* refers to customers and the index *t* refers to the time period of interest (which could be a simple hour, the average across the peak period hours, or some other period of interest).

In this version of the regression, $a_i$is an estimated parameter equal to the mean peak period weekday usage for each customer. The primary parameter of interest is b_1, which provides the estimated demand impact of TOU during the peak period. The parameter is the estimated coefficient on $T_i I_1$. T_i is equal to 1 for the treatment group during the treatment period (e.g., after they are placed on the pricing plan) and 0 otherwise. Finally, I_1 is the variable equal to 1 during the treatment period for all customers and 0 otherwise; this is not a parameter of primary interest, but it allows the regression to estimate the primary parameter of interest without confounding differences between treatment and control customers with differences in usage across years.

Demand impacts have also been estimated for each weekday peak period hour separately for each summer month—meaning there is a separate estimate of the TOU impact for 4-5 PM in June, 5-6 PM in June and so forth, with each estimate providing an average value over that hour for all weekdays in the respective month. This is accomplished using an identical regression specification as above, with a more limited dataset. For example, to produce the estimate for 4-5 PM in June, the dataset is restricted to contain only the hour from 4-5 PM for each weekday during June 2011 and June 2012. All other aspects of the specification remain the same and the interpretation of the variables and estimated parameters are very similar to the case of estimating the overall average effect.

Additionally, demand impacts were estimated for all non-peak periods during the summer, as described in the results section. In these cases, again, the regression specification and interpretation are the same; the only difference is that different hours were included in the regression. These sets of hours can be directly inferred from the results given. For example, to estimate the effect of TOU on the hours immediately before the peak period, the regression only includes hours immediately before the 4-7 PM peak period.

Finally, energy conservation impacts were estimated in addition to demand impacts. Energy conservation is not the primary goal of the treatments, but the treatments could lead to measurable energy savings, which could provide additional value to SMUD. Alternatively, TOU rates could lead to overall increases in usage if customers primarily shift usage from peak to off-peak periods while simultaneously increasing overall usage in response to the lower off-peak prices, which are in effect

[14] If the analysis is being done to estimate impacts for summer 2012, the data set includes data from 2011 and 2012. If the analysis is being done to estimate impacts for summer 2013, the data set includes data from 2011 and 2013. If the analysis is being done to estimate the average impact across both summers, the data set would include data from 2011, 2012 and 2013.

many more hours than higher peak period prices. Determining whether the SPO pricing plans decrease or increase usage, or leave it largely unchanged, is important for cost-effectiveness analysis.

To estimate energy conservation effects, the same specification is used but the estimation is based on monthly usage data rather than hourly or rate-period usage. The dataset includes monthly usage for June-September 2011, 2012 and/or 2013 depending on the time period of interest for the same sets of customers as in the demand impact estimates. The impacts are calculated based on differences in usage between the treatment and control groups during the treatment period and were adjusted based on differences seen in the pretreatment data, the summer of 2011. In this version of the regression, a_i is an estimated parameter equal to the mean monthly usage over pre- and post-treatment periods for each customer. The primary parameter of interest is b_1, which is equal to the estimated monthly energy savings due to TOU during the treatment period. The definitions and interpretations of $T_i I_1$ and $b_2 I_1$ are identical to the demand impact case.

3.2.2 Default TOU Plus IHD Offer and TOU-CPP Plus IHD (RED)

The rest of the TOU analyses are based on REDs rather than RCTs. There are two rates analyzed in the RED framework: default TOU and default TOU-CPP. Both of these treatments included the offer of an IHD. For the TOU-CPP rate, the analysis method summarized in this section focuses on the impact on all summer weekdays. The analysis method used to estimate the incremental effect of the CPP price is discussed in Section 3.2.3.

For both TOU default treatments, the primary analysis of interest is estimation of the peak period demand impact from the TOU rate. The regression specification in equation 3-1 does not directly provide this estimate; instead it provides an estimate of the load impact for the average customer that received an offer, not the average for customers who accepted the offer. This initial load impact estimate is often referred to as the intent-to-treat estimate. Under the reasonable assumption that non-compliers were unaffected by the offer, the intent-to-treat estimate can be transformed into the effect of the treatment on compliers by dividing the intent-to-treat estimate by the fraction of the population enrolled on the pricing plan. This scaled up effect is often referred to as the local average treatment effect. The word “local” is used to indicate that the effect is only measured for customers who responded to the encouragement. In the case where a comparison is made between an encouraged group and a control group with no one on the treatment, it is also referred to as the treatment effect on the treated. If the comparison is made between two groups that are encouraged in different ways (e.g., opt-in encouragement versus default encouragement), the local effect represents the change in usage for customers who would not have enrolled if given that option and who did not opt out from the default enrollment.

It is important to understand how equation 3-1 is used in the RED analyses because it is the first step of each such analysis. In the case of the TOU and TOU-CPP treatments, the dataset includes all customers who were offered the respective treatment (either TOU plus IHD offer or TOU-CPP plus IHD offer) and all customers in the control group. The dataset contains hourly load only during the peak period hours of weekdays from 4-7 PM for summer 2011 and either summer 2012, 2013 or both for both groups. The interpretation of the variables and estimated parameters for these two groups is essentially the same as in the TOU RCT cases above, with the important difference being that all parameters include the effect of non-compliers and are therefore intent-to-treat estimates rather than estimates of the local average treatment effect.

Also analogous to the TOU RCT case is that estimates are developed for individual hours or non-peak periods by altering the set of hours in the regression dataset. Similarly, energy savings impacts are estimated by substituting monthly data for hourly data, in the same way described above for the TOU RCTs. Again, this produces intent-to-treat estimates which must be scaled up.

In each case, intent-to-treat estimates are scaled up to local average treatment effects by dividing by the fraction of customers enrolled at the relevant time. This is complicated somewhat by the fact that customer enrollment changes over the summer as some customers drop out of the treatment. For monthly TOU impacts, the enrollment fraction used for scaling was the average enrollment during that month among the relevant treatment group. For overall TOU impacts, the fraction used was the average enrollment fraction over the period of interest, either 2012, 2013 or both.

For impact estimation, the TOU-CPP plus IHD group can be treated identically to the TOU-only groups. The interpretation of the results must take into account the fact that these customers face much higher prices on certain days. For this reason, we also examine the effect of TOU on this group of customers, excluding CPP days. The method for doing this is to use the same regression analysis, but to exclude CPP days from the dataset.

3.2.3 Opt-in CPP, Default CPP and Default TOU-CPP (RED)

The RED analysis of CPP rates is the same as the analysis described above for TOU rates, with equation 3-1 again being the regression specification and the dataset including the full treatment and control group for each rate. This method applies to opt-in CPP with and without the offer of an IHD and default CPP and TOU-CPP, both of which included the offer of an IHD. The only difference in the analysis of the CPP rates and the TOU rates is that the pretreatment data includes only weekdays with peak temperatures above 90°F in 2011.

Again, for REDs, equation 3-1 produces the intent-to-treat estimate, which must be scaled up by the fraction of customers within the treatment group that is enrolled to produce the local average treatment effect. Due to customers leaving the rate during the summer, this fraction differs across events, and so each CPP event impact is estimated using the fraction of enrolled customers at that point during the summer. Overall, average CPP effects are scaled by the average enrollment fraction over all CPP events.

For the TOU-CPP with IHD group, the effect of the CPP rate on CPP days is estimated in the same way as the effect of the CPP treatment for the other CPP cells.

3.3 Standard Errors

In order to interpret the results of each analysis, it is important to understand not just the point estimates for each variable, but also the variance of each estimate and the associated confidence interval. For RCT analyses, the regression software automatically produces standard error estimates, and the only complication is that those estimates must be calculated using the cluster option, which assumes that the regression errors are correlated with each other within each customer's set of errors.

For RED analyses, the first step is to estimate the standard errors of the intent-to-treat estimates, as produced by the regression with the cluster option. Those standard error estimates are then scaled up using the same scaling factor used to scale the intent-to-treat estimates themselves—the difference in the fraction of compliers between the treatment and control groups. This produces correct standard error estimates for the estimates of the local average treatment effects.

With point estimates and standard errors, confidence bands and tests of statistically significant differences can be calculated. To calculate the p-value of the hypothesis that the point estimates arise from the same distribution, we first calculate the standard error of the difference, which is the square root of the sum of the standard errors from each point estimate. Next, the ratio of the difference to the standard error of the difference is calculated. Under standard assumptions and the central limit theorem, this ratio is distributed with a Gaussian (Normal) distribution with mean zero and variance equal to one. Therefore, the p-value is determined by finding the fraction of the Gaussian distribution that is more extreme (i.e., further from zero) than the calculated ratio.[15] Because two-sided hypothesis tests are performed in all cases, this fraction is doubled and that equals the p-value. The p-value indicates the probability of observing an estimated difference that large if the two estimates came from the same distribution. Therefore, a low p-value indicates that it is unlikely that a difference that large would be observed if the two estimates came from the same distribution. In that sense, a low p-value increases confidence that the observed differences are not due to chance alone and therefore are statistically significant.

[15] Technically, a t-distribution should be used for such a test, but the t-distribution and Gaussian distribution are virtually identical for large sample tests such as this.

4 TOU Pricing Plan Impacts

This section presents the demand and energy impact estimates for the TOU and TOU-CPP pricing plans included in the SPO. The SPO design was intended to provide adequate statistical power to measure treatment effects[16] averaged over each summer for the peak period for each rate option (for TOU, TOU-CPP and CPP options). These average impacts are the primary focus of this evaluation, although sample size calculations also focused on estimating conservation effects. Other impacts of interest can be obtained from the data, including estimates by month, estimates for individual hours of the peak period, individual CPP event day effects and non-peak period effects. When reviewing these additional estimates, it should be kept in mind that the experiment was not designed to estimate these effects. As such, standard error estimates for these parameters tend to be larger. When reviewing impact estimates in the remainder of this section and in Section 5, keep in mind that the convention used is that positive impact values indicate reductions in use and negative values indicate increases.

4.1 Peak Period Load Reductions by Pricing Plan

The TOU peak period covers 4 to 7 PM on all non-holiday weekdays from June through September. During the peak period, the price per kWh for non-EAPR customers is 1.6 to 3 times higher than the off-peak price, depending on whether a customer's energy use puts them in usage tier 1 or 2. For customers on the low-income EAPR rate, the peak period price is 1.2 to 3.6 times higher than the off-peak price.

Table 4-1 shows the average estimated absolute and percentage impacts for the TOU rate options across all summer peak hours. Impacts are shown for each summer and for the two summers combined. The p-values in the last column in the table show whether the difference in impacts across the two summers is statistically significant. Table 4-2 shows the p-values for the pairwise comparisons of load impacts across pricing plans to assess whether the impact for one pricing plan is significantly different from the impact for another plan.

Looking first at the impacts in Table 4-1 averaged across the two years, the largest absolute and percent reductions are from the opt-in TOU group that was offered the IHD. The average impact for this treatment group was 0.21 kW, which equals 11.9% of the whole house reference load. The lowest absolute and percent impact was for the default TOU group (which included an IHD offer, as did all default groups), where the absolute average reduction across the two summers equaled 0.11 kW, or 5.8% of the average customer's whole house reference load. Impacts for the remaining two groups, opt-in TOU with no IHD offer and default TOU-CPP with an IHD offer, were 0.16 kW (9.4%) and 0.17 kW (8.7%), respectively. As seen in Table 4-2, the differences in peak period load impacts across the various pricing plans were statistically significant for 3 pairwise comparisons:

- the default TOU with an IHD offer and default TOU-CPP with an IHD offer, with a p-value of 0.05 (statistically significant at the 90% confidence level);

[16] See CBS Power Analysis in Appendix F of the SPO Interim Report.

- opt-in TOU with an IHD offer and opt-in TOU without an IHD offer, with a p-value of 0.07 (statistically significant at the 90% confidence level); and
- the opt-in TOU with IHD offer and default TOU with IHD offer, which was statistically different at the 99% level of confidence.

Table 4-1: Average Peak Period Load Impacts for TOU Pricing Plans for the Average Weekday

Group	Year	Average Impact per Customer (kW)	95% CI Lower[17]	95% CI Upper	Reference Load (kW)	Impact as % of Reference Load	P Value (Difference Across Years)
Opt-in TOU, No IHD Offer	2012	0.17	0.13	0.22	1.71	10.0%	0.65
	2013	0.15	0.10	0.21	1.69	9.1%	
	Average	0.16	0.12	0.21	1.72	9.4%	n/a
Opt-in TOU, IHD Offer	2012	0.24	0.20	0.27	1.80	13.1%	0.15
	2013	0.20	0.15	0.24	1.79	10.9%	
	Average	0.21	0.18	0.25	1.79	11.9%	n/a
Default TOU, IHD Offer	2012	0.12	0.09	0.15	1.87	6.2%	0.52
	2013	0.10	0.07	0.14	1.80	5.7%	
	Average	0.11	0.08	0.14	1.86	5.8%	n/a
Default TOU-CPP, IHD Offer[18]	2012	0.16	0.11	0.21	1.90	8.2%	0.63
	2013	0.18	0.11	0.24	1.85	9.6%	
	Average	0.17	0.11	0.22	1.91	8.7%	n/a

Table 4-2: P-values for Pair Wise Comparisons of Average Load Impacts Across Two Years for TOU Pricing Plans

Group	Opt-in TOU, No IHD Offer	Opt-in TOU, IHD Offer	Default TOU, IHD Offer	Default TOU-CPP, IHD Offer
Opt-in TOU, No IHD Offer	n/a	n/a	n/a	n/a
Opt-in TOU, IHD Offer	0.07*	n/a	n/a	n/a
Default TOU, IHD Offer	0.05*	0.00**	n/a	n/a
Default TOU-CPP, IHD Offer	0.90	0.13	0.05*	n/a
*Statistically significant at the 90% level; ** Statistically significant at the 99% level				

17 The 95% confidence bands are shown for load impacts in each table in this report. If the upper and lower values of the 95% confidence band bracket 0, it means that the estimated impact is not statistically significant with 95% confidence.

18 Average weekday impacts for the TOU-CPP plan include impacts on both CPP and non-CPP days.

4.2 Impact Persistence

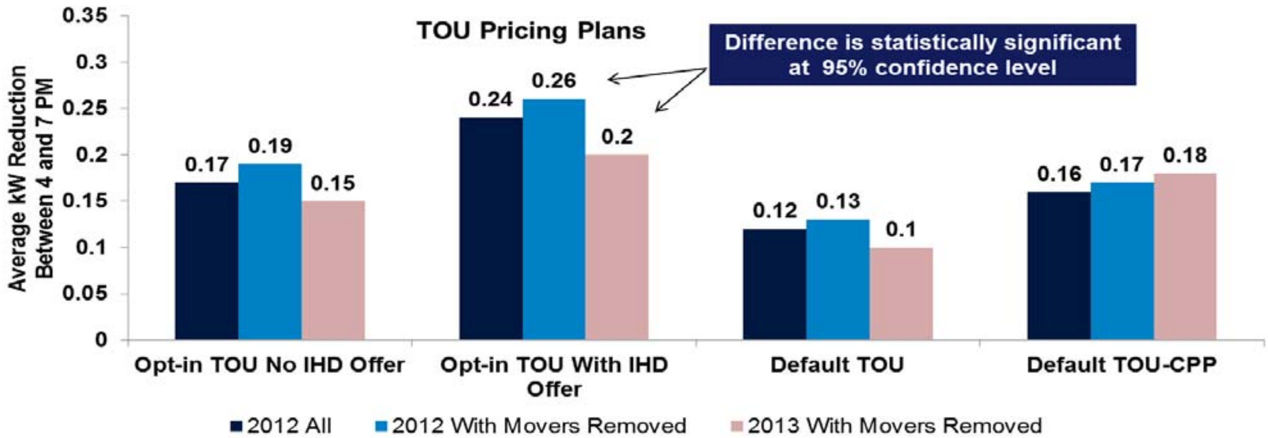
An important issue for resource planning purposes is whether load impacts from time-variant rates persist over time. As seen in Table 4-1, there are small decreases in the average impact from 2012 to 2013 for three of the four pricing plans and a small increase in the impact for the fourth pricing plan, default TOU-CPP. However, as indicated by the p-values in the last column in the table, none of these differences is statistically significant.

The above comparison of load impacts in 2012 with those in 2013, while interesting, is not the best measure of persistence because the population of participants changed across the two summers. As discussed at length in Section 8, customer attrition for most plans equaled roughly 25% over the course of the two summers, with the vast majority of this attrition resulting from customers who moved rather than from those who actively dropped out of the pricing plans. Customers who moved were dropped from their pricing plan and could not re-enroll. Since movers are more likely to live in multiple family dwellings and, therefore, be more likely to have smaller loads than those who don't move, a simple comparison of load impacts across the two summers based on the populations that are enrolled in each summer is not a valid measure of whether load impacts persist among customers who remain on a pricing plan over time, which is a more interesting question from a policy perspective. To make this comparison, load impacts were calculated for each summer based on the segment of customers who did not move over the course of the study.[19]

Figure 4-1 shows impacts for each summer for customers who did not move over the two summers. For comparison, it also shows the estimates based on the full 2012 population. As seen, the impacts for the stable population are larger for each pricing plan, which is consistent with the hypothesis that movers have smaller loads and load response than those who do not move. For three of the four pricing plans, the small differences across years for the non-mover population are not statistically significant – that is, impacts persisted across the two summers for those who were enrolled in both summers. For the opt-in TOU group with an IHD offer, there was a drop in load impacts in the second summer and the difference is statistically significant at the 95% confidence level.

[19] Active drop outs were kept in the database since dropping them would have led to a selection effect that could not be controlled for using the RED analysis methods applied in each case because there were no drop outs in the control group, just movers. Because the same percent of customers should move in both the treatment and control groups, the RED analysis is still valid when movers are dropped.

Figure 4-1: Load Impacts for Each Summer for Customers Who Did Not Move During the Study Period



4.3 Load Impacts by Month

In addition to knowing how average impacts vary across pricing plans, it is useful to observe how impacts vary across months for each plan. Table 4-3 shows the average load reductions by month for the two summers combined for each TOU pricing plan. For the three TOU only plans, September has the lowest absolute and percent load reductions across the four months, with June being the second lowest. The average impacts are highest in July for the two opt-in plans and highest in August for the default TOU plan, but the differences between July and August are not large for any of these plans. Impacts for the default TOU-CPP plan are influenced by the number of event days in each month, which is why the impacts in September are much higher than for the default TOU plan. Across the two years, there were more CPP event days in September (a total of 9) than in any other month.[20]

[20] There was 1 June event used in the analysis, 5 July events, 8 August events and 9 September events across the two years.

Table 4-3: 2012/2013 Average Load Impacts by Month for TOU Pricing Plans[21]

Month	Group	Average Impact per Customer (kW)	95% CI Lower	95% CI Upper	Reference Load (kW)	% Impact
June	Opt-in TOU, No IHD Offer	0.15	0.10	0.19	1.57	9.4%
	Opt-in TOU, IHD Offer	0.17	0.13	0.20	1.55	10.9%
	Default TOU, IHD Offer	0.10	0.07	0.12	1.75	5.5%
	Default TOU-CPP, IHD Offer	0.14	0.09	0.19	1.81	7.6%
July	Opt-in TOU, No IHD Offer	0.21	0.15	0.26	2.11	9.7%
	Opt-in TOU, IHD Offer	0.27	0.23	0.32	2.05	13.4%
	Default TOU, IHD Offer	0.12	0.08	0.15	2.17	5.5%
	Default TOU-CPP, IHD Offer	0.19	0.13	0.25	2.25	8.4%
August	Opt-in TOU, No IHD Offer	0.20	0.14	0.26	1.83	11.2%
	Opt-in TOU, IHD Offer	0.27	0.22	0.31	2.07	12.9%
	Default TOU, IHD Offer	0.14	0.10	0.18	2.15	6.5%
	Default TOU-CPP, IHD Offer	0.20	0.13	0.27	2.22	9.0%
September	Opt-in TOU, No IHD Offer	0.08	0.02	0.14	1.33	6.0%
	Opt-in TOU, IHD Offer	0.14	0.10	0.19	1.50	9.6%
	Default TOU, IHD Offer	0.07	0.04	0.11	1.61	4.5%
	Default TOU-CPP, IHD Offer	0.14	0.07	0.20	1.69	8.1%

4.4 Load Impacts by Customer Type

For opt-in pricing plans, it is useful to understand how load impacts vary across customers who might differ in selected ways such as EAPR status or overall usage. Such information can be used to develop targeted marketing strategies that can improve program cost effectiveness. Even for default plans, knowing the types of customers that produce the largest load reductions can be useful input to educational strategies that might help improve overall load reductions.

Table 4-4 shows how load impacts vary by EAPR status for the four TOU pricing plans. EAPR customers have both lower load impacts on an absolute basis and lower reference loads compared with non-EAPR customers for all four treatment groups. For the two default pricing plans, the difference in the absolute impacts between EAPR and non-EAPR customers is small and is explained completely by the difference in reference loads for the two groups since the percent reductions are almost identical. That is, EAPR customers show the same responsiveness to price as non-EAPR customers when defaulted onto a TOU pricing plan, but the absolute impacts are lower for EAPR customers because their usage is lower. For the two opt-in pricing plans, both the average absolute and percent reductions are lower for EAPR

[21] Hourly impacts by month during the peak period for the TOU pricing plans are presented in Appendix B.

customers than for non-EAPR customers. For the opt-in group with no IHD offer, the load reduction for EAPR customers is less than half as large as for non-EAPR customers even though the reference load for the two groups differed by less than 10%. For the opt-in group with the IHD offer, the absolute impacts differ by about 50% even though the reference loads differ once again by less than 10%.

Table 4-4: 2012/2013 Average Load Impacts by EAPR Status

Group	EAPR					Non-EAPR				
	Impact	95% CI Lower	95% CI Upper	Reference Load	% Impact	Impact	95% CI Lower	95% CI Upper	Reference Load	% Impact
Opt-in TOU, No IHD Offer	0.08	0.00	0.16	1.65	4.8%	0.20	0.15	0.25	1.76	11.3%
Opt-in TOU, IHD Offer	0.14	0.08	0.20	1.70	8.2%	0.24	0.20	0.29	1.84	13.2%
Default TOU, IHD Offer	0.09	0.04	0.15	1.64	5.7%	0.11	0.08	0.14	1.93	5.8%
Default TOU-CPP, IHD Offer	0.15	0.05	0.25	1.76	8.5%	0.17	0.11	0.22	1.96	8.5%

Another important customer characteristic of potential interest is usage. Table 4-5 shows how load impacts vary with usage. All customers on each pricing plan were stratified into quartiles based on average summer usage. Bins 1 through 4 in the table represent the lowest to the highest usage quartile. Absolute impacts increase significantly from the lowest to the highest usage bin for each treatment group, but the magnitude of the spread varies significantly across treatment groups. For example, for the default TOU plan, the difference in impacts is less than a factor of three between the lowest and the highest usage bin. However, for the default TOU-CPP group, the difference is more than a factor of 10. The variation in percent impacts is much different from the variation in absolute impacts, increasing from lowest to highest in some cases but falling in others. One thing that is clear is that for any opt-in pricing plan, targeting high usage customers will be much more cost effective than targeting low usage customers.

Table 4-5: 2012/2013 Average Load Impacts by Usage Quartile for TOU Pricing Plans (Bin 1 is the lowest usage quartile, Bin 4 is the highest usage quartile)

Group	Bins	Reference Load	Impact	95% CI Lower	95% CI Upper	Percent Impact
Opt In TOU, No IHD Offer	1	0.60	0.05	0.01	0.10	9.1%
	2	1.30	0.13	0.06	0.21	10.3%
	3	1.98	0.18	0.09	0.27	9.2%
	4	3.15	0.28	0.15	0.41	8.8%
Opt In TOU, IHD Offer	1	0.62	0.07	0.03	0.11	11.2%
	2	1.33	0.20	0.14	0.26	15.1%
	3	2.00	0.24	0.17	0.31	12.2%
	4	3.16	0.33	0.24	0.42	10.5%
Default TOU, IHD Offer	1	0.64	0.06	0.02	0.09	9.0%
	2	1.35	0.10	0.05	0.14	7.2%
	3	2.05	0.12	0.06	0.18	5.8%
	4	3.30	0.16	0.08	0.24	4.8%
Default TOU-CPP, IHD Offer	1	0.59	0.03	-0.03	0.09	4.6%
	2	1.36	0.07	-0.01	0.14	4.8%
	3	2.07	0.20	0.09	0.30	9.5%
	4	3.53	0.36	0.22	0.50	10.2%

4.5 Load Impacts Outside the Peak Period

Although the peak period hours are of primary interest, it is also useful to know what happens to electricity usage during non-peak hours for customers on the TOU pricing plans, especially those hours just before the peak period when pre-cooling might occur and right after the peak period, when a snapback effect might exist. Table 4-6 shows impacts for each of the four TOU groups for the two hours before the peak period (2 to 4 PM) and the two hours after the peak period (7 to 9 PM) across all summer weekdays for the two summers combined. The results in the table show that there are no statistically significant load reductions in the hours leading up to or following the peak period for any of the TOU pricing plans for the average weekday.

Table 4-6: 2012/2013 Average Load Impacts Before and After Peak Period for TOU Pricing Plans

Group	Average Impact Pre-Peak (2-4PM) (kW)	95% CI Lower	95% CI Upper	Average Impact Post-Peak (7-9 PM) (kW)	95% CI Lower	95% CI Upper
Opt-in TOU, No IHD Offer	-0.03	-0.07	0.00	0.00	-0.04	0.03
Opt-in TOU, IHD Offer	0.00	-0.03	0.03	0.02	-0.01	0.04
Default TOU, IHD Offer	0.00	-0.03	0.02	0.02	-0.01	0.04
Default TOU-CPP, IHD Offer	0.01	-0.03	0.06	0.02	-0.02	0.06

4.6 Energy Savings

In addition to calculating demand impacts during the TOU peak period, overall energy savings was estimated for each treatment. Table 4-7 summarizes this analysis. All four treatment groups showed energy savings of roughly 1% but only the impact estimate for the default TOU plan was statistically significant. Given the lack of load shifting seen in the prior section and the fact that the opt-in groups showed statistically significant load reductions during the peak period (as seen in Table 4-1), even the statistically insignificant impacts shown below may be taken as evidence of energy savings. With significant peak period reduction and no evidence of load shifting, the net result would need to be a modest reduction in overall energy use. Importantly, there is no evidence of an increase in overall electricity use in response to the lower off-peak prices that are in effect the majority of hours.

Table 4-7: Energy Savings for TOU Pricing Plans

Group	Design	Average Monthly Impact (kWh)	95% CI Lower	95% CI Upper	Monthly Reference Load (kWh)	Impact as % of Reference Load
Opt-in TOU, No IHD Offer	RCT	9.4	-6.8	21.6	818	1.1%
Opt-in TOU, IHD Offer		7.4	-7.9	26.7	843	0.9%
Default TOU, IHD Offer	RED	11.4	1.7	21.1	844	1.3%
Default TOU-CPP, IHD Offer		11.9	-8.6	32.4	885	1.3%

5 CPP Pricing Plan Impacts

This section summarizes the demand and energy impact estimates for the CPP pricing plans and for CPP days for the TOU-CPP pricing plan. As in Section 4, which covered the TOU treatments, the primary focus of this section is on average peak-period load impacts across all CPP events for the entire summer. We also examine how impacts vary across events and with fluctuations in temperature on event days. Impact comparisons are also made for customers who were and were not offered an IHD. As in the TOU section, additional estimates are developed for time periods that the experiment was not designed to produce, but that are nevertheless of interest.

5.1 Peak Period Load Reductions

The peak period for the CPP pricing plans is the same as for the TOU plans, 4 to 7 PM. In 2012, 12 CPP event days were called. However, on the first event day, June 20, 2012, customer notifications did not go out to everyone. As a result, the June 20 event day was not included in the analysis. For customers who did not receive notification for the June 20 event, an additional first event was called but not analyzed. This way, when the second event was called on July 10, it was the second event for all customers. In 2013, 12 events were called. Table 5-1 shows the dates, day of week and daily maximum temperature for each event day. Across the two summers, 2 events were called in June (although one was not included in the analysis for reasons stated above), 5 in July, 8 in August and 9 in September. The daily maximum temperature exceeded 90°F on all but 2 CPP days and was 95°F or greater on 16 out of the 24 event days. 5 of the 7 coolest event days occurred in September 2013.

Table 5-1: CPP Event Days for 2012 and 2013

2012 Events			2013 Events		
Date	Day of Week	Daily Maximum Temperature (°F)[22]	Date	Day of Week	Daily Maximum Temperature (°F)
20-Jun-12	Wednesday	Not Analyzed	28-Jun-13	Friday	104
10-Jul-12	Tuesday	101	2-Jul-13	Tuesday	103
12-Jul-12	Thursday	102	3-Jul-13	Wednesday	105
2-Aug-12	Thursday	99	19-Jul-13	Friday	99
8-Aug-12	Wednesday	100	15-Aug-13	Thursday	95
9-Aug-12	Thursday	103	19-Aug-13	Monday	104
10-Aug-12	Friday	103	6-Sep-13	Friday	94
14-Aug-12	Tuesday	96	9-Sep-13	Monday	101
15-Aug-12	Wednesday	95	10-Sep-13	Tuesday	87
12-Sep-12	Wednesday	92	13-Sep-13	Friday	91
13-Sep-12	Thursday	97	19-Sep-13	Thursday	91
14-Sep-12	Friday	91	30-Sep-13	Monday	78

[22] The maximum temperature reported here comes from a maximum temperature file provided by SMUD. In some cases it is slightly higher than the maximum hourly temperature in the hourly temperature file used for analysis purposes. In the comparable table in the interim report, the hourly maximum temperature was reported and it differs slightly on some days from the values reported here which is based on the data contained in the maximum temperature file provided by SMUD.

Table 5-2 shows the average impact across all CPP event hours for 2012, 2013 and the two years combined. Table 5-3 shows the p-values for each pairwise comparison of load impacts by pricing plan based on the two year average. Focusing first on the opt-in plans, the average load reductions for the opt-in CPP plan with no IHD offer was 0.49 kW, or roughly 20.9% of whole house load, and the average for the opt-in CPP plan with an IHD offer was 0.64 kW, or 25.1%. The difference in the two estimates is not statistically significant although this may primarily be due to the relatively large confidence bands around the average value for the opt-in group with no IHD offer. The sample size for this treatment group was small to begin with, with enrollment of only 212 at the start of summer 2012. By the end of summer 2013, the sample size had fallen to less than 150, which is why the confidence bands for the 2013 estimate are so large and also why they are larger for the two year average than for any of the other treatment cells. Indeed, as seen in Table 5-3, the average impact estimate across two years for the CPP plan with no IHD offer is not statistically different from any of the other three plans even though the absolute differences are roughly 50% in two cases.

Table 5-2: Load Impacts for CPP Pricing Plans

Group	Year	Average Impact per Customer (kW)	95% CI Lower	95% CI Upper	Reference Load (kW)	Impact as % of Reference Load	P Value (Difference Across Years)
Opt-in CPP, No IHD Offer	2012	0.52	0.26	0.78	2.38	21.9%	0.78
	2013	0.46	0.16	0.77	2.25	20.6%	
	Average	0.49	0.24	0.73	2.33	20.9%	n/a
Opt-in CPP, IHD Offer	2012	0.69	0.58	0.79	2.62	26.2%	0.27
	2013	0.60	0.48	0.72	2.48	24.1%	
	Average	0.64	0.54	0.73	2.53	25.1%	n/a
Default CPP, IHD Offer	2012	0.32	0.24	0.40	2.64	12.1%	0.16
	2013	0.41	0.32	0.50	2.47	16.5%	
	Average	0.36	0.28	0.44	2.56	14.0%	n/a
Default TOU-CPP, IHD Offer	2012	0.33	0.25	0.41	2.61	12.8%	0.48
	2013	0.29	0.20	0.38	2.43	11.9%	
	Average	0.31	0.24	0.39	2.54	12.3%	n/a

The default CPP plan had an average load reduction of 0.36 kW, or 14.0% of whole house load. This is roughly half as large as for the opt-in CPP plan with an IHD offer and the difference is statistically significant at the 99% confidence level. The default TOU-CPP plan produced an average reduction of 0.31 kW, or 12.3% of whole house load. The difference in impacts between the two default options is not statistically significant.

Table 5-3: P-values for Pair Wise Comparisons of Load Impacts Across CPP Pricing Plans (Based on Averages for 2012/2013 Combined)

Group	Opt-in CPP, No IHD Offer	Opt-in CPP, IHD Offer	Default CPP, IHD Offer	Default TOU-CPP, IHD Offer
Opt-in CPP, No IHD Offer	n/a	n/a	n/a	n/a
Opt-in CPP, IHD Offer	0.27	n/a	n/a	n/a
Default CPP, IHD Offer	0.33	0.00**	n/a	n/a
Default TOU-CPP, IHD Offer	0.18	0.00**	0.39	n/a

** Statistically significant at the 99% confidence level

The last column in Table 5-2 shows the results of tests for statistically significant differences across the two summers. As seen, although there were small decreases in the estimated impacts for three of the four plans, none of the differences across years are statistically significant. Section 5.2 compares impacts across years after controlling for changes in the population of participants due to customers that moved over the two summers.

Although the sample sizes used in SPO were not designed to estimate individual event day load impacts, it is still possible to do so, while recognizing that the confidence intervals around these estimates will be larger than for the average event day. Table 5-4 shows the estimated load impacts for each event day for one of the four treatments, the opt-in CPP rate with IHD offer.[23] As seen, the load impacts vary significantly across event days, from a low of 0.23 kW on the coolest day (September 30, 2013) when the maximum temperature was only 78°F, to a high of 1.0 kW on the hottest day (July 12, 2012), when the maximum temperature was 102°F. In general, load impacts are higher on hotter days than on cooler ones, although other factors such as day of week and random variation in loads mean that the relationship between temperature and load reductions is not perfectly correlated. Figures 5-1 and 5-2 show the relationship between weather and absolute and percentage load reductions, respectively. As seen, the slope of the line is much steeper when based on absolute load reductions than it is when based on percentage load reductions. Indeed, given that the reference load increases significantly with temperature, even if the percentage load reduction was constant across days, a graph of weather versus absolute load reductions would still have a positive slope. As seen in Figure 5-2, however, there is also a positive relationship between temperature and percent reduction, meaning that the average consumer on this rate reduces load more on both a percentage and absolute basis as the daily maximum temperature increases.

Another issue of interest is whether impacts drop off on the second and third day of multi-day events. In other words, do consumers tire of reducing load when it is hot several days in a row? There were two three-day event sequences across the 23 event days, both during the 2012 summer, and three two-day events, with one occurring in 2012 and two in 2013. Differences in impacts were small in four out of five multi-day sequences. The only one where the difference was relatively large was for the two-day event sequence on September 9 and 10 in 2013. However, this difference is due entirely to the drop off in

[23] Appendix C contains impact estimates for each hour of each event day for all four treatments.

temperature on the second event day, when the maximum temperature was only 87°F, compared with 101°F on the prior day. Indeed, the percentage reduction across those two days was nearly identical.

Table 5-4: Event Day Load Impacts for Opt-in CPP with IHD Offer

Date	Day of Week	Daily Maximum Temp (°F)	Load Reduction	95% CI Lower	95% CI Upper	Reference Load	% Impact
10-Jul-12	Tuesday	101	0.84	0.66	1.02	2.70	30.9%
12-Jul-12	Thursday	102	1.00	0.80	1.20	3.13	32.1%
2-Aug-12	Thursday	99	0.59	0.41	0.77	2.61	22.6%
8-Aug-12	Wednesday	100	0.69	0.52	0.86	2.63	26.4%
9-Aug-12	Thursday	103	0.84	0.65	1.03	2.97	28.2%
10-Aug-12	Friday	103	0.90	0.70	1.10	3.16	28.4%
14-Aug-12	Tuesday	96	0.70	0.53	0.87	2.66	26.3%
15-Aug-12	Wednesday	95	0.65	0.48	0.82	2.60	25.1%
12-Sep-12	Wednesday	92	0.48	0.32	0.64	2.00	23.9%
13-Sep-12	Thursday	97	0.45	0.28	0.62	2.16	20.7%
14-Sep-12	Friday	91	0.41	0.24	0.58	2.14	19.0%
2012 Average	n/a	n/a	**0.69**	**0.58**	**0.80**	**2.62**	**26.3%**
28-Jun-13	Friday	104	0.68	0.45	0.91	3.14	21.5%
2-Jul-13	Tuesday	103	0.95	0.73	1.17	3.31	28.6%
3-Jul-13	Wednesday	105	0.94	0.71	1.17	3.49	27.0%
19-Jul-13	Friday	99	0.68	0.47	0.89	2.72	25.1%
15-Aug-13	Thursday	95	0.53	0.33	0.73	2.46	21.7%
19-Aug-13	Monday	104	0.72	0.50	0.94	3.10	23.1%
6-Sep-13	Friday	94	0.46	0.27	0.65	1.90	24.4%
9-Sep-13	Monday	101	0.73	0.52	0.94	2.79	26.3%
10-Sep-13	Tuesday	87	0.55	0.36	0.74	2.04	26.9%
13-Sep-13	Friday	91	0.35	0.15	0.55	1.93	17.9%
19-Sep-13	Thursday	91	0.34	0.14	0.54	1.59	21.2%
30-Sep-13	Monday	78	0.23	0.03	0.43	1.22	18.8%
2013 Average	n/a	n/a	**0.60**	**0.48**	**0.72**	**2.48**	**24.1%**

Figure 5-1: Maximum Temperature and Absolute Load Reduction for Opt-in CPP with IHD Offer

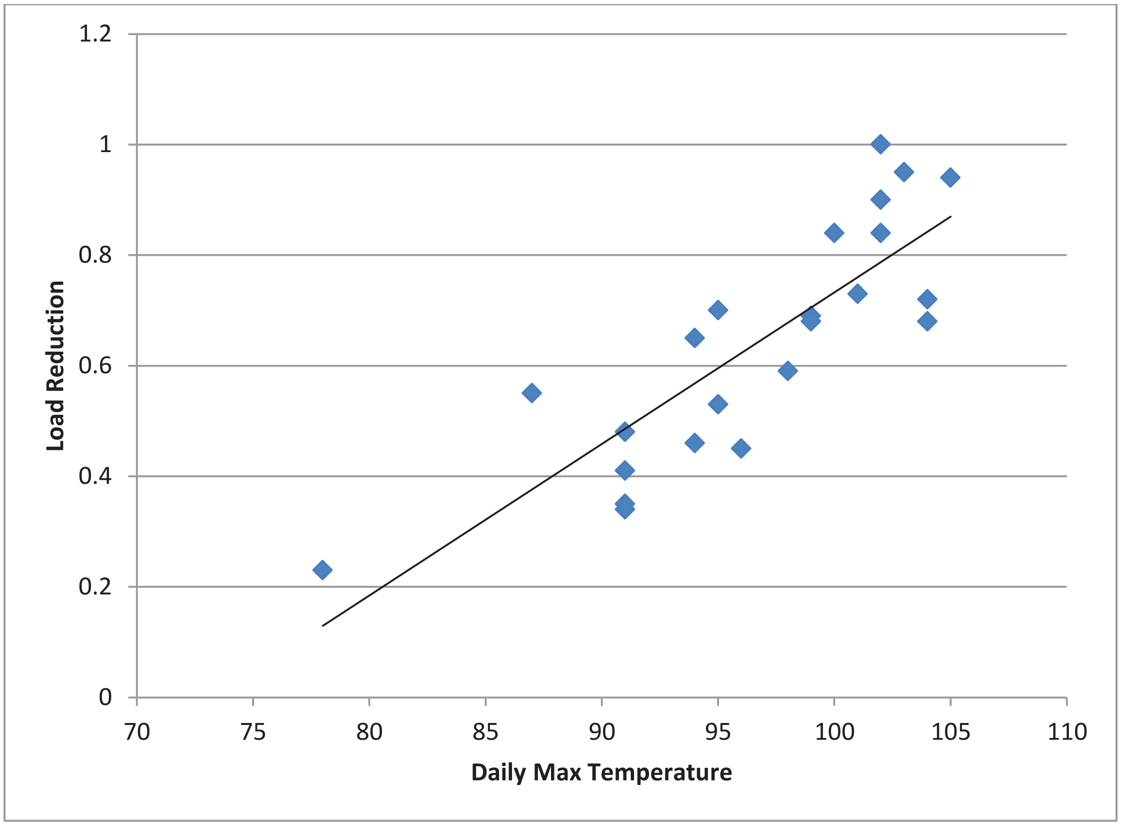
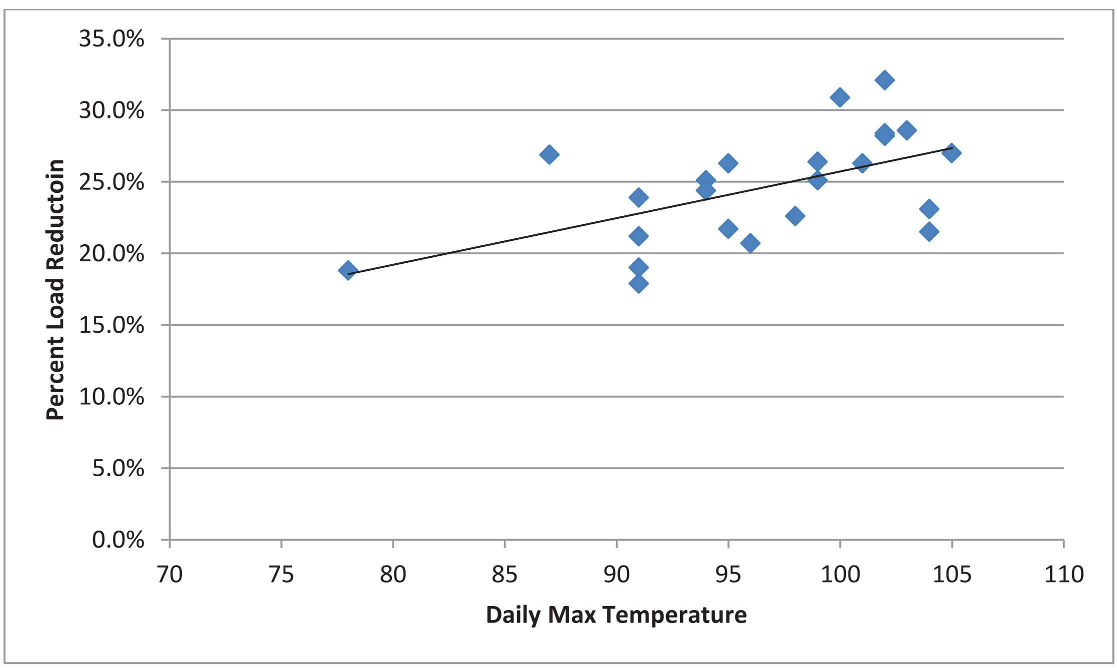


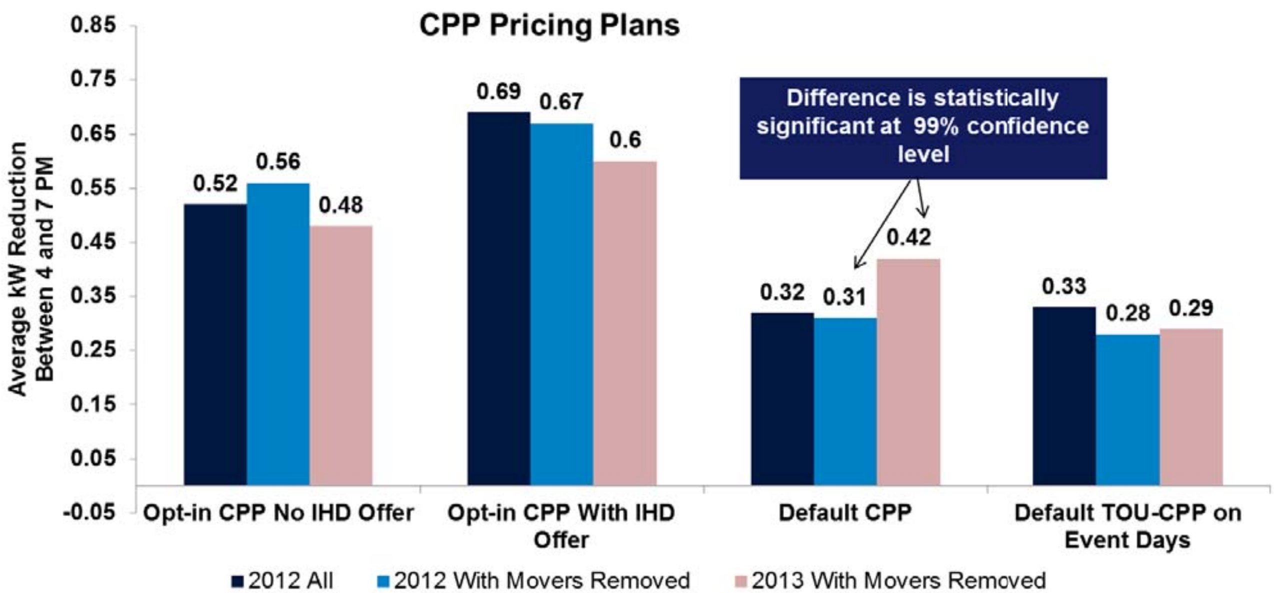
Figure 5-2: Maximum Temperature and Percentage Load Reduction for Opt-in CPP with IHD Offer



5.2 Impact Persistence

Figure 5-3 shows the load impacts for 2012 and 2013 for the population of customers who did not move over that time period. As was seen in Section 4.2 for the TOU pricing plans, after controlling for movers, differences across years were statistically significant for only one of the four pricing plans, in this case for the default CPP plan. It should be noted that the significant difference shows an increase in impacts in the second summer, not a decrease. It would appear that default customers who stayed on the pricing plan became more adept at responding to CPP event notifications than they were in the first summer.

Figure 5-3: Load Impacts for Each Summer for CPP Customers Who Did Not Move During the Study Period



5.3 Load Impacts by Customer Type

Table 5-5 shows the average load impact across event days in both years by pricing plan and EAPR status. In all cases, the impact estimates for non-EAPR customers are larger than for EAPR customers, although for the default TOU-CPP plan, the difference is relatively small. The load impact for EAPR customers for the opt-in CPP plan with no IHD offer is negative and not statistically significant. However, the sample size for this group is quite small, with 65 customers on average in summer 2012 and only 51 customers on average in summer 2013. As such, it may be inappropriate to conclude from this evidence that EAPR customers on this pricing plan are unresponsive to the CPP price signal. It may simply be that the magnitude of their price responsiveness is too small to detect given the small sample size for this group. When comparing impacts between EAPR and non-EAPR customers, it is important to note the percentage impact as well as the absolute impact. Depending on the pricing plan, there is a 10% to 35% difference in reference loads between EAPR and non-EAPR customers and this difference explains some of the difference in absolute impacts.

Table 5-5: 2012/2013 Average Load Impacts by EAPR Status for CPP Pricing Plans

Group	EAPR					Non-EAPR				
	Impact	95% CI Lower	95% CI Upper	Reference Load	% Impact	Impact	95% CI Lower	95% CI Upper	Reference Load	% Impact
Opt in CPP, No IHD	-0.03	-0.38	0.32	1.84	-1.7%	0.69	0.38	1.00	2.51	27.6%
Opt in CPP, IHD Offer	0.30	0.16	0.44	2.18	13.7%	0.76	0.63	0.88	2.65	28.6%
Default CPP-TOU	0.26	0.13	0.40	2.23	11.9%	0.32	0.23	0.40	2.60	12.3%
Default CPP	0.22	0.10	0.35	2.35	9.5%	0.40	0.31	0.49	2.61	15.2%

Table 5-6 shows the average load impacts by pricing plan and usage quartile based on average summer usage. Estimated load impacts are between 4 and 7 times larger for customers in the highest usage quartile compared to those in the lowest. Much of this variation is due to differences in the reference loads, which are between 5 and 6 times larger for high quartile customers compared to the lowest quartile group. The percentage impacts are relatively constant across usage quartiles. Once again, when comparing impacts across pricing plans, it is important to keep in mind that the opt-in sample sizes for the CPP group with no IHD is small, with only about 50 customers in each of the four usage bins. The samples sizes for all of the other plans are reasonably large, with between 150 and 350 in each bin for each pricing plan. The significant increase in the magnitude of the absolute load reductions as usage increase suggests that any opt-in program will likely be more cost effective it if targets high users unless such users are significantly less likely to enroll in the program.

Table 5-6: 2012/2013 Average Load Impacts by Usage Quartile for CPP Pricing Plans (Bin 1 is the lowest usage quartile, Bin 4 is the highest usage quartile)

Group	Bins	Reference Load	Impact	Percent Impact	95% CI Lower	95% CI Upper
Opt in CPP, No IHD Offer	1	0.72	0.16	21.9%	-0.07	0.38
	2	1.65	0.40	24.0%	-0.02	0.81
	3	2.63	0.58	22.2%	0.11	1.06
	4	4.27	1.04	24.3%	0.08	1.99
Opt in CPP, IHD Offer	1	0.83	0.26	31.3%	0.14	0.38
	2	1.76	0.53	29.8%	0.38	0.67
	3	2.68	0.72	26.9%	0.52	0.92
	4	4.06	1.05	25.7%	0.76	1.34
Default TOU-CPP, IHD Offer	1	0.68	0.11	16.3%	0.03	0.19
	2	1.45	0.16	11.2%	0.05	0.27
	3	2.22	0.35	15.8%	0.20	0.50
	4	3.75	0.59	15.6%	0.39	0.79
Default CPP, IHD Offer	1	0.73	0.15	20.6%	0.07	0.23
	2	1.50	0.23	15.3%	0.12	0.34
	3	2.42	0.41	16.7%	0.25	0.56
	4	3.90	0.62	16.0%	0.41	0.84

5.4 Load Impacts Outside the Peak Period

Table 5-7 shows the estimated impacts for the two hours immediately before and after the event period for the average event day. This analysis focuses on determining if pre-cooling behavior occurs before the event period and if a snapback effect can be observed after the event period when customers might adjust their thermostat to a cooler temperature or conduct activities that they avoided doing during the high priced event period. The values in the table for the pre-peak period represent the hours from 2 to 4 PM and the post event hours are from 7 to 9 PM. For two of the four groups, opt-in CPP with no IHD offer and default TOU-CPP, there are no statistically significant impacts in the pre-event period. In the post event period, the impacts are not statistically significant for three of the four pricing plans. Impacts in both the pre- and post-event periods are statistically significant for the opt-in CPP plan with the IHD offer. Notably, the post-treatment effect shows that the peak period reductions continue beyond the event period rather than translate into a snapback effect as is sometimes seen with load control and other demand response programs. The impact in the pre-treatment period is also statistically significant for the default CPP group. For the opt-in group with the IHD offer, the pre- and post-period load reductions, roughly 0.12 kW in both periods, are equal to about 20% of the estimated load reduction during the peak period. Similarly, the pre-event load reduction for default CPP is almost 20% of the peak period load reduction.

Table 5-7: 2012/2013 Impacts Before and After Peak Period on Event Days for CPP Pricing Plans

Group	Average Impact Pre-Peak (kW)	95% CI Lower	95% CI Upper	Average Impact Post-Peak (kW)	95% CI Lower	95% CI Upper
Opt-in CPP, No IHD Offer	0.01	-0.20	0.21	-0.11	-0.30	0.07
Opt-in CPP, IHD Offer	0.12	0.04	0.21	0.12	0.05	0.20
Default CPP, IHD Offer	0.07	0.02	0.12	0.04	-0.01	0.10
Default TOU-CPP, IHD Offer	0.04	-0.01	0.10	0.04	-0.02	0.09

From the perspective of cost-effectiveness, it is useful to know if there are spillover effects from event based tariffs on non-event days. Put another way, is there evidence that customers make behavioral adjustments that carryover to days on which the time-variant rate is not in effect. Table 5-8 shows the estimated load impacts during the peak period on nonevent days. The estimated peak period reduction on nonevent days is statistically significant for three of the four pricing plans, and is positive but insignificant for the opt-in CPP plan with no IHD offer. For two of the pricing plans, opt-in and default CPP with an IHD offer, the nonevent day impacts are roughly one quarter as large as the impacts on event days summarized in Table 5-2. For the default TOU-CPP plan, the nonevent day impacts are almost half as large as the event day impacts. The fact that the TOU-CPP impacts are as large as they are is logical since peak-period pricing is in effect on those days. However, there is no price signal in effect to drive demand reductions on nonevent days for the other two pricing plans. These results are consistent with the hypothesis that CPP customers may adjust their thermostat settings on all weekdays in order to avoid the higher event day prices and/or permanently adjust their behavioral patterns for other end uses on all weekdays.

Table 5-8: 2012/2013 Average Peak Period Impacts on Non-Event Days for CPP Pricing Plans

Group	Average Impact During Peak Hours on Nonevent Weekdays (kW)	95% CI Lower	95% CI Upper	% of Event Day Impact
Opt-in CPP, No IHD Offer	0.04	-0.13	0.21	8%
Opt-in CPP, IHD Offer	0.15	0.08	0.21	23%
Default CPP, IHD Offer	0.10	0.06	0.15	28%
Default TOU-CPP, IHD Offer	0.14	0.09	0.19	45%

An important corollary of the above findings regarding statistically significant load reductions on nonevent days is that within-subjects analysis of load impacts based only on post treatment period data would significantly understate the load impacts on event days. Such analysis, which is often used to estimate impacts for CPP programs or pilots where randomly selected control groups are not available, relies on loads on hot-nonevent days to estimate reference loads. The evidence presented here showing significant reductions on these nonevent days means that this type of analysis will produce impact estimates that are downward biased. An alternative approach to impact estimation when randomly chosen control groups are not available is to develop a control group using statistical matching methods. If the matching is based on proxy days from the post treatment period, the bias would be the same as for a within-subjects analysis. On the other hand, if pretreatment data is used for matching, no such bias would exist. A comparison of load impacts based on the RCT/RED designs used in the SPO, within-subjects analysis and statistical matching can be found in Section 9 of the SPO Interim Report.

5.5 Overall Energy Savings

Table 5-9 contains estimates of overall energy savings for customers on CPP rates. In this analysis, the monthly usage of each treatment and control group was compared for each month across the two summers. Pretreatment data from the summer of 2011 was also included to account for any differences between the groups before the treatment began. For opt-in CPP with no IHD offer and default TOU-CPP, energy savings were small and were not statistically significant. However, for both the opt-in and default CPP groups that included an IHD offer, energy savings were equal to between 2.7% and 3.6% of average monthly electricity use. This result is consistent with the prior finding that these participants had large reductions during the peak period and also showed statistically significant reductions in the pre-event period. The opt-in group also showed statistically significant reductions in the post event period.

Table 5-9: 2012/2013 Average Energy Savings for CPP Pricing Plans

Group	Design	Average Summer Energy Savings (kWh)	95% CI Lower	95% CI Upper	Monthly Reference Load (kWh)	Impact as % of Reference Load
Opt-in CPP, No IHD Offer	RED	-7.7	-68.7	53.3	758	-1.0%
Opt-in CPP, IHD Offer		30.1	3.3	56.9	856	3.5%
Default CPP, IHD Offer		22.8	6.2	39.4	864	2.6%
Default TOU-CPP, IHD Offer		11.9	-8.6	32.4	885	1.3%

5.6 TOU Impacts on CPP Event Days

When comparing load impacts and cost-effectiveness for TOU and CPP pricing plans, it is useful to examine the load reductions from TOU rates under the same weather conditions as those that occur on CPP days since load impacts for TOU rates increase with temperature. Table 5-10 shows the average impact for both CPP and TOU rates across the 23 historical event days used in the analysis. For convenience, it also shows the average impacts for TOU plans on the average weekday, which were previously shown in Table 4-1. Table 5-11 shows the results from the tests to determine whether differences across pricing plans are statistically significant. Of particular interest is whether there are statistically significant differences in peak period reductions under CPP event-like weather conditions for CPP and TOU pricing plans.

Table 5-10: Peak Period Load Reductions for All Pricing Plans

Group	CPP Day Impacts			Average Weekday Impacts		
	Impact	Reference Load	% Impact	Impact	Reference Load	% Impact
Opt in TOU, IHD Offer	0.32	2.38	13.3%	0.21	1.79	11.9%
Opt in TOU, No IHD Offer	0.23	2.24	10.1%	0.16	1.72	9.4%
Opt-in CPP, IHD Offer	0.64	2.53	25.1%	n/a	n/a	n/a
Opt-in CPP, No IHD Offer	0.49	2.33	20.9%	n/a	n/a	n/a
Default TOU, IHD Offer	0.15	2.47	5.9%	0.11	1.86	5.8%
Default CPP, IHD Offer	0.36	2.56	14.0%	n/a	n/a	n/a
Default TOU-CPP, IHD Offer	0.31	2.54	12.3%	0.17	1.91	8.7%

As seen in Table 5-10, impacts for TOU pricing plans are significantly higher on CPP days than on the average summer weekday. The ratio of load reductions on CPP days to non-CPP days ranges from a low of 1.25 for default TOU to a high of 1.91 for the opt-in TOU plan with no IHD offer. The ratios for the default TOU-CPP plan and the opt-in TOU plan with the IHD offer are 1.82 and 1.52, respectively. For three of the four pricing plans, these differences are largely due to differences in the reference loads between CPP and non-CPP days, as indicated by little change in the percentage load reductions on the two day types. For the default TOU-CPP plan, the percentage load reduction is higher on CPP days than on non-CPP days. This is logical since prices are also higher on CPP days for this pricing plan.

Table 5-11 shows the results of statistical tests to determine whether the load impacts are significantly different between TOU and CPP rates on CPP days for the relevant comparisons. As seen, CPP pricing plans produce significantly greater impacts on CPP days than TOU plans in all cases, which is to be expected since prices are significantly higher under CPP plans compared with comparable TOU plans. In each relevant comparison, the load reductions are roughly twice as large under the CPP plan compared with the comparable TOU plan.

Table 5-11: Pairwise Comparison of Load Reductions for CPP and TOU Pricing Plans on CPP Days

Group	Opt-in TOU, IHD Offer	Opt-in TOU, No IHD Offer	Default TOU, IHD Offer
Opt-in CPP, IHD Offer	0.00**	n/a	n/a
Opt-in CPP, No IHD Offer	n/a	0.05*	n/a
Default CPP, IHD Offer	n/a	n/a	0.00**

*Statistically significant at the 90% level; ** Statistically significant at the 99% level

6 The Influence of In Home Displays

SMUD's SPO was designed to assess the impact of the offer of an IHD on customer acceptance of opt-in time-variant pricing plans by marketing TOU and CPP rates with and without the offer of an IHD. This issue is analyzed in Section 8. As discussed there, the offer of a free IHD does not increase customer acceptance rates for the time-variant pricing plans included in the SPO.

Another useful investigation concerns the acceptance of and connection rates for IHDs among treatment groups that received an IHD offer. What percent of customers who received an IHD offer accepted it and what percent of those customers receiving an IHD connected the device with their meter? These issues are discussed below in Section 6.1. A related issue concerns the characteristics of customers who do and don't request an IHD when given the option and who do and don't connect the device once it is received. These issues are discussed in Section 6.2.

A third important issue is whether IHDs influence consumer electricity use. The SPO was designed to determine if there are differences in load impacts for customers who were *offered* an IHD as part of the rate offer, and those who were *not offered* an IHD as part of the rate offer. As seen in Sections 4 and 5, there is some difference in load impacts across treatment cells that did and did not include an IHD offer. However, testing the load impact of an IHD *offer* is different from testing the load impact of an IHD, because many people who were offered an IHD did not accept one and many who accepted an IHD did not use it. Given the general interest in whether or not IHDs influence usage behavior, it is likely that some readers will draw conclusions about the influence of IHDs by observing these differences. To reduce the likelihood that readers will draw incorrect conclusions about the influence of IHDs on energy use and demand response, we examine this issue in Section 6.3.

6.1 IHD Acceptance and Use

As previously discussed, two of the opt-in treatment groups were also offered a free IHD if they enrolled on the rate. Acceptance of the IHD was not a condition of going on the pricing plan. Opt-in customers could indicate at the time of enrollment whether or not they wanted the IHD. If they did, the IHD was mailed to them pre-commissioned, so that when they unpacked it and turned it on, it was supposed to automatically connect with their meter and start displaying information.

All customers selected for the default pricing plans were offered a free IHD. Because customers were automatically enrolled unless they opted-out, there was not the same opportunity to simply "check a box" at the time of enrollment to indicate whether or not they wanted an IHD. Instead, those who wanted an IHD had to take a proactive step to request it. Put another way, the transaction costs associated with requesting an IHD were higher for default customers compared with opt-in customers. In addition, customer inertia may reduce acceptance rates for default customers compared with opt-in customers who were already engaged in a transaction when asked to indicate their interest in receiving an IHD. Once requested, as with the opt-in treatment groups, a pre-commissioned IHD was mailed to customers and all that was needed to use it was to unpack it and turn it on.

In summer 2012, SMUD was able to determine from the meter data management system the number of IHD devices that were connected to meters at any point in time but was not able to link those devices to individual customer accounts. However, in summer 2013, data became available that provided a daily log for each customer indicating whether or not their IHD was connected to their meter.[24] As such, for the second year of the pilot, it was possible to identify customers who had their IHDs connected during the entire summer, those who never had it connected during summer 2013, and those who were connected on some days and not on others.

For each treatment group, Table 6-1 shows the number of customers who requested an IHD at the beginning of the pilot, the IHD acceptance rate (the number accepting divided by the number offered), the number of customers who accepted an IHD that were still enrolled at the beginning of the summer period in 2013 and, of those, the percent that had their device connected with their meter during the entire summer, the percent that were connected at some point in time during summer 2013 and the percent that were never connected in 2013.

Table 6-1: IHD Acceptance and Connection Rates

Group	Enrolled 6/1/12	# That Accept IHD	Acceptance Rate	# of Customers With IHDs Still Enrolled as of 6/1/13	% Connected All the Time	% Connected Some of the Time	% Never Connected
Opt-in CPP, IHD Offer	1,569	1,498	95%	1,195	11.6%	27.4%	61.0%
Opt-in TOU, IHD Offer	2,092	2,017	96%	1,597	11.6%	22.8%	65.6%
Default TOU-CPP, IHD Offer	588	136	23%	112	18.8%	39.3%	42.0%
Default CPP, IHD Offer	701	167	24%	140	14.3%	42.9%	42.9%
Default TOU, IHD Offer	2,018	418	21%	363	18.2%	23.1%	58.7%

As seen in the table, roughly 96% of opt-in customers requested an IHD whereas fewer than 25% of default customers did so. As seen in the last three columns in the table, roughly two thirds of opt-in customers who accepted an IHD and who were still enrolled at the beginning of the 2013 summer never had their device connected in 2013. This “never connected rate” was much lower for two of the three default groups, equal to roughly 42% for the default TOU-CPP and CPP groups. The higher connection rate for default customers compared with opt-in customers is consistent with a hypothesis that, since default customers had to take a proactive step to request the device compared with the passive “check the box” approach for opt-in customers, they were more invested in using the device once it arrived. As

[24] Reporting functionality from the HAN Communication Manager (HCM) had not been established prior to the launch of the technology and took approximately a year after go-live to established automated reporting out of HCM. However, it should be noted that the functionality was available in HCM, but SMUD had not created business requirements to set-up that functionality before the program launch, primarily because reporting on IHD connectivity had not been part of the critical path for program launch or reporting to the DOE.

seen in Section 6.2, default customers who requested the device were much more engaged customers in that they had a higher propensity to participate in other SMUD programs. Why the "never connected rate" for default TOU customers is closer to that of opt-in customers than it is to that of the other default groups is unclear.

Although not shown in Table 6-1, it should be noted that roughly 70% of those who were connected some of the time had their devices communicating with their meters more than 50% of all summer days. Put another way, most of the customers that were connected some of the time were connected most of the time.

6.2 Customer Characteristics of IHD Users

For planning purposes, it is useful to examine the characteristics of customers who did and did not request an IHD and also the characteristics of those who had their IHD connected during the summer of 2013. Since nearly all opt-in participants requested an IHD, it was not possible to distinguish between those who did and did not request the technology for opt-in pricing plans. For default pricing plans, a binary outcome model (logit)[25] was estimated relating the likelihood of requesting an IHD to customer characteristics such as EAPR status, participation in other SMUD programs and other variables. Because the logit model is nonlinear, the estimated coefficients do not represent changes in the expected probabilities that would result from changes in the explanatory variables.[26] Such "marginal effects" provide meaningful interpretations of how different variables affect the likelihood of a given choice controlling for all other variables. For a logit model specification, marginal effects are calculated using a transformation of the parameter estimates that involves the logistic cumulative density function. Throughout the remainder of this report, the marginal effects (and not the estimated logit coefficients) are reported for all choice models.[27] The marginal effects show the change in the likelihood of the outcome variable given the presence of a particular characteristic for binary variables (e.g., participants in another SMUD program) or given a 1% change in the magnitude of a continuous variable (e.g., share of summer usage on peak).

Table 6-2 shows the marginal effects for a model relating the likelihood of requesting an IHD to customer characteristics. As seen in the first row of the table, the likelihood of requesting an IHD is 6% higher for EAPR pricing plan participants than for non-EAPR participants. There is no difference in the likelihood of requesting an IHD for CPP or TOU-CPP participants compared with TOU participants (as seen by the second and third rows in the table). The greater the share of summer electricity use that occurs during the peak hours from 4 to 7 PM, the greater the likelihood of requesting and IHD, but the magnitude of the influence is relatively small. A 10% increase in peak period usage as a percent of summer usage increases the likelihood of requesting an IHD by 1.6%. Participation in SMUD's EE

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25 Logit, probit and linear probability models were estimated and the alternative specifications produced results quite similar to those associated with the logit model.

26 The specification of the logit model is Pr(accepting/connecting IHD) = $\exp(x'\beta) / (1 + \exp(x'\beta))$, where the β terms are the coefficients to be estimated. This nonlinear specification ensures that the predicted probabilities will be between zero and one.

27 All reported marginal effects are average marginal effects (AME) as opposed to marginal effects at the mean (MEM) or marginal effects at representative values (MER).

loan/rebate, EnergyHelp, Green Energy and MyAccount programs increases the likelihood of requesting an IHD by 6 to 9%.

Table 6-2: Likelihood of Requesting an IHD for Default Pricing Plans

Variable	Marginal Effect	Interpretation
EAPR status	0.059**	EAPR customers are 6% more likely to request an IHD than non-EAPR customers
CPP pricing plan	0.026	Participants on the default CPP pricing plan are not more or less likely to request an IHD than those on the TOU pricing plan
TOU-CPP pricing plan	0.017	Participants on the default TOU-CPP pricing plan are not more or less likely to request an IHD than those on the TOU pricing plan
Share of summer 2011 kWh consumed on peak	0.159+	Participants that use more of their total summer usage during the peak period are more likely to request an IHD
Carbon Offsets program	0.050	Participation in the Carbon Offsets program is not correlated with the likelihood of requesting an IHD
Received EE loan or rebate	0.058**	Participants in the EE load/rebate program are 6% more likely to request an IHD
EnergyHelp program	0.079**	Participants in the EnergyHelp program are 8% more likely to request an IHD
Green Energy program	0.059**	Participants in the Green Energy program are 6% more likely to request an IHD
Customer enrolled in MyAccount	0.087**	MyAccount customers are 9% more likely to request an IHD

**p<0.01; *p<0.05; +p<0.1

As was seen in Table 6-1, many customers who requested and received IHDs did not have the device connected during the summer of 2013 when connection rate data became available. Tables 6-3 and 6-4 show the marginal effects from a logit model that relates the likelihood of having the IHD connected during the summer of 2013 to customer and rate characteristics. The dependent variable equals 1 if the device was connected at any point in time during summer 2013, and 0 if it was never connected during that summer. Table 6-3 shows results for the opt-in pricing plans and Table 6-4 shows the same results for default pricing plans.

As seen in Table 6-3, EAPR customers on the opt-in pricing plans who requested an IHD were less likely to have had it connected in 2013 than non-EAPR customers. Customers on the opt-in TOU pricing plan were less likely than those on the CPP plan to have their IHD connected. Opt-in customers in the Carbon Offsets and EE loan/rebate programs were more likely to have had their IHD connected, but participants in the EnergyHelp program were significantly less likely to have had their device connected.

Participation in the Green Energy program is not correlated with the likelihood of having the IHD connected. MyAccount customers were 12% more likely to have had their IHD connected than non-MyAccount customers.

Table 6-3: IHD Connection Likelihood for Opt-in Pricing Plans (Among those requesting and receiving an IHD, the likelihood of the IHD being connected at some time during summer of 2013)

Variable	Marginal Effect	Interpretation
EAPR status	-0.103**	EAPR customers are 10% less likely to have had their IHD connected
TOU pricing plan	-0.041*	Participants on the opt-in TOU pricing plan are 4% less likely to have had their IHD connected than participants on the opt0in CPP pricing plan
Share of summer 2011 kWh consumed on peak	0.003**	Participants that use more of their total summer usage during the peak period are slightly more likely to have their IHD connected
Carbon Offsets program	0.153+	Carbon Offset customers are 15% more likely to have their IHDs connected (with confidence interval of 90%)
Received EE loan or rebate	0.066**	Participants in the EE loan or rebate program are 7% more likely to have their IHDs connected
EnergyHelp program	-0.102*	EnergyHelp participants are 10% less likely to have their IHDs connected
Green Energy program	0.022	Participation in the Green Energy program is not correlated with the likelihood of having an IHD connected
Customer enrolled in MyAccount	0.121**	MyAccount customers are 12% more likely to have their IHDs' connected

**p<0.01; *p<0.05; +p<0.1

Table 6-4 shows the marginal effects from the connection model for the default pricing plans. As with the opt-in plans, EAPR customers were less likely to have had their device connected in 2013 than non-EAPR customers. Participants in the CPP and TOU-CPP pricing plans were 15% more likely than TOU customers to have had the device connected, indicating that participants on dynamic rates may see greater value in using the IHD than those on static time-variant rate options. Customers that have higher usage on peak were slightly more likely to have had their device connected. Unlike with the opt-in plans, participation in other SMUD programs, except for MyAccount, was not correlated with the likelihood of having the IHD connected.

Table 6-4: IHD Connection Likelihood for Default Pricing Plans (Among those requesting and receiving an IHD, the likelihood of the IHD being connected at some time during summer of 2013)

Variable	Marginal Effect	Interpretation
EAPR status	-0.081+	EAPR customers are 8% less likely to have had their IHD connected
CPP pricing plan	0.147**	Participants on the default CPP pricing plan are 15% more likely to have had their IHD connected than participants on the default TOU pricing plan
TOU-CPP pricing plan	0.148**	Participants on the default TOU-CPP pricing plan are 15% more likely to have had their IHD connected than participants on the default TOU pricing plan
Share of summer 2011 kWh consumed on peak	0.005*	Participants that use more of their total summer usage during the peak period are slightly more likely to have their IHD connected
Carbon Offsets program	-0.078	Participation in the Carbon Offsets program is not correlated with the likelihood of having the IHD connected
Received EE loan or rebate	-0.014	Participation in the EE load/rebate program is not correlated with the likelihood of having the IHD connected
EnergyHelp program	-0.114	Participation in the EnergyHelp program is not correlated with the likelihood of having the IHD connected
Green Energy program	0.058	Participation in the Green Energy program is not correlated with the likelihood of having the IHD connected
Customer enrolled in MyAccount	0.163**	MyAccount customers are 16% more likely to have their IHDs' connected

**p<0.01; *p<0.05; +p<0.1

6.3 Load Impacts for Treatments With and Without an IHD Offer

As indicated previously, the SPO was designed primarily to examine the impact of the offer of an IHD on customer acceptance of time-variant rate options. The empirical evidence summarized in Section 8 shows that an IHD offer does not influence customer acceptance of the pricing plans. However, it is possible that those who accept an IHD respond more than those who do not. A comparison of load impacts for TOU and CPP plans with and without an IHD offer is a measure of the incremental effect of the offer, not necessarily the incremental impact of use of the IHD.

One estimate of the effect of the offer of an IHD on energy use can be developed by comparing the load reduction for opt-in TOU with and without an IHD offer and opt-in CPP with and without an IHD offer in

Tables 4-1 and 5-2. For the TOU case, the estimated load reduction for the opt-in TOU group receiving an IHD offer is 0.21 kW (for the two summers combined). Without an IHD offer, the impact is 0.16 kW. For the opt-in CPP plan, the estimated impacts with and without an IHD offer are 0.64 kW and 0.49 kW respectively. As seen in Table 4-2, the 0.05 kW difference for the TOU plan is statistically significant at the 90% confidence level. As seen in Table 5-3, although the 0.15 kW difference between the two groups for the CPP pricing plan is larger than the difference for the TOU plan, it is not statistically significant at the 90% confidence level, perhaps due to the small sample size for the opt-in CPP treatment with no IHD offer, which was roughly 200 in 2012 and had dwindled to roughly 150 by the end of the 2013 summer.

While it is tempting to consider these differences to equal the impact of the IHD offer on demand, and even more tempting to attribute the difference to the impact of the IHD, not just the offer, both conclusions are incorrect. The first is incorrect because the estimate does not take into account pretreatment differences between the groups that were and were not offered the IHD. Each estimate itself is internally valid and is based on a difference-in-differences regression, but the difference between the two estimates does not factor in pretreatment differences between the groups. As seen in Figures 6-1 and 6-2, there are small but meaningful differences in usage between the two groups during the pretreatment period. The difference during the peak period on the average weekday for the TOU groups is 0.06 kW and the difference for the CPP groups is 0.20 kW. When these pretreatment differences are subtracted from the observed difference during the treatment period, the estimated impact of the IHD is essentially 0 in the case of the TOU plan and is actually negative for the CPP plan. Put another way, after correcting for pretreatment differences, the offer of the IHD does not influence demand response for opt-in pricing plans.

Figure 6-1: Usage by TOU Opt-in Customers With and Without an IHD Offer

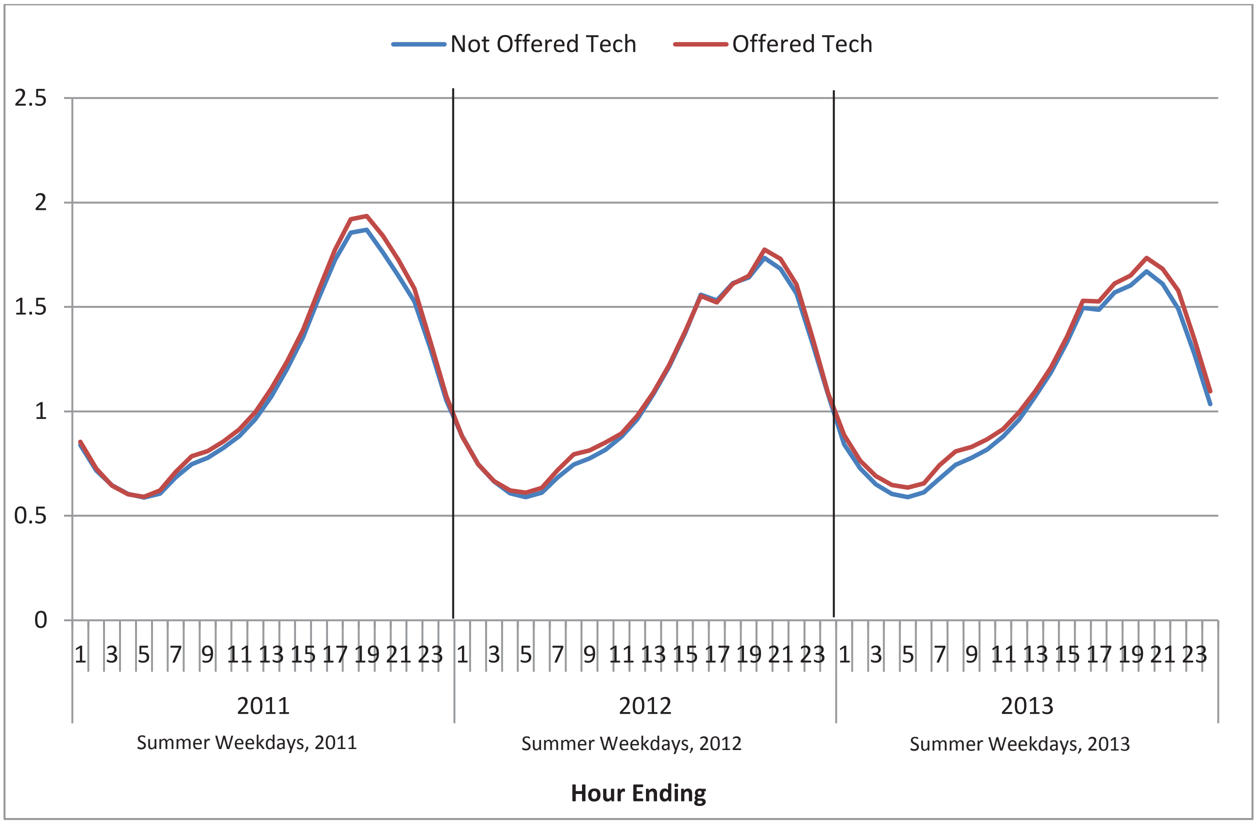
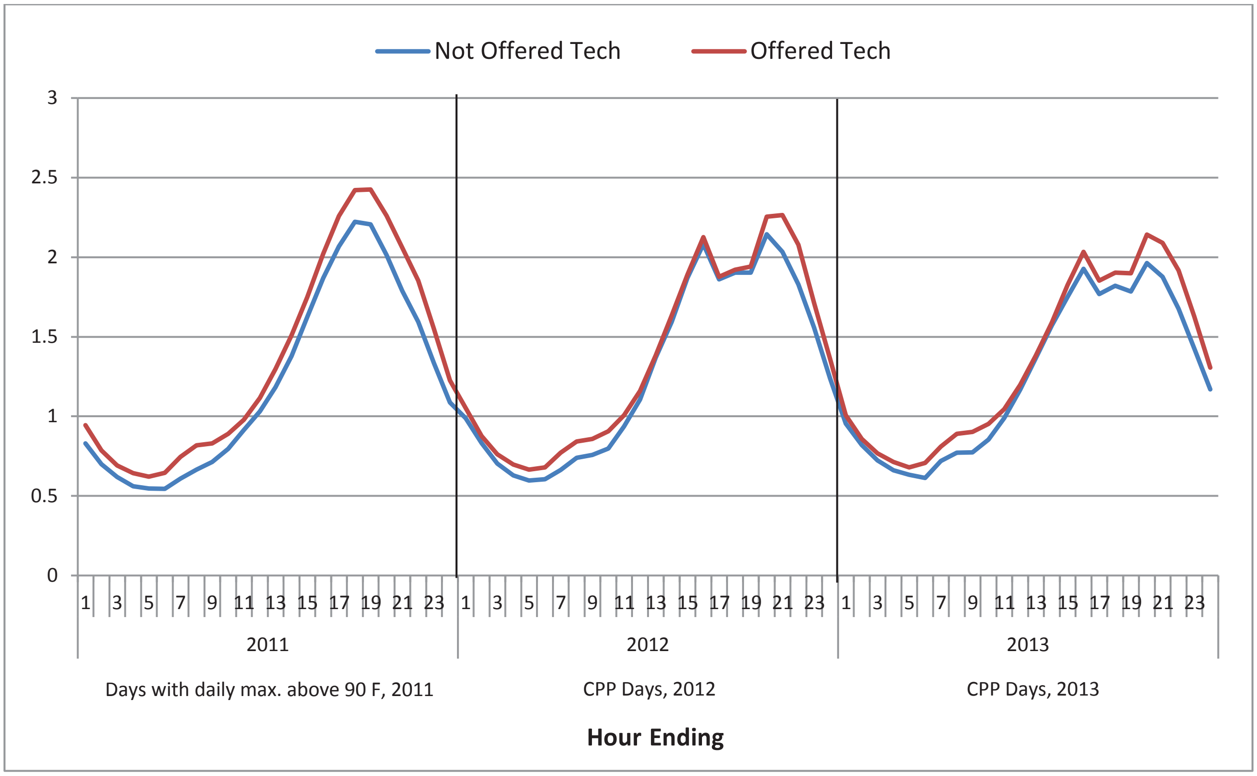


Figure 6-2: Usage by CPP Opt-in Customers With and Without IHD Offer



As previously discussed, nearly everyone in the opt-in pricing plans accepted an IHD although many did not connect it. A relevant question is whether those who did connect the device were more responsive to the price signals than those who did not. Figures 6-3 and 6-4 show hourly usage for opt-in TOU and opt-in CPP customers, respectively, during the pretreatment and treatment periods for customers that had their devices connected at least some of the time during the summer of 2013 and those that did not. Also included in the figures are loads for customers in the treatment groups who were not offered an IHD.[28]

Looking first at the opt-in TOU pricing plan (Figure 6-3), several things are noteworthy. Those who had their IHDs connected some or all of the time in 2013 had higher pretreatment peak period loads than those who did not. Those who were not connected (the largest share by far) had pretreatment loads nearly identical to TOU customers that were never offered an IHD. Connected customers were much more responsive than those who were not connected and also more responsive than those who were never offered an IHD. As evidenced by the pretreatment difference in loads, there is a strong selection effect among those who were connected. These customers are "peakier" and much more responsive than those that were not connected, but this greater responsiveness cannot be attributed to use of the IHD. While it is possible that some of this difference is attributable to the IHD, it is also possible that the entire difference is due to selection effects and that these customers are simply much more engaged in

[28] It should be noted that the pretreatment period loads for TOU customers are for the average weekday but the pretreatment loads for CPP customers are for days in which the average temperature during the peak period exceeded 90°F as these hot days are more representative of CPP event days.

managing their energy use than non-connected customers and that this engagement effect explains why they kept the IHD connected during this period and also why they responded more to the price signal.

Figure 6-3: Usage by Opt-in TOU Customers With Devices Connected and Not Connected in Summer 2013

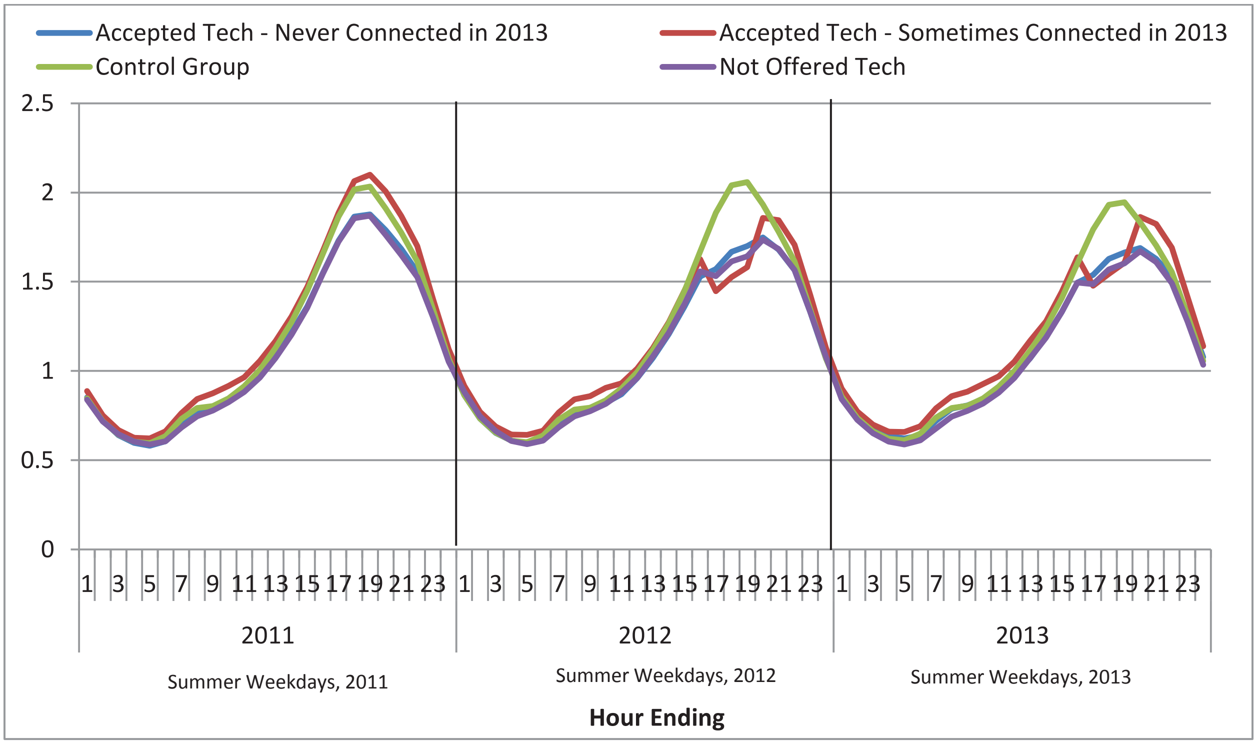
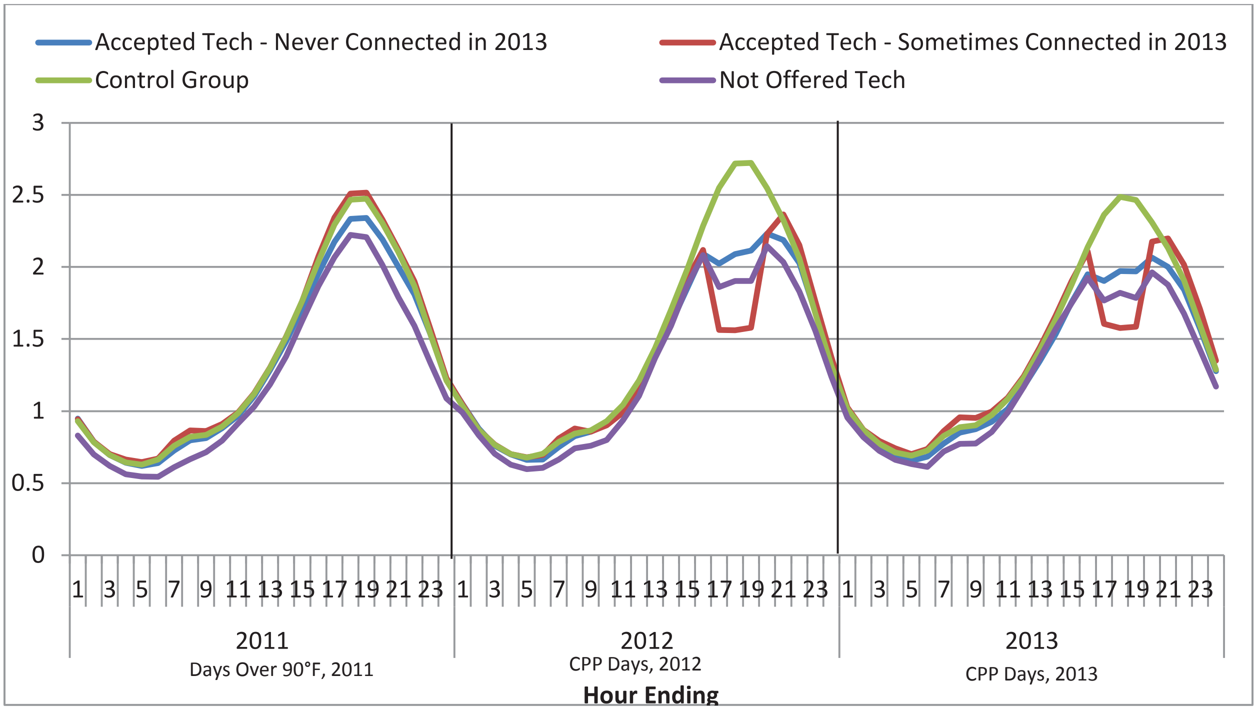


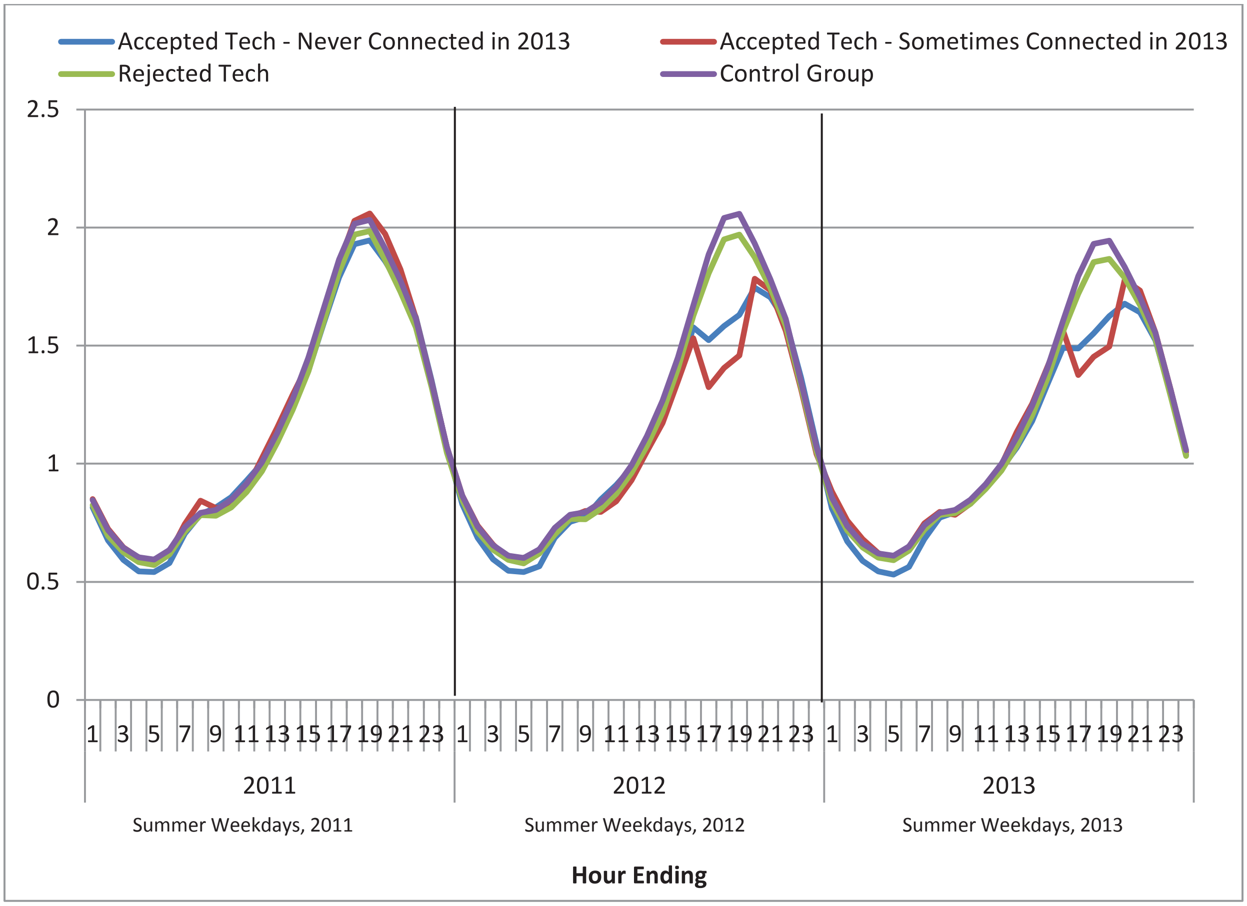
Figure 6-4: Usage by Opt-in CPP Customers With Devices Connected and Not Connected in Summer 2013



The same basic patterns observed for the opt-in TOU plan are seen for the opt-in CPP plan. Those who kept their devices connected during the summer of 2013 were much more responsive than those who did not. In this instance, however, there is a difference in the pretreatment period between those who accepted the IHD but were not connected in 2013 and those who were not offered the IHD.

Figures 6-5 through 6-8 show load shapes on the default pricing plans that were and were not connected. They also show loads for customers who rejected the offer of an IHD and for the control group for each pricing plan. As seen in Figure 6-5, customers who accepted an IHD offer were much more price responsive than those who did not. Indeed, the average response for those who did not appears to be minimal, although there is some reduction in usage during the peak period over the two years compared with the control group, but not enough to show the notch during the peak period that depicts a strong load reduction as is seen for the IHD accepting group.

Figure 6-5: Usage by Default TOU Customers who Did and Did Not Accept an IHD



Figures 6-6 and 6-7 both pertain to the default TOU-CPP plan. The first figure shows loads for the average weekday while the second represents loads on CPP days (and hot days during the pretreatment period). Figure 6-8 is for default CPP customers. In all cases, the same basic patterns are observed, the most notable being the strong selection effects at work for those who accepted an IHD and, among that group, those who were and were not connected in 2013.

Figure 6-6: Usage by Default TOU-CPP Customers who Did and Did Not Accept an IHD (Average Summer Weekday)

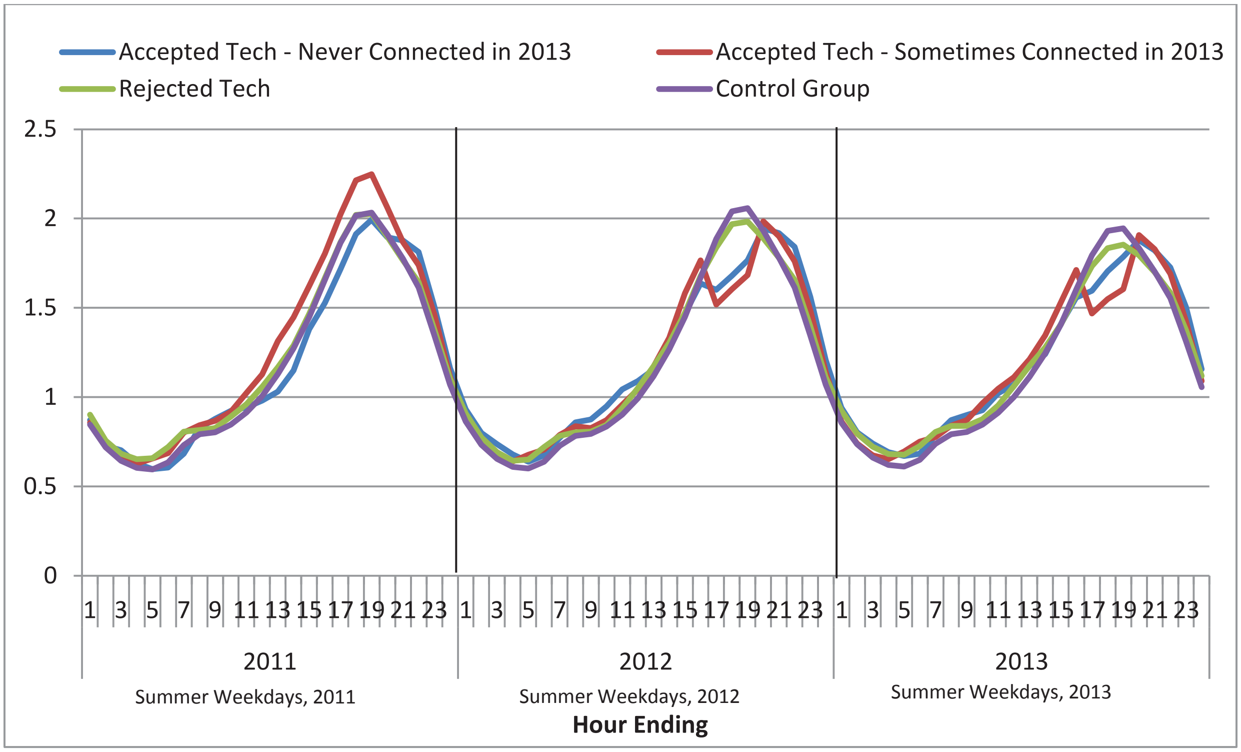


Figure 6-7: Usage by Default TOU-CPP Customers who Did and Did Not Accept An IHD (Hot, Non-event Days for Pretreatment Period)

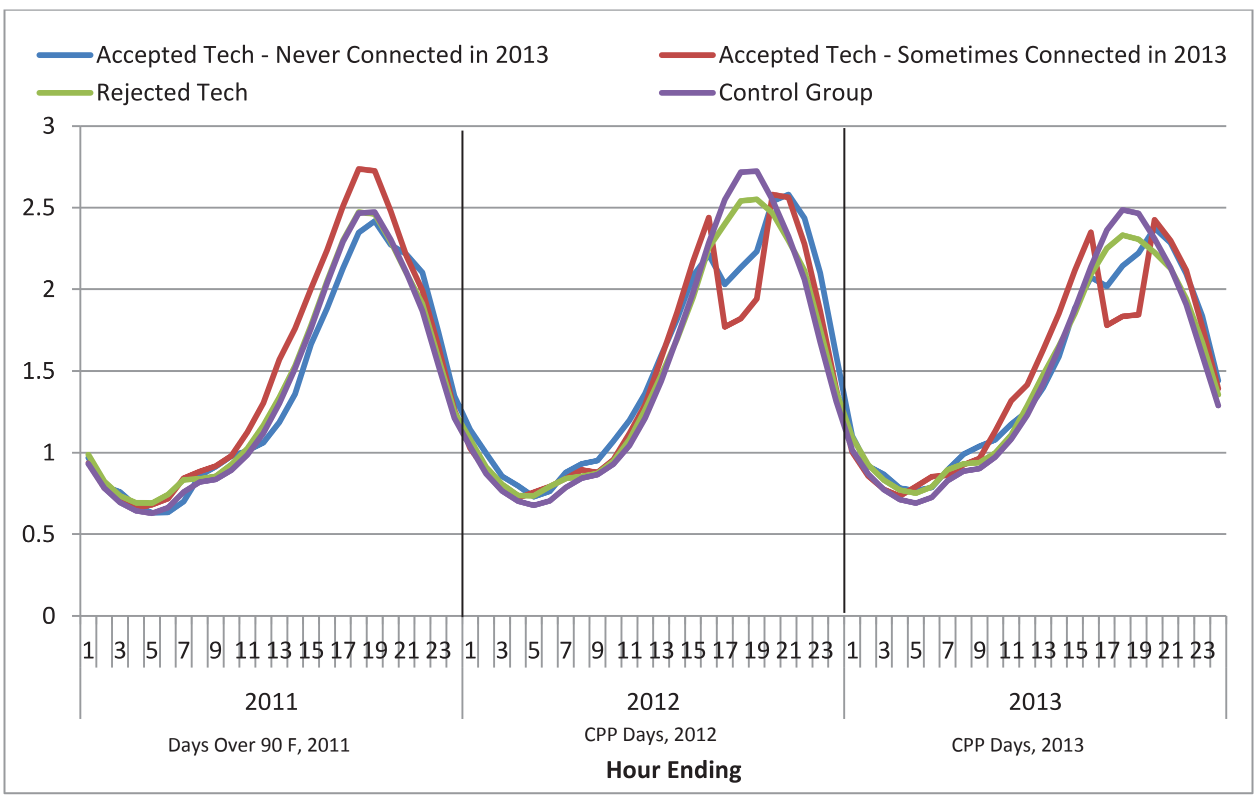
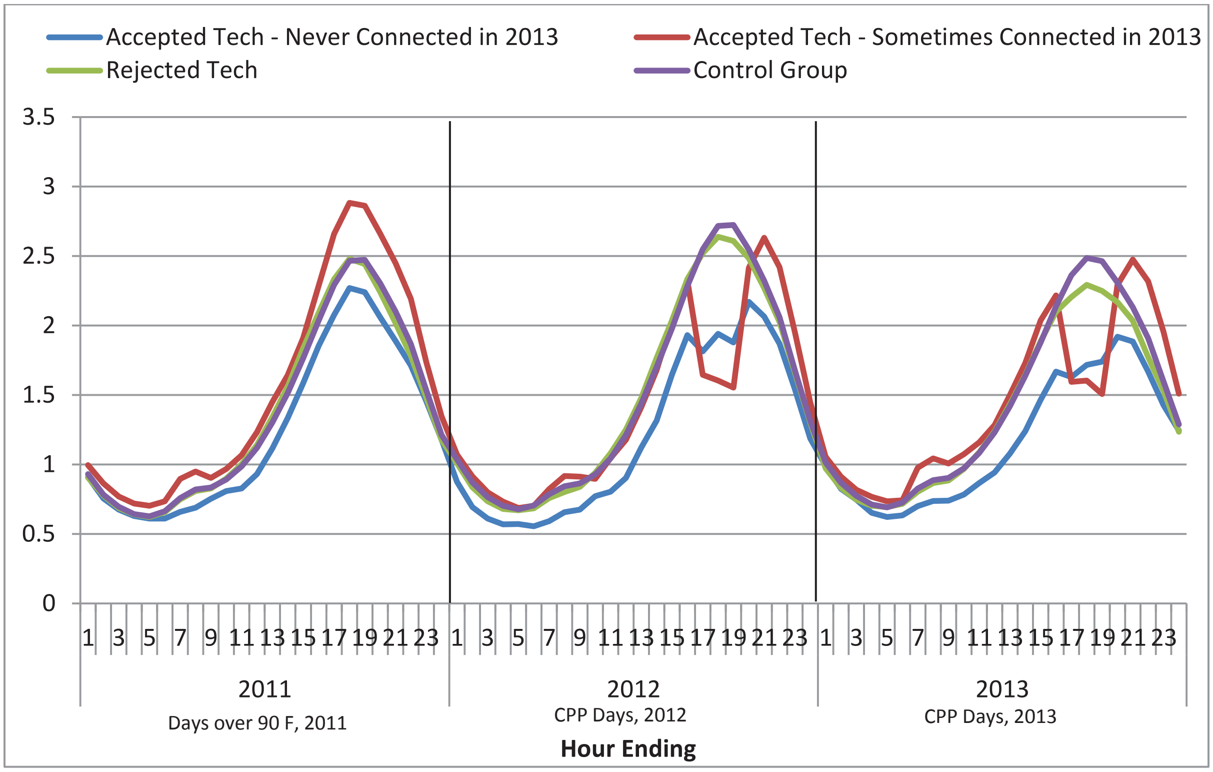


Figure 6-8: Usage by Default CPP Customers who Did and Did Not Accept An IHD



7 Price Elasticity Estimation

One of the primary goals of the SPO pilot was to determine the degree to which residential customers in SMUD's service territory respond to the price signals associated with time-varying rates. The impact estimates summarized in Sections 4 and 5 show that the average participant reduced load in response to the specific price signals tested in the SPO pilot. There is also interest in predicting how demand response might change if SMUD were to offer similar pricing plans but with different price ratios and levels than were tested in the SPO pilot. Price elasticities are a simple metric that quantifies the relationship between changes in price and changes in energy use. This section documents the development of price elasticity estimates based on the SPO results and shows how they can be used to predict changes in energy use as a function of changes in peak and off-peak prices.

7.1 Analysis Methodology

The SPO pilot was not designed specifically to estimate price elasticities for each pricing plan. A pilot designed to estimate price elasticities for a specific pricing plan would ideally involve multiple test cells, each with a different set of peak and off-peak prices.[29] This was not done in the SPO. However, by pooling customers across pricing plans, additional variation in prices can be included in the estimating database. As evidenced by the impact estimates summarized in Sections 4 and 5, price responsiveness appears to vary between customers who enroll through opt-in and default recruitment strategies. Elasticities may also vary between EAPR and non-EAPR customers. As such, the demand modeling summarized below that produces price elasticity estimates was done separately for opt-in and default plans and for EAPR and non-EAPR customers within the default and opt-in pricing plans. That is, the analysis produces four sets of price elasticities.

A structural economic model of demand is used to estimate price elasticities. The model is consistent with the neoclassical theory of utility maximization in which customers are assumed to consume the amount of electricity that maximizes their well-being subject to a budget constraint that is influenced by prices. Estimating a structural model requires the specification of a functional form for the demand equations that represent consumer preferences. In this study, the constant elasticity of substitution (CES) functional form is used. This function has been widely used in the analysis of electricity pricing experiments, including California's Statewide Pricing Pilot.[30] The CES model is comprised of two equations. The first equation expresses the ratio of peak and off-peak energy use as a function of an intercept term and the ratio of peak and off-peak prices.

$$ln\left(\frac{Q_1}{Q_2}\right) = a_{12} + b_{12} * ln\left(\frac{P_1}{P_2}\right) \quad (7\text{-}1)$$

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[29] For an example of a pilot that included multiple prices for each rate option, see George and Faruqui, *Impact Evaluation of California's Statewide Pricing Pilot*. Final Report, March 16, 2005. http://www.energyarchive.ca.gov/demandresponse/documents/group3_final_reports/2005-03-24_SPP_FINAL_REP.PDF

[30] *Ibid*

where Q_i is electricity use (kWh/hour) in period *i* in and P_i is the price of electricity in period *i*. The term a_{12} is the intercept and b_{12} is the elasticity of substitution, which measures the degree of substitutability between the peak and off-peak periods for a given set of prices. Equation 7-1 captures tradeoffs in electricity consumption that occur between rate periods in the same day.

The second equation in the CES model pertains to daily electricity consumption and has the following specification:

$$ln(Q_d) = c + d * ln(P_d) \quad (7\text{-}2)$$

In this equation, Q_d is the total electricity consumed in a day and P_d is the average price for that day, which is a weighted average of the peak and off-peak prices. Equation 7-2 is often called the daily equation since it captures changes in electricity consumption at the daily level that result from changes in prices and the term *d* is the daily price elasticity.

Taken together, Equations 7-1 and 7-2 form a system of equations that can be estimated using a dataset consisting of electricity consumption for a large number of customers at the daily level in the post-treatment period (summer 2012 and summer 2013). Such a dataset was constructed using customer load data and information on each customer's experimental pricing plan. Econometric estimation adds idiosyncratic error terms to both equations and the resulting equations were then estimated jointly using seemingly unrelated regression (SUR) in Stata. As mentioned earlier, separate models were estimated for four combinations of pricing plans that vary based on whether customers were enrolled on a default or opt-in basis and whether or not they faced EAPR or non-EAPR prices.

Because of the tiered nature of the SPO rates, there is a simultaneity problem that must be addressed during the estimation process. In order to properly estimate the parameters of the model, the relationship between prices and quantities must flow in only one direction – namely the prices are allowed to influence the amount of electricity consumed in each period, but the amount of electricity consumption cannot influence the prices. With a tiered rate structure in which the price of electricity increases after a certain amount of electricity has been consumed each month, this condition is violated since the amount of electricity consumption determines the price in each period and also affects the weights that are used to calculate the average daily price.

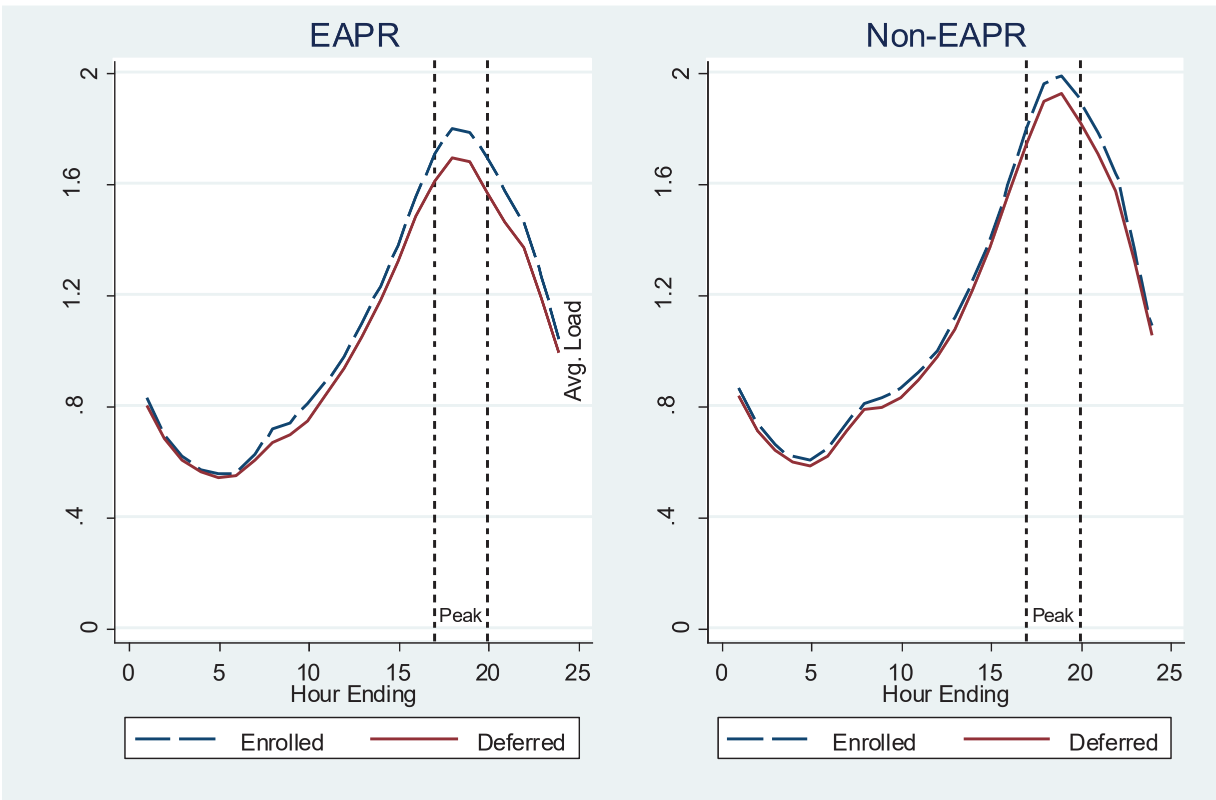
To avoid the simultaneity problem, the average electricity consumption of the relevant control group was used to determine the applicable tier for the average customer and also to weight the peak and off-peak prices used to calculate the average daily price.[31] The practical result of this solution is that all customers face only the base usage prices since the average consumption of the control groups is below the base usage threshold.

During the course of the analysis, it was discovered that pre-treatment load differences existed between customers who chose to enroll in the opt-in TOU rate and those who accepted the rate offer but were deferred (the de-facto control group). These pre-treatment loads are shown in Figure 7-1. For both

[31] These average values were calculated both on CPP and non-CPP days to allow for some difference between very hot days and more mild days.

EAPR and Non-EAPR customers, the enrolled group has noticeably higher average loads, particularly during the peak period (hours ending 17-20). The result of this pre-treatment difference in the CES model that utilizes only post-treatment data is that reductions in peak period consumption due to the increase in the peak period price appear smaller than they are in reality, which causes the model to underestimate the peak period elasticities.[32] In a similar fashion, any increases in off-peak consumption that are caused by the price change will appear larger than the change that actually occurred, which will again result in biased elasticity estimates. To correct for these problems, only the deferred control group and the opt-in CPP group were used to estimate elasticities for opt-in customers.

Figure 7-1: Pre-treatment Summer Loads for Enrolled and Deferred TOU Customers



7.2 Price Elasticity Estimates

Parameter estimates from the CES model are shown in Table 7-1. Values for the elasticities vary substantially across default and opt-in pricing plans and EAPR and non-EAPR customers. Specifically, non-EAPR customers appear more willing to shift consumption from the peak to off-peak period than EAPR customers and customers on default rates are less willing to shift than opt-in customers. These findings are consistent with those reported elsewhere. For example, in the impact evaluation of California's Statewide Pricing Pilot, CARE customers, which, like EAPR customers, qualify based on income and receive significant price discounts, showed very little price responsiveness. Similarly,

32 This pretreatment difference was corrected for when estimating the impacts reported in Section 4 through the use of the difference-in-differences regression methodology.

numerous evaluations of PG&E's SmartRate critical peak pricing program have shown that CARE customers provide significantly smaller demand reductions than do non-CARE customers.

Table 7-1: CES Parameter Estimates

Elasticity	Default Non-EAPR	Default EAPR	Opt-in non-EAPR	Opt-in EAPR
Elasticity of Substitution	-.069**	-.024**	-.183**	-.089**
Daily Elasticity	-.030**	.019	-.035**	-.011

Note: ** = significant at 99% level, * = significant at 95% level

The elasticity of substitution and daily price elasticity estimates found here are comparable to those found in California's Statewide Pricing Pilot. The elasticity of substitution during the hotter summer months found in that study for the CPP rate for customers in the hottest climate zone (comparable to SMUD's service territory) was -0.127 and the daily price elasticity was -0.033.[33] These values represent the combined population of CARE and non-CARE customers. Roughly one third of SMUD's pilot participants are EAPR customers. If we calculate a weighted average elasticity from Table 7-1 for the opt-in pricing plans, for example, based on a split of 30% EAPR and 70% non-EAPR customers, the elasticity of substitution would equal -0.155 and the daily price elasticity would equal -0.028. Thus, the value found here for the elasticity of substitution is about 20% higher than in the Statewide Pricing Pilot and the daily price elasticity is about 15% lower. Since the change in demand given a change in price is a function of both values, it appears the SMUD's customers show responsiveness to price similar to the most comparable segment of customers that were tested in the Statewide Pricing Pilot roughly ten years ago.

Once the parameters of the CES were estimated, it is relatively straightforward to calculate point elasticities (own and cross-price) for the different customer segments and simulate the impacts of other TOU and CPP rates that were not included in the pilot.[34] Four different point elasticities are shown in

[33] *Ibid*, Table 4-6.

[34] For detailed derivations of the elasticities, refer to Appendices 7, 8, and 9 of the Impact Evaluation of the California Statewide Pricing Pilot (CRA 2005). http://www.energyarchive.ca.gov/demandresponse/documents/group3_final_reports/2005-03-24_SPP_APPENDICES.PDF. At a high level, the model is estimated using all of the rate groups for each combination of EAPR and default to produce estimates of the elasticity of substitution (EOS) and daily (DAILY) price elasticities. These estimates are converted into own and cross price elasticities using the average percentage of electricity used during each rate period and the average expenditure ($) during each period for each of the groups as follows:

Define perc_p as % usage during peak hours and share_p as % of electricity expenditure during peak period). Then,

E(p,p) = perc_op*EOS + share_p*DAILY

E(p,op) = (-1)*perc_op*EOS + share_op*DAILY

E(op,p) = (-1)*perc_p* EOS + share_p*DAILY

E(op,op) = perc_p*EOS + share_op*DAILY

Table 7-2: the own-price elasticity for the peak period ($E_{p,p}$), the cross-price elasticity of peak consumption with respect to off-peak price ($E_{p,op}$), the cross-price elasticity of off-peak consumption with respect to the peak price ($E_{op,p}$) and the own-price elasticity for the off-peak period ($E_{op,op}$).

Table 7-2: Own and Cross Price Elasticities

EAPR Status	Rate Type	Rate	$E_{p,p}$	$E_{p,op}$	$E_{op,p}$	$E_{op,op}$
EAPR	Opt-in	TOU	-0.078	0.067	0.011	-0.022
		CPP	-0.076	0.064	0.014	-0.025
	Default	TOU	-0.011	0.030	0.013	0.006
		CPP	-0.015	0.033	0.009	0.009
		TOU-CPP	-0.010	0.029	0.014	0.005
Non-EAPR	Opt-in	TOU	-0.166	0.131	0.017	-0.053
		CPP	-0.159	0.124	0.024	-0.059
	Default	TOU	-0.069	0.038	0.001	-0.031
		CPP	-0.064	0.033	0.005	-0.036
		TOU-CPP	-0.071	0.040	-0.002	-0.029

The elasticities represent the percentage change in electricity consumption that would result from a 1% increase in a particular price. For example, an own-price elasticity of -0.166 for the peak period means that increasing the peak period price by 1% would reduce peak consumption by 0.166%, or that a 10% price increase would reduce consumption by about 1.7%. Own-price elasticities for both the peak and off-peak periods are negative, reflecting that increases in the price during either period would reduce electricity usage during that period. Cross-price elasticities are positive, indicating that the peak and off-peak periods are substitutable goods.

Similar to the elasticity of substitution estimates, there are also patterns across EAPR status and rate types in the point elasticities. EAPR customers are generally less responsive to price than non-EAPR customers (about 50% less responsive), while customers who enrolled in an opt-in plan are significantly more price responsive than default customers on average. The latter is expected since one reason opt-in customers likely chose the rate was because they have loads that can be more readily shifted (or they are more willing to shift those loads). Opt-in customers are also more likely to have a better understanding of the rates since they made an active choice to enroll as opposed to being enrolled without any required action. Despite the large differences in average price responsiveness, default rates provide a much larger aggregate impact due to the larger number of people for whom the rate applies. Lastly, on a percentage basis, customers respond more to changes in the peak price than to changes in the off-peak price.

As a check on the reliability of the model, load impacts during the peak period were calculated for each pricing plan and compared to the load impacts reported in Sections 4 and 5 based on the RCT/RED impact analysis. This comparison is shown in Table 7-3. Impact estimates from the model match up almost exactly with the measured impacts for CPP rates and are also very close for TOU rates. The close match between the results provides confidence that the CES model is doing a good job of capturing the underlying preferences of customers. It also suggests that the simplifying assumptions made regarding the price signals used in the estimation database in order to eliminate the simultaneity problem associated with increasing block pricing accurately capture whatever heuristics consumers use to make usage decisions when faced with such complex rate structures.

Table 7-3: Comparison of Load Impacts from CES Model with Measured Load Impacts

Rate	Group	% Measured Peak Load Reduction (2012-2013 avg)	% Peak Load Reduction Using CES Model
CPP	Opt-in, IHD Offer	26%	26%
	Default TOU-CPP, IHD Offer	13%	13%
	Default CPP, IHD Offer	12%	12%
TOU	Opt-in, IHD Offer	13%	15%
	Default TOU-CPP with IHD Offer	6%	6%
	Default TOU with IHD Offer	8%	7%

7.3 Simulating the Impact of Changes in Prices

The primary benefit of estimating a structural demand model is that it allows for predictions of what load impacts would be under alternative rates of interest that were not offered as part of the SPO pilot. Combined with the conjoint analysis and choice analysis, using elasticities from the CES model can help to estimate important counterfactual outcomes that would result from changing many characteristics of the time-varying rates. The only components of the rates that can be explored with the CES elasticities are the prices in each rate period. Because these elasticities are point elasticities, they are most valid for examining small price changes in the neighborhood of the original rates as opposed to larger price changes.

Predicted load impacts for several TOU and CPP rates that differ based on the non-EAPR price[35] in the peak period are presented in Table 7-4. The rates that were included in SPO are also shown in the table (in bold) for comparison purposes. For the default CPP rate, the model predicts that reducing the peak period price from $0.75/kWh to $0.60/kWh would reduce the peak period load reduction for enrolled customers by 1.3 percentage points on CPP days, from 11.7% to 10.4%. Increasing the price to $0.90/kWh would increase load reduction by 1.1 percentage points, from 11.7% to 12.8%. For opt-in CPP customers, the same price increase would produce a larger change in load reduction, 2 percentage points, from 26.4% to 28.4%. Similar interpretations apply for changing the peak price for a TOU rate.

[35] For the purposes of this exercise, EAPR prices are also adjusted so that they are 65% of the Non-EAPR price.

Table 7-4: Predicted Load Impacts for Non-SPO Prices

Rate	Enrollment	Peak Price	Off-Peak Price	Peak Load Reduction on Applicable Days
CPP	Default	$1.20	$0.09	14.4%
		$1.05	$0.09	13.7%
		$0.90	$0.09	12.8%
		$0.75	***$0.09***	***11.7%***
		$0.60	$0.09	10.4%
		$0.45	$0.09	8.8%
		$0.30	$0.09	6.5%
	Opt-in	$1.20	$0.09	31.5%
		$1.05	$0.09	30.1%
		$0.90	$0.09	28.4%
		$0.75	***$0.09***	***26.4%***
		$0.60	$0.09	23.8%
		$0.45	$0.09	20.5%
		$0.30	$0.09	15.6%
TOU	Default	$0.42	$0.08	8.4%
		$0.37	$0.08	7.7%
		$0.32	$0.08	6.9%
		$0.27	***$0.08***	***5.9%***
		$0.22	$0.08	4.8%
		$0.17	$0.08	3.3%
		$0.12	$0.08	1.5%
	Opt-in	$0.42	$0.08	19.9%
		$0.37	$0.08	18.4%
		$0.32	$0.08	16.7%
		$0.27	***$0.08***	***14.6%***
		$0.22	$0.08	12.0%
		$0.17	$0.08	8.8%
		$0.12	$0.08	4.3%

8 Program Marketing, Customer Acceptance and Retention

SMUD's SPO is one of the few pricing pilots that have been done in the industry that systematically examined the issue of customer acceptance of time-variant rates. Specifically, SPO allows for a comparison of:

- Acceptance rates for CPP and TOU rates based on opt-in and default enrollment, and for the TOU-CPP rate based on default enrollment; and
- The impact of offering enabling technology, in the form of a free IHD, on customer acceptance of CPP and TOU rates.

Understanding if there are significant differences in acceptance rates for various forms of time-variant rates, how acceptance rates differ between default and opt-in enrollment, and whether offering an IHD to customers affects acceptance rates, are all critical issues in developing an effective pricing strategy. Findings from the SPO pilot provide some of the best empirical evidence to help settle debates about these issues that have been waged for more than a decade based largely on assumptions, assertions and, at best, qualitative evidence from focus groups.

Table 8-1 summarizes the customer acceptance rates for each SPO pricing plan. Among the most important findings are:

- SMUD's multi-faceted marketing strategy for opt-in pricing plans led to acceptance rates that ranged from 16.4% to 18.8%. These high acceptance rates contradict the often cited claim that very few customers will voluntarily enroll on time-variant rates.
- The offer of enabling technology in the form of a free IHD did not materially increase customer acceptance of either the CPP or TOU plan.
- The default treatment groups display extremely high enrollment rates, ranging from a low of almost 93% for the TOU-CPP plan to a high of almost 98% for the TOU plan.
- Once enrolled, the dropout rate across the two summers ranged from a low of 4.0% for default TOU to a high of 9.3% for opt-in CPP with no IHD offer. The percent of customers who moved, and therefore dropped off the pricing plan, ranged from roughly 18% to 22% over the two SPO summer periods. Since many customers who move relocate within the SMUD service territory, this high move rate suggests that, if SMUD were to offer time-variant pricing plans in the future, allowing customers to default onto the same plan when they relocate would retain many more customers on each plan and would significantly reduce marketing costs by avoiding solicitations to customers that were previously on the plan.

Table 8-1: Customer Acceptance Rates for SPO Pricing Plans[36]

Recruitment Approach	Rate	IHD Offer	Acceptance Rate	Drop Out Rate Over 2 Summers (6/1/12 – 9/30/13)	Move Out Rate Over 2 Summers (6/1/12 – 9/30/13)	Overall Attrition (drop outs + Movers)
Opt-in	CPP	No	18.8%	9.3%	22.4%	31.8%
		Yes	18.2%	7.3%	19.0%	26.3%
	TOU	No	16.4%	5.9%	20.8%	26.7%
		Yes	17.5%	5.2%	21.4%	26.6%
Default	CPP	Yes	95.9%	5.7%	18.0%	23.7%
	TOU	Yes	97.6%	4.0%	21.3%	25.3%
	TOU-CPP	Yes	92.9%	7.7%	19.4%	27.0%

The remainder of this section is divided into two primary subsections. Section 8.1 focuses on customer acceptance, enrollment, retention and attrition for the opt-in rates while Section 8.2 covers the same topics for default rates. Each section contains both descriptive statistics as well as analysis to determine key drivers of customer acceptance and attrition for each pricing plan. Customer acceptance of and connectivity for IHDs was covered in Section 6.

8.1 Opt-in Pricing Plans

The SPO pilot included two opt-in pricing plans, CPP and TOU. Each plan was offered to two randomly chosen groups of customers, with one offer including a free IHD while the other did not. Thus, there were four treatment cells for opt-in plans. Comparing acceptance rates for CPP with and without an IHD, and TOU with and without an IHD, is a direct measure of whether the offer of a free IHD materially increases acceptance rates for the two rates. Comparing acceptance rates for the CPP and TOU pricing plans will indicate whether customers generally have a stronger preference for one plan over the other when comparing it to the standard tariff. Importantly, this comparison is not the same as asking a group of customers to choose between CPP and TOU plans, which would be a more direct measure of customer preferences among time-variant rate options. Even if the same percent of customers took the two pricing plans, it could be that customers who accept the CPP rate might prefer the TOU rate over CPP if they had a choice, and vice versa. This issue is explored in Section 9 through analysis of a conjoint survey in which customers were given the option of choosing among multiple pricing plans. As will be seen, there does appear to be a relatively strong preference for TOU over CPP rates when both are offered simultaneously.

Before summarizing the acceptance rates and other outcomes associated with marketing and enrollment, it is worth noting that there is a difference between the number of customers drawn

[36] For opt-in pricing plans, the acceptance rate was calculated by taking the number of customers who enrolled at any point prior to or during the summer of 2012 and dividing it by the number of customers who received marketing materials. For default plans, the acceptance rate was calculated by taking the number of customers who did not opt out of the rate as of June 1, 2012 and dividing it by the number of customers who received marketing materials.

into the various treatment samples and the number who received treatment offers. SMUD pulled the treatment samples in late August 2011. Between the time when the sample was pulled and when the marketing materials were first sent, some customers moved, in which case they were dropped from the research sample since they no longer qualified to participate in the study. Table 8-2 reports the number of customers in the original sample and the number of customers who received marketing offers. These differences are small for the opt-in treatments because the time between when the sample was drawn and when the first solicitations were sent was relatively brief. As shown in Section 8.2, more customers were lost between the sample draw and the initial offer for default customers because default notifications were not sent until April 2012, more than seven months after the sample was drawn. In the remainder of this section, the basis for all estimates of customer acceptance and enrollment rates is the number of customers receiving the offer, not the number in the initial sample.

Table 8-2: Number of Customers Sampled and Number of Customers Receiving Opt-in Offers

Group	Total in Sample	Total Offered	% Offered
Control Group	45,863	45,183	99%
Opt-In CPP, No IHD Offer	1,214	1,187	98%
Opt-In CPP, IHD Offer	9,198	9,060	98%
Opt-In TOU, No IHD Offer, Control (Deferred)	7,630	7,513	98%
Opt-In TOU, No IHD Offer, Enrolled	7,634	7,500	98%
Opt-In TOU, IHD Offer, Control (Deferred)	12,707	12,553	99%
Opt-In TOU, IHD Offer, Enrolled	12,743	12,554	99%

8.1.1 Customer Acceptance of Opt-in Pricing Plans

Table 8-3 summarizes the main findings concerning customer acceptance of the opt-in pricing plans. Overall, acceptance rates were quite high relative to participation in most other opt-in, time-variant rate programs, especially when considering the relatively short period over which marketing occurred. By comparison, PG&E's SmartRate tariff, a CPP rate first marketed in 2008 that is structurally similar to the SPO CPP rate, had an acceptance rate of roughly 8% in its first two years of offering the rate.[37] With two exceptions (Salt River Project and Arizona Public Service), most other utility programs have acceptance rates of 5% or less, often much less.[38] The fact that SPO obtained acceptance rates approaching 20%

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[37] See "2009 Load Impact Evaluation for Pacific Gas and Electric Company's Residential SmartRate—Peak Day Pricing and TOU Tariffs and SmartAC Program, Volume 2: Ex Ante Load Impacts" by S. George, J. Bode, M. Perry & A. Goett. Prepared for PG&E.

[38] Based on personal correspondence between Stephen George and representatives from APS and SRP conducted for a confidential client, as of late 2010, Arizona Public Service had roughly 51% of residential customers, and 65% of residential kWh served, enrolled on one of five TOU rates. Around the same time, Salt River Project had 28% of its residential accounts on one of two TOU rates and estimated that it had nearly 50% of its target market of high use customers on these rates.

from the general population in a single campaign suggests that other utilities can achieve similar acceptance rates using a well-researched and concerted marketing effort.

Table 8-3: Acceptance Rates for Opt-in Pricing Plans

Group	Total Offered	Total Accepted	Acceptance Rate
Opt-in CPP, No IHD Offer	1,187	223	18.8%
Opt-in CPP, IHD Offer	9,060	1,651	18.2%
Opt-in TOU, No IHD Offer	7,500	1,229	16.4%
Opt-in TOU, IHD Offer	12,554	2,199	17.5%

The differences in acceptance rates across the various pricing plans are small, although some are statistically significant. Table 8-4 shows the p-statistic associated with the pairwise comparisons of acceptance rates across the various pricing plans. A p-value of 0.05 indicates that the difference is statistically significant at the 95% confidence level. The acceptance rate for the CPP pricing plan with no IHD offer, 18.8%, is more than 2 percentage points higher than the 16.4% acceptance rate for the TOU plan, and this difference is significant at the 95% confidence level, with a p-value of 0.04. The acceptance rates for the same two pricing plans with the IHD included are 18.2% and 17.5%, respectively. This difference is not statistically significant at the 95% confidence level. As discussed in the introduction to this section, and in more detail in Section 9, the slightly higher acceptance rates for the CPP plans over the TOU plans should not be interpreted as a preference by consumers for CPP over TOU rates. Indeed, when offered simultaneously in the conjoint survey discussed in Section 9, there is a strong preference for TOU rates over CPP rates.

Table 8-4: P-values for Pairwise Comparisons of Customer Acceptance Rates for Opt-in Pricing Plans

Group	Opt-in CPP, No IHD Offer	Opt-in CPP, IHD Offer	Opt-in TOU, No IHD Offer	Opt-in TOU, IHD Offer
Opt-in CPP, No IHD Offer	n/a	n/a	n/a	n/a
Opt-in CPP, IHD Offer	0.64	n/a	n/a	n/a
Opt-in TOU, No IHD Offer	0.04	0.00	n/a	n/a
Opt-in TOU, IHD Offer	0.27	0.18	0.04	n/a

8.1.2 Choice Analysis

An important consideration in developing pricing strategies going forward is whether customers who enroll on time-variant rates differ from those who do not. Knowing the characteristics of customers who are more likely to enroll on time-variant rates is useful for future targeting and for estimating the likely penetration of such rates among customers that were not included in the SPO pilot population. To investigate these issues, a binary outcome model (logit)[39] was estimated for each rate option. The logit model relates the likelihood of accepting a rate offer to customer characteristics such as EAPR status, bill impacts and participation in other SMUD programs.

Models were initially estimated using two datasets – one containing the billing and load data for every SPO participant (N=47,076) and the second containing billing data plus survey responses to a residential appliance saturation survey (RASS) that was completed (N=2,509) to gather detailed information on customer characteristics. A comparison of results from models estimated on the two datasets showed that the signs and magnitudes of several key variables were considerably different. If the RASS sample was representative of the SPO population, we would expect the same model to yield the same results using both datasets. We believe that this problem is symptomatic of a selection effect associated with survey response. Further investigation showed that survey respondents are more “engaged” with their energy consumption than the general population of SMUD customers as evidenced by participation in other SMUD programs, including MyAccount. This higher level of engagement caused these customers not only to respond at higher rates to the RASS but to also be more likely to accept one of the pricing plans. Attempts to correct for this response bias using a Heckman two-step estimator were unsuccessful. As such, all of the analysis presented below is based on the full SPO population and relies on variables that are available for all customers, not just survey respondents. This approach has the advantage that SMUD can use these models for targeting and for extrapolation to the full SMUD population.

Table 8-5 shows the marginal effects[40] from the choice model that can be used to predict enrollment for the opt-in TOU pricing plans offered in the SPO. The table also provides examples of how the likelihood of enrollment would change given a change in the magnitude of the explanatory variables in the model. The explanatory variables include EAPR status, whether or not an IHD was included in the pricing plan marketing offer, bill savings associated with going on the rate in the absence of a change in behavior (e.g., a measure of the degree of structural win from selecting the rate) and binary variables representing participation in other SMUD programs, including enrollment in MyAccount. The bill savings variable equals a customer’s bill based on usage during the summer of 2011 and the time-variant pricing plan that they eventually enrolled in divided by the bill based on the same summer 2011 usage and the otherwise applicable SMUD tariff, multiplied by 100 to turn the variable into a percentage value. It represents the bill savings they would achieve on the new pricing plan if they didn’t change their usage.

As seen in the table, EAPR customers are about 10% more likely to enroll on the TOU plan than are non-EAPR customers. The likelihood of enrollment is also positively correlated with participation in the Carbon Offsets, EnergyHelp, Green Energy and My Account programs, but participation in the EE loan/rebate program is not a driver of enrollment on TOU rates. The higher the bill savings that would result from enrolling on the TOU plan in the absence of changing usage behavior, the greater the likelihood of enrollment. The offer of an IHD has no statistically significant impact on enrollment.

[39] Logit, probit and linear probability models were estimated and the alternative specifications produced results quite similar to those associated with the logit model.

[40] See the discussion at the beginning of Section 6.2 concerning choice modeling and marginal effects.

Table 8-5: TOU Pricing Plan Customer Choice Model Summary

Variable	Marginal Effect	Interpretation
EAPR status	0.106**	EAPR customers are 10% more likely to enroll in TOU than non-EAPR customers
IHD offer included	0.004	Offer of IHD has no statistically significant impact on enrollment
2011 summer savings as % of summer bill compared with standard tariff	0.237**	Bill savings of 10% increases the likelihood of enrollment by 2.4%
Carbon Offsets program	0.102**	Carbon Offset customers are 10% more likely to enroll in TOU pricing plan
Received EE loan or rebate	0.008	Having received an EE loan or rebate has no statistically significant impact on enrollment
EnergyHelp program	0.088**	EnergyHelp participants are 9% more likely to enroll in the TOU pricing plan
Green Energy program	0.061**	Green Energy participants are 6% more likely to enroll in the TOU pricing plan
Customer enrolled in MyAccount	0.075**	MyAccount customers are 7.5% more likely to enroll in the TOU pricing plan

**p<0.01; *p<0.05; +p<0.1

Table 8-6 shows the marginal effects from the logit model for the opt-in CPP pricing plans. Results for the CPP plans are quite similar to those for the TOU plans, with one significant exception. In this case, the bill impact from enrolling on the rate has a negative sign and is not statistically significant.

Table 8-6: CPP Pricing Plan Customer Choice Model Summary

Variable	Marginal Effect	Interpretation
EAPR status	0.105**	EAPR customers are 10% more likely to enroll in CPP pricing plan than non-EAPR customers
IHD offer included	0.000	Offer of IHD does not increase enrollment in CPP
2011 summer savings as % of summer bill compared with standard tariff	-0.047	Bill savings compared with standard rate is not statistically significant and has opposite sign compared with the TOU choice model
Carbon Offsets program	0.126**	Carbon Offset customers are 13% more likely to enroll in CPP pricing plan
Received EE loan or rebate	0.006	Having received an EE loan or rebate has no statistically significant impact on enrollment
EnergyHelp program	0.087**	EnergyHelp participants are 9% more likely to enroll in the CPP pricing plan
Green Energy program	0.052**	Green Energy participants are 5% more likely to enroll in the CPP pricing plan
Customer enrolled in MyAccount	0.097**	MyAccount customers are 10% more likely to enroll in the CPP pricing plan

**p<0.01; *p<0.05; +p<0.1

8.1.3 Customer Retention and Attrition for Opt-in Pricing Plans

Tables 8-7 through 8-9 summarize the retention, churn and dropout rates for each opt-in pricing plan for three time periods: summer 2012, the period in between the two SPO summers, and summer 2013. Although the intention was to cease enrollment after June 1, 2012, a few customers were enrolled during the first summer and 2 customers were actually enrolled in between the two summer periods. These new enrollees must be factored into the calculation of the retention and dropout rates. The retention rate for each period is equal to the enrollment at the end of the period divided by the sum of enrollment at the start of the period plus enrollment during the period. The dropout rate equals the number of drop outs during the period divided by the number of participants enrolled at the start of the period plus enrollment during the period.

As discussed at the beginning of this section, the number of movers is much larger than the number of people who leave each pricing plan because they prefer an alternative plan. The overall dropout rate is quite low, as shown previously in Table 8-1.[41] As seen in Tables 8-7 through 8-9, the dropout rate is relatively constant throughout the period, although it is slightly higher in the first summer than in the

[41] It should be noted that the dropout rates shown in Table 8-1 do not equal the sum of the dropout rates in Tables 8-7 through 8-9, because the dropout rates in the latter tables apply to each of the three periods and the denominator in each period is different from the denominator used to calculate the values in Table 8-1.

second summer for all four pricing plans. Due to the relatively constant move rate, the retention rate is also lower in between the two summers than it is during either summer period. As mentioned previously, given the high move rate, a pricing strategy that allows customers who move within the SMUD service territory to default onto the rate they had previously been on would significantly reduce marketing costs associated with maintaining or increasing program enrollment over a long time period.

Table 8-7: Customer Retention for Opt-in Pricing Plans for Summer 2012

Group	Total Enrolled June 1, 2012	Total Enrolled Sept 30, 2012	Enrolled After June 1	Movers	Dropouts	Summer 2012 Retention Rate[42]	Summer 2012 Dropout Rate[43]
Opt-in CPP, No IHD Offer	212	193	2	15	7	90.2%	3.3%
Opt-in CPP, IHD Offer	1,569	1,454	19	87	48	91.6%	3.0%
Opt-in TOU, No IHD Offer	1,157	1,074	35	83	37	90.1%	3.1%
Opt-in TOU, IHD Offer	2,092	1,936	24	131	49	91.5%	2.3%

Table 8-8: Customer Retention in Between Summer Periods

Group	Total Enrolled Sept 30, 2012	Total Enrolled June 1, 2013	Enrolled During Period	Movers	Dropouts	Interim Period Retention Rate	Interim Period Dropout Rate
Opt-in CPP, No IHD Offer	193	161	0	23	9	83.4%	4.7%
Opt-in CPP, IHD Offer	1,454	1,265	1	149	41	86.9%	2.8%
Opt-in TOU, No IHD Offer	1,074	941	1	113	21	86.6%	2.0%
Opt-in TOU, IHD Offer	1,936	1,664	0	232	40	85.6%	2.1%

42 The retention rate equals the number of customers enrolled at the beginning of the period, plus enrollments during the period, divided by the number of customers enrolled at the end of the period.

43 The dropout rate equals the number of drop outs divided by the number of enrolled customers at the beginning of the period plus enrollees during the period.

Table 8-9: Customer Retention for Opt-in Pricing Plans for Summer 2013

Group	Total Enrolled June 1, 2013	Total Enrolled Sept 30, 2013	Enrolled During Period	Movers	Dropouts	Summer 2013 Retention Rate	Summer 2013 Dropout Rate
Opt-in CPP, No IHD Offer	161	147	0	10	4	91.3%	2.5%
Opt-in CPP, IHD Offer	1,265	1,172	0	66	27	92.6%	2.1%
Opt-in TOU, No IHD Offer	941	877	0	52	12	93.2%	1.3%
Opt-in TOU, IHD Offer	1,664	1,554	0	90	20	93.4%	1.2%

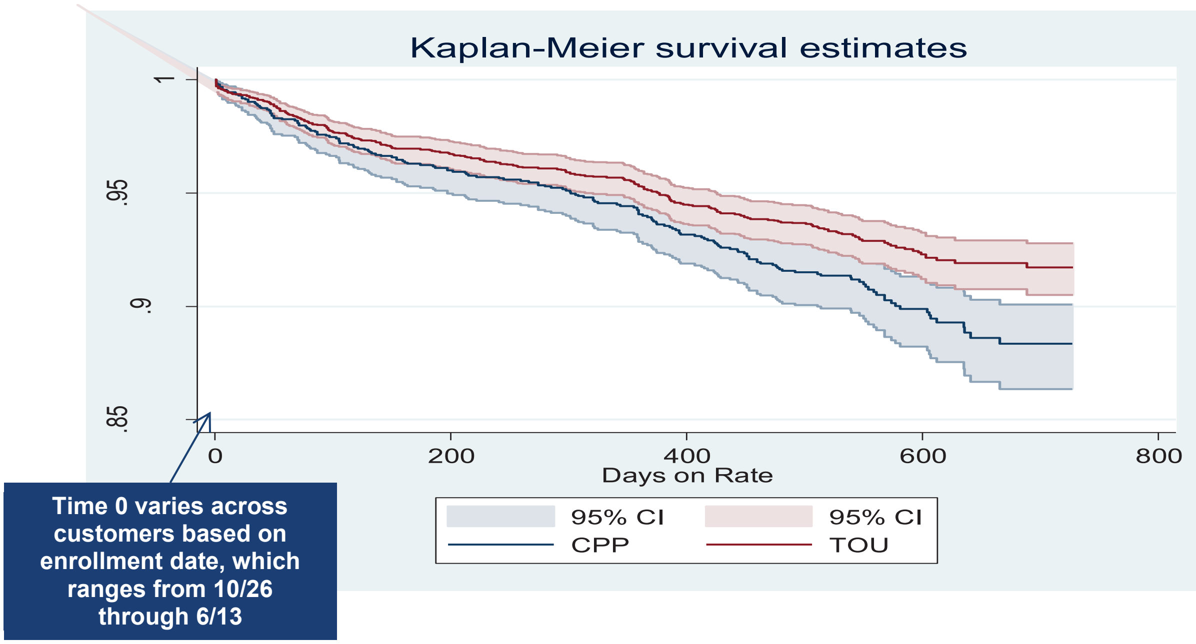
8.1.4 Modeling Opt-Out Decisions for Opt-in Pricing Plans

The prior section provided summary statistics on customer retention, move rates and dropout rates for the opt-in pricing plans. This section examines dropout rates using two different approaches.

The first approach involves a Kaplan-Meier survival function for the opt-in TOU and CPP pricing plans (combining the treatment cells with and without the IHD offer for each plan). This function displays the likelihood of staying on a pricing plan as a function of time, which in this instance is measured as the number of days since accepting the plan offer, not since enrolling on the plan. The Kaplan-Meier curve is graphed in Figure 9-1. Note that this function depicts active de-enrollment, not customers who left the plan because they moved. Given that marketing began in the fall of 2011 and customers were not actually enrolled on an opt-in pricing plan until June 1, 2012, some customers may have dropped out before even going on the plan. Note also that the starting point (0 in the graph) varies across customers. The first customer acceptances occurred on October 26, 2011 and the last one included in this database occurred on June 13, 2012.

As seen in the figure, opt-out rates are slightly greater for the CPP pricing plans than for the TOU plans. The Kaplan-Meyer function is relatively smooth over the entire historical period. However, this may be due, in part, to the fact that each customer has a different start date so that specific events, such as the lead up to each summer when customers were reminded that they were being placed on the rate or following multiple CPP event periods, are blurred in terms of when they occur for the average customer. As will be seen in Section 8.2, for default treatments, nearly everyone was marketed to at the same time so the time since acceptance is nearly the same for everyone and it is easier to see how attrition correlates with certain events.

Figure 8-1: Kaplan-Meyer Survival Function for Opt-in Pricing Plans



As seen in the figure, the retention rates are slightly higher for the TOU plans than for the CPP plans or, put differently, at any point in time, customers are slightly more likely to opt-out of the CPP plans than the TOU plans. For a customer who accepted the pricing plan offer in the spring of 2012 (say around April 1, 2012), the probability that they were still on the plan near the end of the second summer (around September 30, 2013, which is roughly 500 days after acceptance) is roughly 94% for TOU customers and about 91% for CPP customers. After about 500 days following acceptance, there is a sharper drop off in the Kaplan-Meyer curve for the CPP plans than for the TOU plans, so a customer that enrolled in the fall of 2011 (more than 600 days prior to the end of summer 2013), has about a 92% probability of still being on a TOU plan but a CPP customer has only about an 87% probability of still being enrolled.

To better understand how the likelihood of dropping off each plan varies with customer characteristics, a Cox Proportional Hazard (Cox PH) model was estimated. A Cox PH model provides estimates of the hazard ratio, which is defined as the instantaneous probability of a customer dropping off a plan at time *t* given that they have not dropped prior to that time:

$$\text{HR} = \frac{\textit{Probability that customers with characteristic X drop out}}{\textit{Baseline probability of dropping out that depends only on time}}$$

The hazard ratio is interpreted as follows:

- A HR equal to 1 means that the characteristic of interest has no impact on the likelihood of dropping out;

- A HR > 1 means that a characteristic increases the likelihood of dropping out (e.g., a HR of 1.1 on the EAPR variable, for example, means that EAPR customers are 10% more likely to drop out at any given time than non-EAPR customers);
- A HR < 1 means that a characteristic decreases the likelihood of dropping out (e.g., a HR of 0.9 for the EAPR variable would mean EAPR customers are 10% less likely to drop out than non-EAPR customers).

Table 8-10 summarizes the results of the Cox PH model estimation for opt-in pricing plans. When interpreting these results, it is very important to keep in mind that dropout rates are quite low overall, so that even variables that significantly change the probability of dropping out may not be significant from a practical standpoint. For example, the fact that CPP customers are 80% more likely to drop out than TOU customers means that the dropout rate is around 9% rather than 5%. This difference may not be material in terms of its impact on program cost effectiveness or overall demand response achieved. As seen below, most variables tested are not statistically significant. Being on the CPP plan increases the likelihood of dropping out relative to being on the TOU plan as does having received an EE load or rebate, whereas higher bill savings reduces the likelihood of dropping out.

Table 8-10: Cox PH Model Results for Opt-in Pricing Plans

Variable	Hazard Ratio Estimates	Interpretation
EAPR status	0.84	EAPR customers are less likely to drop out than non-EAPR customers but the impact is not statistically significant
CPP	1.79**	Customers who opt-in to the CPP pricing plan are 80% more likely to drop out than those who opt-in to the TOU pricing plan (but opt-out rates are low for both plans)
2011 Summer Savings as a % of Summer Bill	0.03**	A 10% savings on summer bills reduces the likelihood of an opt-in customer dropping out by 30%.
Carbon Offsets program	0.21	Enrollment in the Carbon Offsets program reduces the likelihood of dropping out, but is not statistically significant
Received EE loan or rebate	1.30*	Customers who received an EE loan or rebate are 30% more likely to drop out
EnergyHelp program	0.64	Customers enrolled in the EnergyHelp program are more likely to drop out, but the impact is not statistically significant
Green Energy program	0.99	Enrollment in the Green Energy program has essentially no impact on dropout rates
Customer enrolled in MyAccount	1.01	MyAccount has no impact on dropout rates for opt-in customers

**p<0.01; *p<0.05; +p<0.1

Note: The interpretation of the summer savings coefficient differs from the others due to the structure of the Cox PH model. The initial estimate of 0.03 represents the impact of saving 100% of summer bills and was converted to a more easily interpretable impact of 10% savings.

8.2 Default Treatments

The SPO pilot included three default treatments—CPP, TOU and a combination TOU-CPP plan. In addition to being defaulted onto the new rate, all groups were offered a free IHD. As mentioned previously, it is worth noting the difference between the number of customers drawn into the various treatment samples and the number who were defaulted onto the new pricing plans. SMUD pulled the treatment samples in late August 2011. Between the time when the samples were pulled and when the default notifications were sent, some customers moved, in which case these customers were dropped from the research sample as they no longer qualified to participate in the study. Table 8-11 reports the number of customers in the original sample and the number of customers who received marketing offers. These differences are larger for the default treatments than for the opt-in treatments because the time between when the sample was drawn and when the first solicitations were sent was longer for default treatments. Notifications were not sent until April 2012, which was more than seven months after the sample was drawn. In the remainder of this section, the basis for all estimates of customer acceptance and enrollment rates is the number of customers receiving the offer, not the number in the initial sample.

Table 8-11: Number of Customers Sampled and Number of Customers Defaulted Onto New Pricing Plans

Group	Total in Sample	Total Offered	% Offered
Default TOU-CPP, IHD Offer	729	680	93%
Default CPP, IHD Offer	846	780	92%
Default TOU, IHD Offer	2,410	2,219	92%

8.2.1 Customer Acceptance of Default Pricing Plans

Table 8-12 summarizes the main findings concerning customer acceptance of the default pricing plans. For default plans, acceptance is defined by customers who did not dropout prior to going on the plan, but the acceptance rate excludes those who moved between receiving a default notification and going on the plan. In this way, the acceptance rate reflects only customers who proactively chose not to be defaulted onto the new plan, not those who never went on the plan because of other factors such as moving. Overall, acceptance rates were extremely high, ranging from 93% to over 97%. This far exceeded SMUD's pilot design assumptions, which were that 50% of customers would opt out prior to being placed on the default pricing plan.

Table 8-12: Acceptance Rates for Default Pricing Plans

Group	Total Offered	Movers Prior to 6/1/12	Dropouts Prior to 6/1/12	Total Accepted	Total Offered Less Movers	Acceptance Rate
Default TOU-CPP, IHD Offer	680	47	45	588	633	92.9%
Default CPP, IHD Offer	780	49	30	701	731	95.9%
Default TOU, IHD Offer	2,219	152	49	2,018	2,067	97.6%

Although the range of acceptance rates across the three default plans is less than five percentage points, each is statistically different from the other two at the 95% confidence level. Table 8-13 shows the p-statistics for the pairwise comparisons of acceptance rates for the default pricing plans. The acceptance rate for the TOU-CPP plan, 92.9%, is more than 3 percentage points lower than the acceptance rate for the CPP plan which, in turn, is two percentage points lower than for the TOU plan. Although these differences are statistically significant, they may not be material from a policy or program planning perspective, given how high the acceptance rates were for all default plans.

Table 8-13: P-statistics for Pairwise Comparisons of Customer Acceptance Rates for Default Pricing Plans

Group	Default TOU-CPP, IHD Offer	Default CPP, IHD Offer	Default TOU, IHD Offer
Default TOU-CPP, IHD Offer	n/a	n/a	n/a
Default CPP, IHD Offer	0.02	n/a	n/a
Default TOU, IHD Offer	0.00	0.01	n/a

8.2.2 Customer Retention and Attrition for Default Pricing Plans

Table 8-14 shows retention rates for each default pricing plan. As discussed previously, when examining retention rates, it is important to distinguish between movers and dropouts. As with the opt-in plans, the overall attrition/retention rate is influenced much more by movers than by customers dropping out of the plans. The pattern of dropouts for default plans is similar to that for the opt-in plans in that the dropout rate for default customers was higher in the first summer than during the period in between summers and lowest in the second summer. Dropout rates for the TOU plan were quite low in all periods. By the second summer period, additional dropouts were lower than in either of the other two time periods for all three pricing plans. A close comparison of the overall dropout rate for default customers in Tables 8-14 through 8-16 with the dropout rates for the opt-in pricing plans shows that the dropout rate was higher for opt-in plans than for default plans. This seemingly counterintuitive finding actually has a logic to it in that the average opt-in customer is much more aware of and engaged in the rate choice than the average default customer, which includes a sub-segment of customers who were not even aware that they were on the new pricing plan as indicated in the results from the end of pilot survey summarized in Section 11.

Table 8-14: Customer Retention for Default Pricing Plans for Summer 2012

Group	Total Enrolled June 1, 2012	Total Enrolled Sept 30, 2012	Movers	Dropouts	Summer 2012 Retention Rate[44]	Summer 2012 Dropout Rate[45]
TOU-CPP	588	527	37	26	89.6%	4.4%
CPP	701	645	38	44	92.0%	2.7%
TOU	2,018	1,839	135	19	91.1%	2.2%

Table 8-15: Customer Retention in Between Summer Periods for Default Pricing Plans

Group	Total Enrolled Sept 30, 2012	Total Enrolled June 1, 2013	Movers	Dropouts	Interim Period Retention Rate	Interim Period Dropout Rate
TOU-CPP	527	465	50	12	88.2%	2.3%
CPP	645	566	64	15	87.8%	2.3%
TOU	1,839	1,628	187	24	88.5%	1.3%

Table 8-16: Customer Retention for Default Pricing Plans for Summer 2013

Group	Total Enrolled June 1, 2013	Total Enrolled Sept 30, 2013	Movers	Dropouts	Summer 2013 Retention Rate	Summer 2013 Dropout Rate
TOU-CPP	465	431	27	7	92.7%	1.5%
CPP	566	536	24	6	94.7%	1.1%
TOU	1,628	1,508	108	12	92.6%	0.7%

8.2.3 Modeling Opt-Out Decisions for Default Pricing Plans

Figure 8-2 shows the Kaplan-Meier survival functions for the three default pricing plans combined and Figure 8-3 shows the functions for each plan separately. As seen in Figure 8-2, dropout rates were highest between when notifications of being defaulted onto the pricing plan were sent out and when enrollment occurred, although as seen above, the dropout rate even during this period was quite low. The relatively high rate continued in the first few weeks after enrollment and then flattened out

[44] The retention rate equals the number of customers enrolled at the beginning of the period, plus enrollments during the period, divided by the number of customers enrolled at the end of the period.

[45] The dropout rate equals the number of drop outs divided by the number of enrolled customers at the beginning of the period.

significantly during the first summer and between summers until the notifications went out in spring 2013 telling customers they would be going back on the pricing plan in June 2013, when there was a small uptick in the number of dropouts. While this pattern of de-enrollment is logical and might be relevant from a policy perspective if dropout rates were higher, the fact that they are so low in general minimizes the relevance of these findings from a practical perspective.

Figure 8-3 shows the Kaplan-Meier survival functions for each default pricing plan separately. It shows that the probability of dropping out is higher for the CPP plan relative to the TOU plan and highest for the TOU-CPP plan relative to the other two options. The relatively steep decline during the summer period for the two CPP options relative to the TOU plan is likely a function of the CPP events that occur during the summer period.

Figure 8-2: Kaplan-Meier Survival Function for All Default Rates Combined

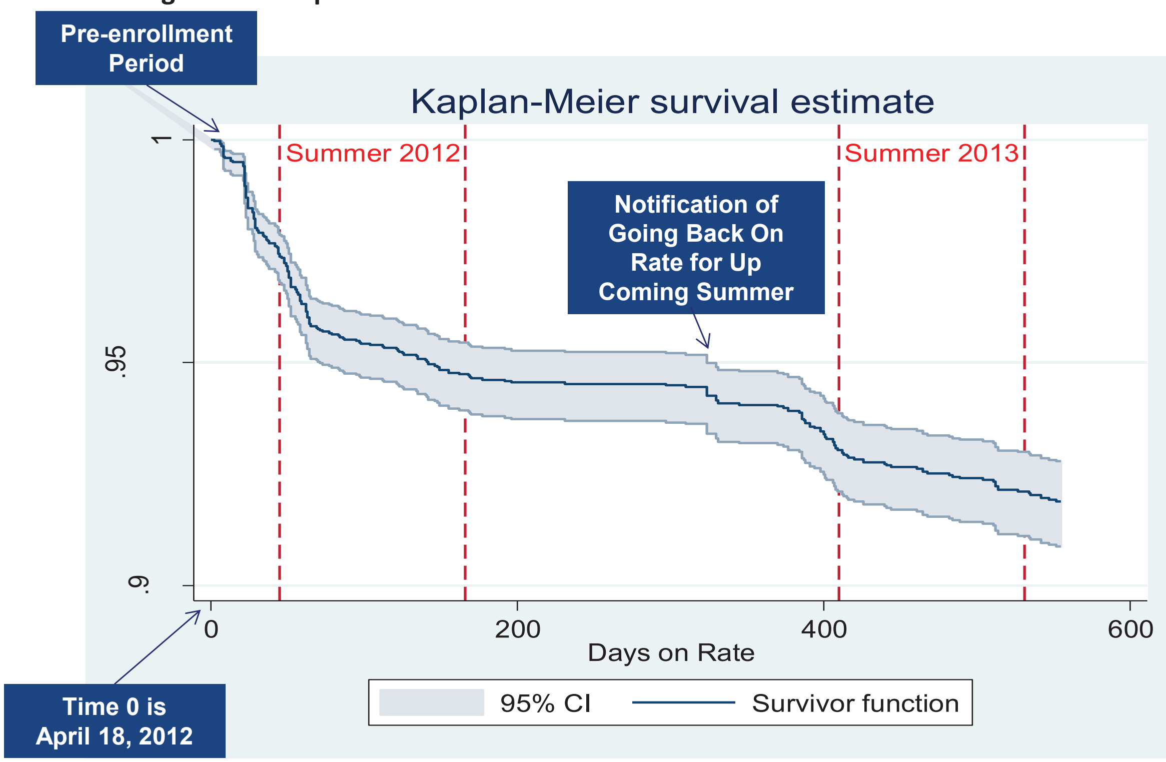
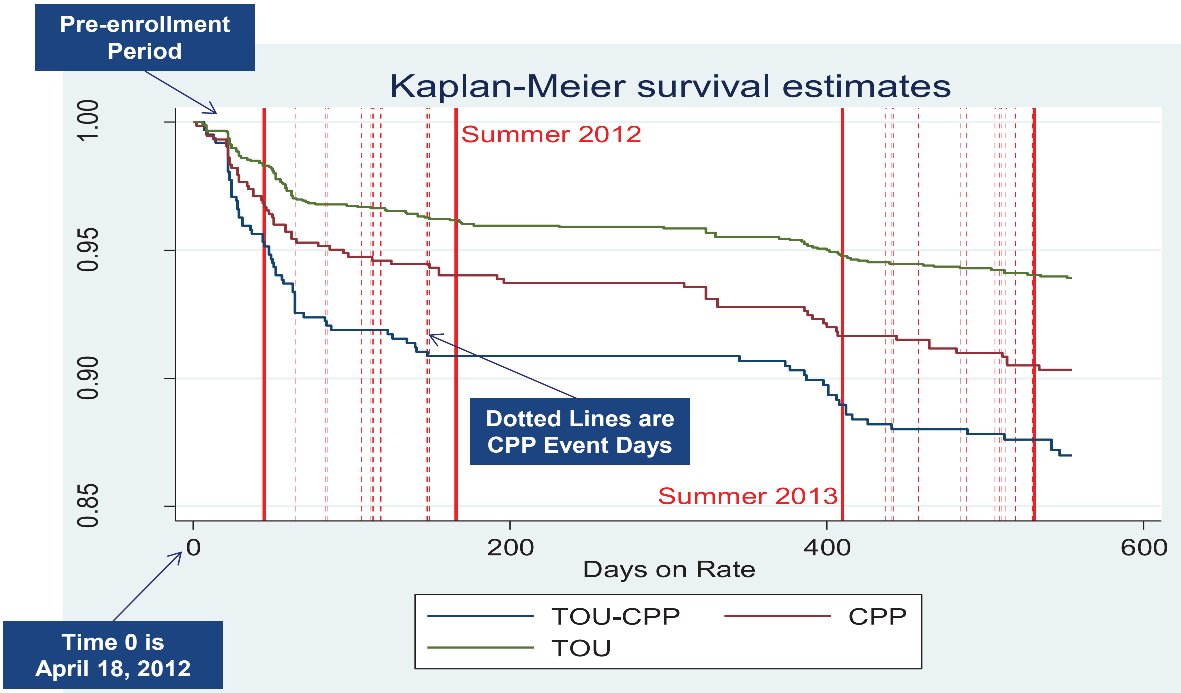


Figure 8-3: Kaplan-Meier Survival Functions by Default Option



As was done for the opt-in treatment options, a Cox PH model was estimated for each default pricing plan. Table 8-17 summarizes the results from the modeling exercise. The results indicate that customers who were defaulted onto the TOU-CPP plan were more than two times as likely to opt out at any given point in time compared with customers who were defaulted onto the TOU plan and CPP customers were roughly 2 times more likely to opt-out compared with TOU customers. Customers who save 10% of their bill on the time-varying rate are 24% less likely to opt out. Several variables representing enrollment in other SMUD programs were also included in the model. These show that EAPR customers are about 32% less likely to opt-out at any given time, while customers who either received an EE loan/rebate or were enrolled in MyAccount are about 1.4 times more likely to opt out.

When interpreting the above findings, the reader is once again cautioned that the relatively large size of some of the coefficients, indicating a substantial difference in dropout rates across customers with different characteristics, doesn't mean that dropout rates are high for any group. For example, given the two-year dropout rate of 4% for the average TOU participant, if one segment is 50% more likely to dropout than another, it means that if the dropout rate for one segment is 4%, the dropout for the other would be 6%. Neither dropout rate is very high from a practical perspective.

Table 8-17: Cox PH Model Results for Default Pricing Plans

Variable	Hazard Ratio Estimates	Interpretation
EAPR status	0.68**	EAPR customers are 32% less likely to drop out than non-EAPR customers
CPP	2.07*	Customers defaulted onto CPP are two times more likely to drop out than those defaulted onto TOU
TOU-CPP	2.52**	Customers defaulted onto TOU-CPP are two and a half times more likely to drop out than those defaulted onto TOU
2011 Summer Savings as a % of Summer Bill	0.07**	A 10% savings on summer bills reduces the likelihood of dropping out by 24%
Carbon Offsets program	0.51	Enrollment in the Carbon Offsets program reduces the likelihood of dropping out, but is not statistically significant
Received EE loan or rebate	1.44*	Customers who received an EE loan or rebate are 44% more likely to drop out
EnergyHelp program	1.61	Customers enrolled in the EnergyHelp program are more likely to drop out, but the impact is not statistically significant
Green Energy program	0.90	Enrollment in the Green Energy program reduces the likelihood of dropping out, but is not statistically significant
Customer enrolled in MyAccount	1.37*	MyAccount customers are 37% more likely to drop out

**p<0.01; *p<0.05; +p<0.1

Note: The interpretation of the summer savings coefficient differs from the others due to the structure of the Cox PH model. The initial estimate of 0.07 represents the impact of saving 100% of summer bills and was converted to a more easily interpretable impact of 10% savings

9 Analysis of the Impact of Changes in Rate Characteristics on Customer Acceptance

The analysis in Section 8 discussed acceptance rates for SPO participants for the specific pricing plans that were included in the pilot. SMUD has interest in knowing the impact on customer acceptance of potential changes in the characteristics of pricing plans, including peak-to-off-peak price ratios, the extent and timing of the peak period, the number of event days for CPP prices, and others. This section summarizes the analysis of and findings from a conjoint survey that was conducted to explore these important planning issues.

During development of the survey strategy, an important consideration was the risk of over surveying the SPO participant population. Two issues are relevant. One is to avoid risking the validity of the load impact estimates obtained from the SPO by reminding, through frequent surveys, that customers were being studied, which can influence behavior. This is referred to as a Hawthorne effect, where the knowledge that one is being studied causes a change in behavior that wouldn't necessarily occur if the intervention were offered without the subject's knowledge that they were being studied. The second issue is the risk of survey fatigue, which can reduce response rates and potentially bias results. Since there were many other issues of interest to SMUD that could only be explored through a survey among SPO participants at the end of the pilot (summarized in Section 10), a decision was made to conduct the conjoint survey among customers who did not participate in the SPO (other than as control group customers as discussed below). With this in mind, the following three customer segments were surveyed:

- **SPO control group** – Customers who were used for evaluation purposes as part of the SPO pilot, but were not offered any of the SPO rates. This segment is most representative of the SPO participants;
- **Ineligible group** – Customers who were ineligible for the SPO pilot, including customers in SMUD's balanced billing and direct load control programs; and
- **Eligible group** – Customers who were eligible for the SPO pilot, but either were not sampled or did not have a smart meter at the time of the SPO sampling (and therefore could not participate).

These last two segments were included so that the results could be extrapolated to SMUD's entire customer population, not just those that were included in the SPO.

Table 9-1 summarizes the sample design and response rate by study group. To gauge response rates and test the viability of the conjoint survey instrument, a pre-test was conducted among 500 customers. Based on this pre-test, the number of records to release for the full launch was determined, with the goal of meeting the target number of completed surveys for each study group. Across the pre-test and full launch, 3,031 total surveys were sent and 1,142 surveys were completed, equaling an overall response rate of 38%.

Table 9-1: Sample Design and Response Rate by Study Group

Study Group	Target Completes	Records Released			Completed Surveys	Response Rate
		Pre-test	Full Launch	Overall		
SPO Control Group	500	250	1,265	1,515	590	39%
Ineligible Group	250	125	633	758	313	41%
Eligible Group	250	125	633	758	239	32%
Total	**1,000**	**500**	**2,531**	**3,031**	**1,142**	**38%**

Even though SPO participants were not surveyed, the actual choices they made as part of the pilot were factored into the survey analysis and modeling by "anchoring" the survey results to the choices made by SPO participants during the pilot. Conjoint surveys are a good way to examine the trade-offs customers make among products and services that differ according to various attribute combinations and to determine the relative importance of each attribute on customer choice. However, it is well known that such surveys significantly overstate acceptance rates for new product or service offerings relative to the status quo.[46] This is due, at least in part, to the fact that customers typically don't factor in the transaction costs associated with proactively making a purchase or changing pricing plans, for example, when responding to such surveys. Another big reason for differences in acceptance rates from conjoint surveys and actual market choices is that survey acceptance rates typically are reported for those who respond to the survey whereas market acceptance rates are calculated as the number accepting an offer divided by the number who were sent an offer. As such, these acceptance rates include in the denominator people who were marketed to but who do not make a choice after considering the offer (e.g., because they didn't open the envelope or pick up the phone in response to a marketing solicitation). As a result of these and perhaps other factors, it is not uncommon to find that acceptance rates in conjoint surveys are 3 or 4 (or more) times larger than those seen when choices are actually made by consumers. Consequently, whenever possible, it is very important to anchor a conjoint survey to actual choice data. This was done here by having the first set of choices made by survey respondents be equal to the pricing plans that were offered in the SPO. The ratio of the actual acceptance rate to the survey acceptance rate was then used to adjust all acceptance rates determined from survey-based simulations of alternative pricing plans.

The remainder of this section is organized as follows. Section 9.1 summarizes the survey instrument and process. Section 9.2 discusses the model that was estimated using the survey data and Section 9.3 presents the results from a simulation exercise that predicts the change in customer acceptance rates based on changes in rate attributes. Appendix D summarizes results from the survey showing how customer characteristics vary across the three customer segments that were included in the survey sample.

[46] See Breidert, Hahsler and Reutterer. "A Review of Methods for Measuring Willingness to Pay." Innovative Marketing, Volume 2, Issue 4, 2006.

9.1 Survey Instrument Design

The survey instrument included three sections:

- Preferences for SPO rates as a single alternative to the standard rate;
- Conjoint exercise, including nine choice sets with three rate options in each set; and
- Customer behavior and characteristics.

The first section described the current standard rate that the customer was on and then described the rate types (TOU, CPP and CPP-TOU) and technology options (IHD) included in some of the SPO pricing plans. All of these descriptions closely replicated the marketing materials from the SPO, including the specific prices that were used for the TOU, CPP and CPP-TOU pricing plans. After reading each pricing plan description, respondents were asked to indicate whether they preferred each plan over the standard rate, totaling three choices. Section 9.2 discusses the results from this section of the survey.

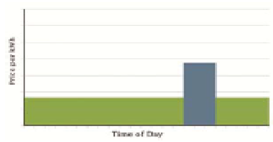
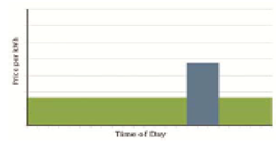
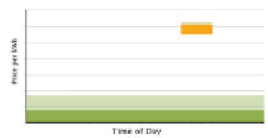
In the conjoint section of the survey, each respondent viewed 27 randomly selected choice options (9 sets of 3) and made 9 choices in total. The choice options included variations of the following rate components:

- Plan type – Standard, TOU, CPP or CPP-TOU
- Tier structure – with or without
- Tier 1 price for each plan
- Tier 2 price for each plan
- TOU on-peak price for each plan – 0.5x to 2x SPO price ratios
- CPP on-peak price for each plan – 0.5x to 2x SPO price ratios
- On-peak time period – 1-7 PM, 3-7 PM or 4-7 PM
- Number of CPP days – 6, 12, 18 or 24
- Technology option – none, IHD or PCT

Figure 9-1 provides an example choice set. Appendix E provides more details on the steps that were taken to randomly assign all of the pricing plan components across the choice sets that were shown to survey participants.

Finally, it is important to note that there were two different versions of the survey, depending on whether or not a customer was on the EAPR tariff. A non-EAPR customer would receive the version describing SMUD's non-EAPR rates and an EAPR customer would receive the version describing SMUD's EAPR rates, including the time-varying options.

Figure 9-1: Example Choice Set

Case 8 of 9	Plan A	Plan B	Plan C
Plan Type	Summer Weekday Value Plan 	Summer Weekday Value Plan 	Off-Peak Discount Plan 
Electricity Prices	**Off-Peak:** $0.10/kWh first 700 kWh $0.10/kWh in excess of 700 kWh **On-Peak:** $0.17/kWh	**Off-Peak:** $0.07/kWh first 700 kWh $0.07/kWh in excess of 700 kWh **On-Peak:** $0.28/kWh	**Off-Peak:** $0.09/kWh first 700 kWh $0.15/kWh in excess of 700 kWh **On-Peak:** $1.54/kWh on Conservation Days Otherwise, same as Off-Peak
On-Peak ( ) & Off-Peak ( ) Periods			
Conservation Days	None	None	6 Days
Free Technology			None
Which plan do you prefer?	A	B	C

A survey pre-test was implemented according to the following schedule:

- 3/19/2013: SMUD sent initial letter
- 3/25/2013 (+4 business days): Direct mail letter with survey URL and incentive ($5 bill)
- 3/27/2013 (+2 business days): Email with survey URL (if available)
- 4/01/2013 (+3 business days): Reminder postcard
- 4/03/2013 (+2 business days): Reminder email (if available)
- 4/11/2013 (+6 business days): Reminder letter with hard copy survey.

The full launch was implemented according to the following schedule:

- 4/09/2013: SMUD sent initial letter
- 4/15/2013 (+4 business days): Direct mail letter with survey URL and incentive ($5 bill)
- 4/17/2013 (+2 business days): Email with survey URL (if available)
- 4/22/2013 (+3 business days): Reminder postcard
- 4/24/2013 (+2 business days): Reminder email (if available)
- 5/02/2013 (+6 business days): Reminder letter with hard copy survey

As seen above, the full launch followed the same implementation procedures as the pre-test, including the same days of the week for delivering each communication. As such, the final survey dataset was able to combine information from both phases of the study.

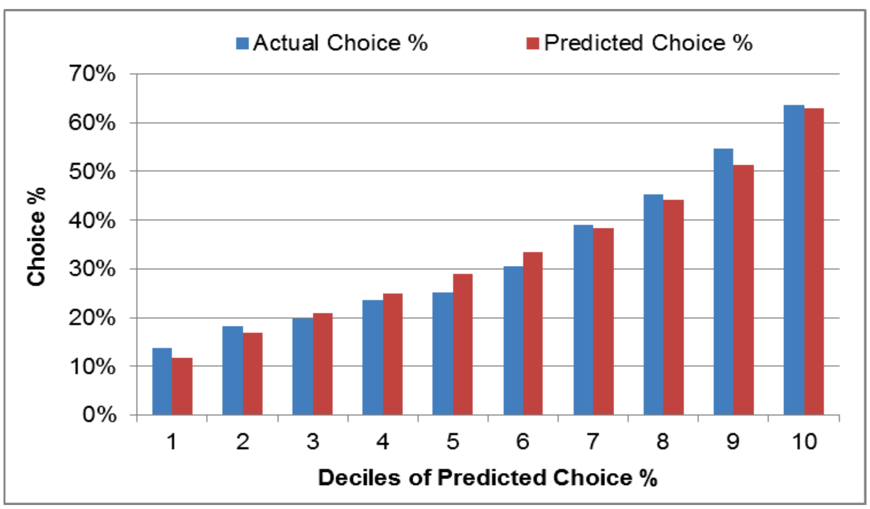
9.2 Survey Analysis and Model Estimation

Data from the conjoint survey was used to estimate a conditional logit model that can be used to predict the likelihood of enrolling in a pricing plan as a function of attributes of the rate structure and other features of the plan such as whether or not enabling technology is included in the offer. The magnitude and significance of the model coefficients also indicate the relative influence of various attributes on customer choice.

As discussed in the prior section, each survey respondent was asked to complete nine choice exercises. When a survey respondent chose one of the three options, that option was coded as a 1 in the estimation dataset and the options that were not chosen were coded as 0s. Thus, when estimating the conditional logit model, the analysis dataset included 27 observations per respondent, with nine 1s for the options that were chosen and 18 0s for the options that were not chosen. The final analysis dataset included 30,834 observations (1,142 respondents x 27 observations for each respondent), which provides a large amount of information for estimating electricity rate preferences.

The choice likelihoods based on the model and the actual choices made in the survey, sorted by deciles of likelihoods[47] estimated by the model, are shown in Figure 9-2. The figure shows that there is a very strong correlation between predicted likelihoods and the options chosen by survey respondents (depicted in the figure as "actual"). In other words, the model captures important variation that determines why some rates are chosen by respondents and others are not.

Figure 9-2: Predicted and Actual Choice Percentages



[47] The logit model was used to predict the likelihood of each pricing plan being selected. For example, one plan might have a 5% likelihood of being selected and another might have a 15% likelihood of being selected and so on, Once all of the likelihood predictions were made, they were sorted by deciles and then compared with the percentage choices that were made in the survey (e.g., the "actual choice percentages). The figure shows the match between actual and predicted likelihoods by decile.

Table 9-2 shows the estimated coefficients for the conditional logit model developed from the conjoint survey data. Most of the variables in the model are highly statistically significant and the signs and relative magnitudes appear reasonable. For example, holding all else equal, an increase in any of the prices leads to a decrease in the likelihood that a given pricing plan is chosen. In addition, it makes sense that respondents are most sensitive to changes in the tier 1 price because the largest amount of electricity usage is charged at this price for most customers.[48] Similarly, it makes sense that respondents are least sensitive to changes in the CPP price because the smallest amount of electricity usage is exposed to that price given that it is in effect for only 3 hours a day for a limited number of days.

As for technology, both the IHD and PCT lead to a small increase in enrollment. Recall from the discussion in Section 8, there was no difference in acceptance rates for those who were and were not offered an IHD in the SPO. An increase in the number of CPP event days or in the length of the peak period leads to a decrease in the likelihood that a given pricing plan is chosen. A pricing plan with tiers is less desirable than one without tiers, all else equal, but this difference was not statistically significant at the 90% level of confidence. The “Ineligible X Time-varying” coefficient shows that customers in the ineligible group were significantly more likely to choose the time-varying rate options. This is most likely due to the fact that many of these ineligible customers were participants in SMUD’s direct load control program and, as such, would be more likely to also participate in a time-varying rate program. Finally, the model included binary variables for the pricing plan types. The signs and magnitudes of the coefficients indicate that respondents have a substantially higher preference for TOU than any other pricing plan type, especially relative to CPP. This finding would appear to contradict what was found in the SPO, where enrollment in TOU and CPP rates was very similar. This apparent contradiction is explored more fully in Section 9.3.

With perfect information, one would expect to see customers who are structural winners enroll on time-varying pricing plans at higher rates than those who are not structural winners. A structural winner is a customer whose bill will go down by enrolling on a time-varying pricing plan even if they don’t change their usage behavior. Bills would go down even more for structural winners if they adjusted their behavior to use less electricity during the peak period. Furthermore, if one time-varying rate reduced bills more than the other, one would expect the likelihood of enrollment to be higher for the rate with the greatest bill reduction. Of course, customers do not have perfect information and rates are complex so they may use heuristics (e.g., I don’t use much air conditioning so this might be a good rate for me) that are imperfectly correlated with the amount of potential bill reduction for each rate choice.

[48] On average, around 85% of summer usage is in the first tier (under 700 kWh per month).

Table 9-2: Conditional Logit Model Output for All Customers
(* p<0.05, ** p<0.01, *** p<0.001)

Variable	Definition	Coefficient	T-Statistic
Tier 1 Price	The price in $/kWh in tier 1	-0.089***	-5.8
Tier 2 Price	The price in $/kWh in tier 2	-0.028**	-3.1
Peak Period Price	The price in $/kWh during the peak period as defined in the pricing plan	-0.024***	-7.8
CPP Price	The price in $/kWh during the peak period on CPP days	-0.010***	-10.9
IHD	1 if offer includes an IHD, 0 otherwise	0.086*	2.3
PCT	1 if offer includes a PCT, 0 otherwise	0.112**	3.0
CPP Event Days	The maximum # of CPP events that can be called for each plan offer	-0.029***	-7.9
TOU Length	# of hours in the peak period for the TOU rate	-0.233***	-10.2
CPP Length	# of hours in the peak period for the CPP rate	-0.176***	-6.9
CPP-TOU Length	# of hours in the peak period for the CPP-TOU rate	-0.213***	-8.0
Tiers	1 if the offer is a tiered rate, 0 otherwise	-0.124	-1.8
Ineligible X Time-varying	1 if a customer was in the ineligible group and the given option in the survey was a time-varying rate	0.700***	6.4
TOU	1 if the offer is a TOU rate, 0 otherwise	0.618***	5.3
CPP	1 if the offer is a CPP rate, 0 otherwise	-0.098	-0.7
CPP-TOU	1 if the offer is a CPP-TOU rate, 0 otherwise	0.431**	2.8
Observations			30,834
Pseudo R-squared			0.098

To determine the extent to which being a structural winner influences rate choice, we used interval data to calculate 2012 summer bills for each customer on each pricing plan offered in the survey and also for the standard rate. These calculations could only be done for the 569 SPO pilot control group customers for whom interval data was available. Since customers received the survey in May 2013, the prior year's summer usage was most pertinent. Prices during non-summer months are the same for all pricing plans so only differences in summer bills were relevant. After testing various specifications of this variable in the conjoint model, we found that percent wins/losses relative to the standard rate had the highest predictive power. To understand how the percent wins/losses variable was calculated, consider this example:

- Using 2012 interval data for a given survey respondent, assume the bill for the summer was $900 for one of the time-varying pricing plans.
- Assume the bill under the standard rate for the same survey respondent equaled $1,000.
- Therefore, the percent wins/losses variable would equal 10% (=($1000-$900)/$1000).

Considering that summer bills ranged from less than $100 to over $1,000, specifying this variable on a percentage basis was the best way to normalize the variable in the model.

Table 9-3 shows the results from adding this variable to the model shown in Table 9-2. Table 9-3 contains two columns, one that includes only the variables in Table 9-2 but estimated on the subpopulation of 569 customers for which interval data is available (e.g., the control group from the SPO). A comparison of the coefficients in Tables 9-2 and 9-3 suggests that there are differences between the control group population and the other two customer segments that were included in the estimation of the model in Table 9-2, although these differences are small and do not change any of the conclusions from the basic model. The second column in Table 9-3 adds the structural wins/losses variable to the model. As seen, the coefficient on this variable is large relative to the other coefficients and is statistically significant. The positive sign means that larger structural winners are more likely than smaller winners to enroll and both are more likely than structural losers to enroll on a time varying rate.

Table 9-3: Conditional Logit Model Output with % Wins/Losses Variable (Control Group Only) (* p<0.05, ** p<0.01, *** p<0.001, T-statistics Shown Below Coefficients)

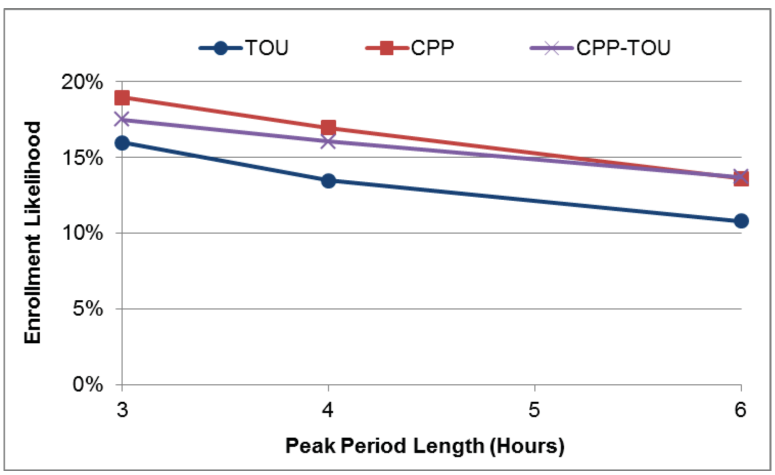
Variable	Model From Table 9-2	Alternative Specification
% Wins/Losses		0.8998** 2.9
Tier 1 Price	-0.0754*** -3.5	-0.0097 -0.3
Tier 2 Price	-0.0340** -2.6	-0.0441** -3.3
TOU Peak Price	-0.0266*** -5.9	-0.0189*** -3.7
CPP Price	-0.0103*** -7.6	-0.0082*** -5.4
IHD	0.0397 0.7	0.0369 0.7
PCT	0.0866 1.7	0.0885 1.7
CPP Event Days	-0.0328*** -6.4	-0.0262*** -4.8
TOU Length	-0.2748*** -8.4	-0.2475*** -7.4
CPP Length	-0.1894*** -5.1	-0.1663*** -4.4
CPP-TOU Length	-0.1796*** -5.0	-0.1381*** -3.6
Tiers	-0.0801 -0.9	-0.0281 -0.3
TOU	0.8576*** 5.5	0.8493*** 5.4
CPP	-0.0316 -0.2	-0.1637 -0.8
CPP-TOU	0.3125 1.5	0.1452 0.7
Observations	15,903	15,903
Pseudo R-squared	0.122	0.123

9.3 Predicted Enrollment Likelihoods

After finalizing the conditional logit model, it was used to simulate enrollment for 1,358 different pricing plans that vary with respect to attribute combinations. Whereas the survey data is based on choice sets with three alternatives, this simulation is based on choice sets with two alternatives (default standard rate and each time-varying plan separately). These results were based on the model in Table 9-2[49] rather than Table 9-3 because the model in Table 9-2 is based on the full SMUD population, not just those that were eligible for SPO or had smart meters at the time of the pilot. The simulation results show how predicted enrollment likelihoods change as each pricing plan attribute changes (unless otherwise specified, other attributes are held at the SPO specifications). Prices are not held constant as other attributes vary – rather, peak and off-peak prices change in order to reflect how prices would be developed by SMUD in the future. For example, a CPP pricing plan that can be called up to 24 times in a year will have lower peak and off-peak prices than one that can only be called up to 12 times a year because these simultaneous changes in the number of event days and prices is consistent with prices that might ultimately be offered or comparisons that SMUD will want to simulate to determine pricing strategy moving forward. The remainder of this section summarizes the results from these simulation exercises for non-EAPR customers. EAPR results are similar.

Figure 9-3 shows how the likelihood of enrollment varies with changes in peak period length. As the peak period length increases for each pricing plan, the enrollment likelihood decreases. Even though these longer peak periods correspond with a decrease in prices (for reasons discussed above), survey respondents clearly preferred the shorter peak period. From an enrollment perspective, a three-hour peak period (the SPO design) is optimal. Basically, customers prefer fewer peak period hours with slightly higher prices over longer peak periods with lower prices.

Figure 9-3: Predicted Enrollment Likelihood by Peak Period Length



For the CPP plans, Figure 9-4 shows how the predicted enrollment likelihood changes as the number of CPP days vary. The enrollment likelihood is roughly the same for 6 and 12 event days but as the number of event days increases beyond 12, the enrollment likelihood decreases even though the peak and off-

[49] As discussed previously, the conjoint survey results were calibrated to reproduce the actual choices seen in the SPO by comparing the stated preference acceptance rates with the revealed preference rates (from the SPO). This calibration was accomplished by inserting three constants into the enrollment model shown in Table 9-2 equal to -1.77 for the TOU rate, -0.42 for the CPP rate and -0.94 for the CPP-TOU rate. With these adjustment factors in the model, when the SPO rate attributes are input to the model, the estimate likelihood equals the observed enrollment rates for each pricing plan reported in Section 8.

peak prices decrease in order to offset the greater number of CPP days. From an enrollment perspective, 6 to 12 CPP event days is optimal. Basically, customers prefer fewer event hours with slightly higher prices. As with peak period length, the optimal number of CPP event days is consistent with the design of the SPO rates, which were designed around 12 event days each summer.

Figure 9-4: Predicted Enrollment Likelihood by Number of CPP Days

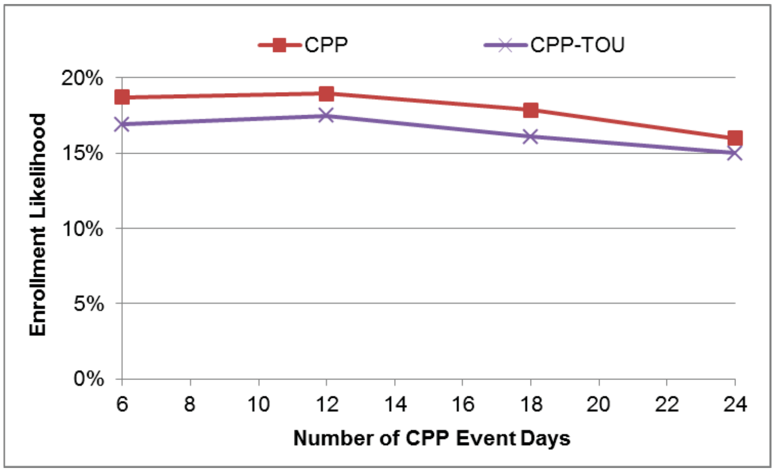


Figure 9-5 shows the enrollment likelihood by TOU price signal and Table 9-4 shows the prices that were included in the survey. The price signal is expressed as a multiple of the SPO rate designs. Contrary to what many policymakers assert, price signal has a minimal impact on enrollment likelihood. As shown in Table 9-4, the TOU peak price increases from \$0.22/kWh at 0.75x to \$0.39/kWh at 2x, but given that tier 1 and tier 2 prices decrease by around 33% as a result, this increase in the TOU peak price leads to a small change in the enrollment likelihood, from around 16% to 14%. A similar result is found for CPP-TOU, for which the enrollment likelihoods range from 15.5% to 17.5% across the TOU price signals.

Figure 9-5: Predicted Enrollment Likelihood by TOU Price Signal

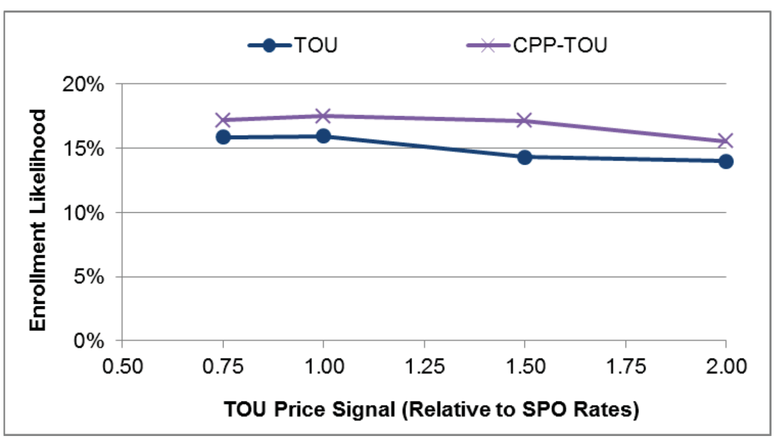


Table 9-4: Associated Prices by TOU Price Signal for Figure 5-3

Rate Type	TOU Price Signal	Tier 1 Price ($/kWh)	Tier 2 Price ($/kWh)	TOU Peak Price ($/kWh)	CPP Price ($/kWh)
TOU	0.75	$0.09	$0.18	$0.22	--
	1.00	$0.08	$0.16	$0.26	--
	1.50	$0.07	$0.14	$0.34	--
	2.00	$0.06	$0.12	$0.39	--
CPP-TOU	0.75	$0.08	$0.15	$0.19	$0.72
	1.00	$0.07	$0.14	$0.23	$0.72
	1.50	$0.06	$0.12	$0.30	$0.72
	2.00	$0.06	$0.11	$0.36	$0.72

Figure 9-6 shows the enrollment likelihood by CPP price signal and Table 9-5 shows the associated prices for each CPP price signal (relative to SPO rates). Unlike for the TOU price signal, an increase in the CPP price signal leads to a steady decrease in the enrollment likelihood. As shown in Table 9-5, the CPP peak price increases from $0.40/kWh at 0.5x to $1.24/kWh at 2x, which leads to a 22% decrease in tier 1 and tier 2 prices. Nonetheless, this decrease in off-peak prices is insufficient to offset the decrease in enrollment that results from CPP prices that rise above $1.00/kWh, even though those CPP prices are in effect for only 1.2% of summer hours (36 of 2,904 hours). A similar result is found for CPP-TOU, for which the enrollment likelihoods also steadily decrease as the CPP price signal increases. As such, these results suggest that customers may experience a “sticker shock” effect for CPP prices of around $1.00/kWh or higher.

Figure 9-6: Predicted Enrollment Likelihood by CPP Price Signal

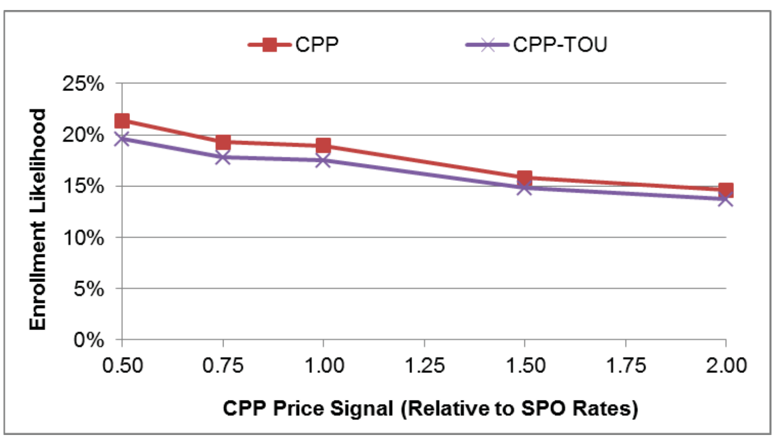
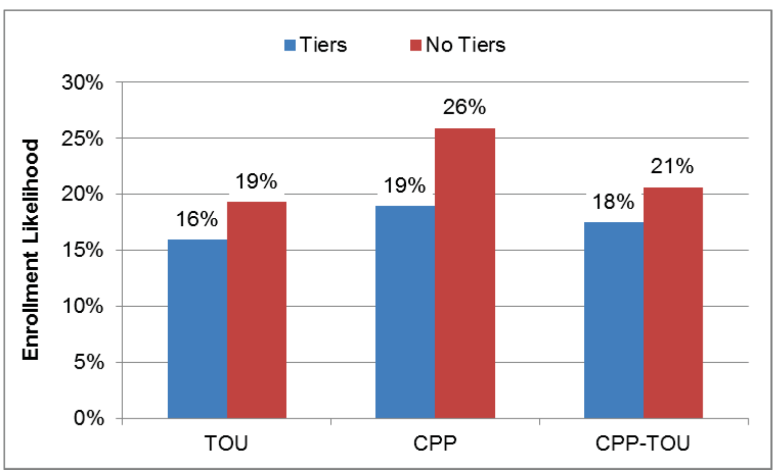


Table 9-5: Associated Prices by CPP Price Signal for Figure 5-4

Rate Type	CPP Price Signal	Tier 1 Price ($/kWh)	Tier 2 Price ($/kWh)	TOU Peak Price ($/kWh)	CPP Price ($/kWh)
CPP	0.50	$0.09	$0.18	--	$0.40
	0.75	$0.09	$0.17	--	$0.58
	1.00	$0.08	$0.16	--	$0.74
	1.50	$0.08	$0.15	--	$1.01
	2.00	$0.07	$0.14	--	$1.24
CPP-TOU	0.50	$0.08	$0.16	$0.25	$0.39
	0.75	$0.08	$0.15	$0.24	$0.56
	1.00	$0.07	$0.14	$0.23	$0.72
	1.50	$0.07	$0.13	$0.21	$0.99
	2.00	$0.06	$0.12	$0.20	$1.22

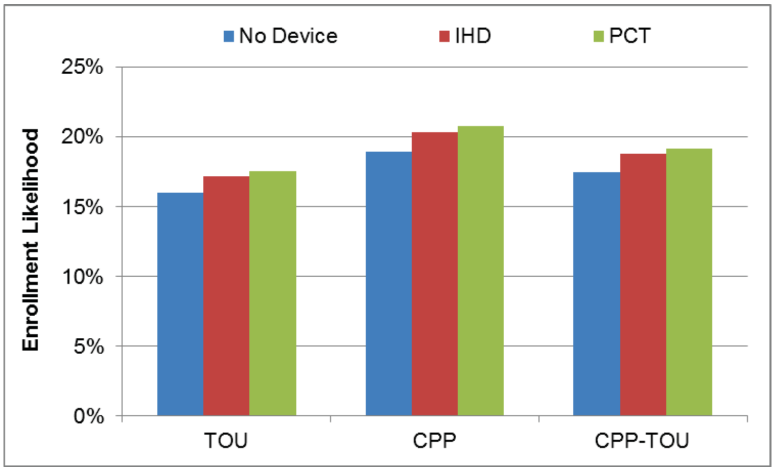
Figure 9-7 shows the predicted enrollment likelihood by rate tier structure. Time-varying rates without tiers are clearly preferred. In addition, although it is not shown in the figure, the analysis shows that nearly 62% of respondents prefer the standard rate without tiers relative to the current standard rate. As discussed above, customers are most sensitive to changes in the tier 1 price because the largest amount of electricity usage is charged at this price for most customers (around 85% on average). However, a rate without tiers is preferred not only because of its simplicity, but also because the tier 2 price in the model decreases substantially in order to equal the tier 1 price. Even though this decrease in price for usage above 700 kWh only applies to around 15% of usage on average, it leads to a substantial increase in enrollment likelihood.

Figure 9-7: Predicted Enrollment Likelihood by Tier Structure



Finally, the model estimated the enrollment likelihood by technology option. These results are illustrated in Figure 9-8. As in the SPO pilot, the technology offer has a minimal impact on enrollment.

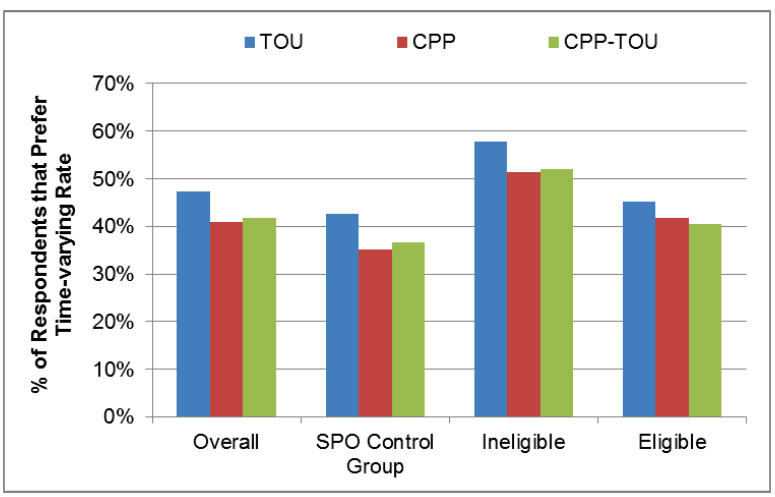
Figure 9-8: Enrollment Likelihood by Technology Option



As discussed in Section 9.2, the conditional logit model includes additional constants for each time-varying rate in order to calibrate the model to SPO opt-in enrollment rates. Without these adjustments, the model suggests that respondents have a substantially higher preference for TOU than any other pricing plan type, especially relative to CPP. This result is somewhat unexpected given the nearly equal TOU and CPP enrollment rates from the SPO pilot and is explained more fully below.

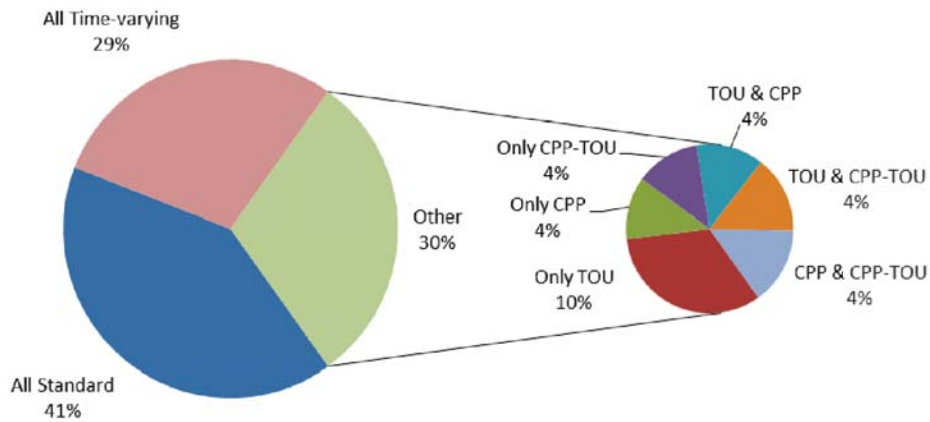
To begin, we first analyzed responses from the first section in the questionnaire where each time-varying rate from the SPO was presented as a single alternative to the standard rate. Figure 9-9 summarizes those results. When the SPO rates were presented separately as a single alternative to the standard rate, respondents had a slightly higher preference for TOU but, in general, the results were similar to the pilot, which showed that preferences for opt-in TOU and CPP were roughly the same. This finding further motivates the question as to why respondents strongly preferred TOU in the conjoint exercise (when multiple rates were offered simultaneously).

Figure 9-9: Preferences for Time-varying Rates as a Single Alternative to the Standard Rate



To explore this issue further, we analyzed the distribution of preferences for the bivariate choice set (e.g., current versus one other choice). As seen in Figure 9-10, most respondents fall into the two "all-or-nothing" categories – they either prefer all time-varying rate options or none. As a result, there is a lot of overlap between customers who prefer TOU and those who prefer CPP, which can potentially lead to unexpected results when both rates are offered simultaneously, as in the conjoint exercise.

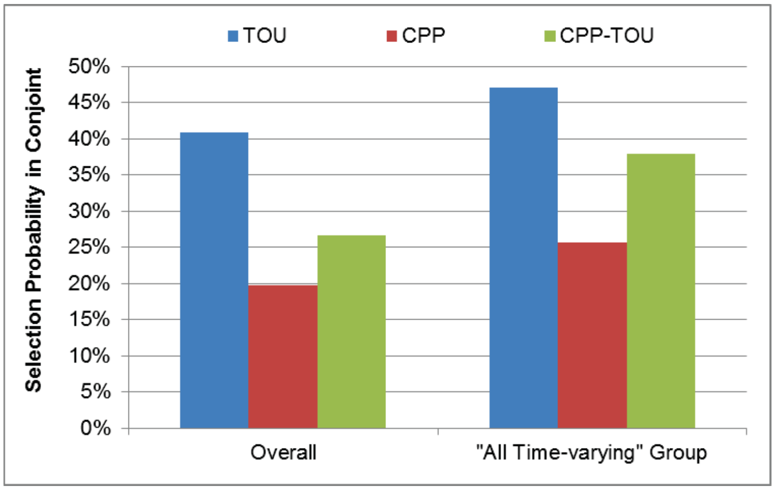
Figure 9-10: Distribution of Preferences for Time-varying Rates as a Single Alternative



Finally, to assess the impact of this overlap between customers who prefer TOU and those who prefer CPP, we further analyzed the unadjusted[50] conjoint exercise responses, focusing on respondents that prefer all of the time-varying rates as a single alternative to the standard rate. For this "All Time-varying" group and all customers (as a comparison), Figure 9-11 summarizes preferences for each type of time-varying rate in the conjoint exercise. When the conjoint exercise presents a TOU rate to respondents in the "All Time-varying" group, of the three choice options, the TOU rate was chosen around 47% of the time. Even though these customers also prefer CPP over the standard rate, with a 25% selection probability, the CPP rate is much less likely than the TOU rate to be chosen when it is presented in the conjoint exercise. Therefore, when multiple rates are offered simultaneously as in the conjoint exercise, while both TOU and CPP are preferable to the standard rate for these customers, TOU is clearly the most preferred option.

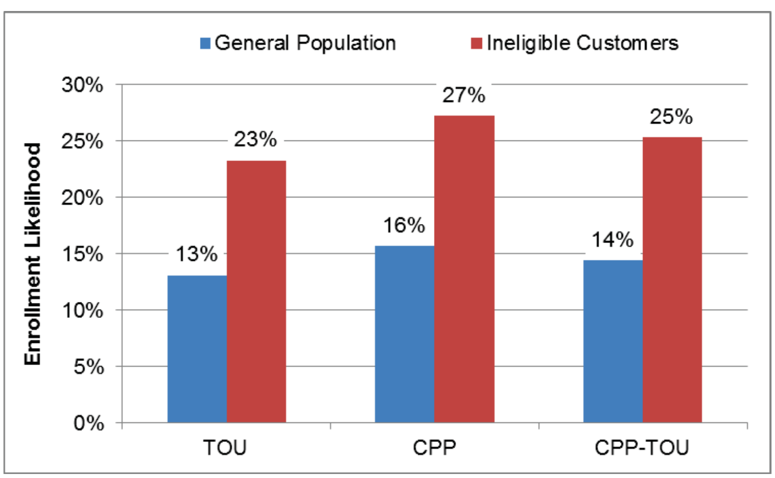
[50] The results in Figure 9-11 are raw responses that are not adjusted by the TOU, CPP and CPP-TOU constants in the conditional logit model.

Figure 9-11: Time-varying Rate Preferences in the Conjoint Exercise (Unadjusted[2])



As mentioned at the outset of this report section, in addition to predicting how enrollment rates vary with changes in pricing plan attributes, SMUD was also interested in determining whether customers who were not eligible for the SPO would have different enrollment likelihoods than those who did participate. This is why the survey plan targeted not just the SPO control group but also those who were not eligible due to participation in other SMUD programs. To determine whether ineligible customers might behave differently, a variable equal to 1 if a customer was in the ineligible group and the given option in the survey was a time-varying rate. We call this variable "Ineligible X Time-varying." As shown in Figure 9-12, customers that were ineligible for the pilot (mostly due to being in SMUD's AC load control program) are significantly more likely to enroll in time-varying rates. This finding is consistent with those of other utilities and also with the SPO choice analysis summarized in Section 8. Customers that have shown a willingness to enroll in one utility program (in this case, SMUD's AC load control program) are significantly more likely to enroll in another program.

Figure 9-12: Predicted Enrollment Likelihood by Population Segment



10 Cost Effectiveness Analysis

The primary objective of time-variant rates is to improve economic efficiency by reducing demand during periods when generation, transmission and distribution costs are high and/or shifting load to periods when costs are lower. As seen in prior sections, each pricing plan examined in the SPO resulted in different per customer and aggregate changes in energy use by rate period. Default pricing plans had lower average demand reductions than opt-in plans but had much higher participation rates. When the lower average reductions are combined with the much higher participation rates, default plans will produce higher aggregate demand reductions compared with opt-in plans. Similarly, CPP pricing plans produce greater reductions during peak periods on event days compared with TOU pricing plans but TOU plans deliver demand reductions every weekday while CPP plans only reduce demand on event days. Opt-in and default plans are likely to have very different costs as well. Recruitment costs per enrolled customer were significantly higher for opt-in plans compared with default plans. CPP pricing plans were somewhat more costly to implement due to more complex billing and notification requirements, but also delivered larger demand reductions per customer. Given all of these differences, it is useful to compare the relative benefits and costs associated with each pricing plan as input to future pricing strategy. This section summarizes the cost effectiveness methodology and results for each SPO pricing plan and for variations on default plans that exclude the offer of IHDs, which add significantly to the cost of the default programs.

Cost-effectiveness analysis is a forward looking exercise. It can be used to address three important questions concerning time-variant pricing plans or other demand response resources:

- Is it cost effective to continue to operate the pricing plan without expansion? This scenario accounts for the fact that, in many instances, equipment and recruitment costs are sunk. However, if operating costs are high and benefits low, it might make sense to terminate the program rather than continue to operate it.
- Is it cost effective to recruit additional participants onto a pricing plan? This scenario addresses the question of whether increased enrollment will increase or decrease overall cost-effectiveness. Under this scenario, start-up costs are treated as sunk and the focus is on marginal cost-effectiveness of new enrollees given initial recruitment, enrollment and equipment costs as well as ongoing costs of keeping customers enrolled and engaged.
- Is an option cost-effective taking into consideration all costs, including sunk costs?

The analysis presented in this section focuses on the second and third questions. The analysis examines the 7 pricing plans included in the SPO plus three additional scenarios that simulate the three SPO default plans but without the offer of an IHD. Table 10-1 summarizes the ten scenarios that are examined.

Table 10-1: Summary of Cost Effectiveness Scenarios Analyzed

Rate	Opt-in Enrollment		Default Enrollment	
	No IHD offer	IHD offer	No IHD offer	IHD offer
TOU	X	X	Δ	X
CPP	X	X	Δ	X
TOU-CPP			Δ	X

The analysis summarized here is based on the two-year average enrollment rates and load impacts from the SPO under the assumption that these values would hold if the pricing plans were offered to SMUD's entire residential population. The costs, summarized below, also use SPO values as the starting point. Cost effectiveness analysis is often done based on impact estimates derived under normal and extreme weather conditions since demand response impacts can vary significantly with differences in weather. The load impacts, and therefore the net benefits, are larger under extreme weather conditions than under normal weather conditions. 2012 and 2013 were actually cooler than normal weather conditions on both average weekdays and on event days, and much cooler than extreme weather conditions (typically characterized by conditions that occur once every 10 years). As such, the net benefits summarized here understate the values that would result under a more typical ex ante analysis, especially one based on extreme weather conditions.

The remainder of this section is organized as follows. Section 10.1 presents a conceptual overview of the cost effectiveness framework that was used to estimate net benefits, and the benefit-cost ratio, for each scenario. Section 10.2 summarizes the inputs that were used for the analysis. Section 10.3 summarizes the results, including sensitivity analysis that shows which variables most impact net benefits.

10.1 Cost Effectiveness Framework

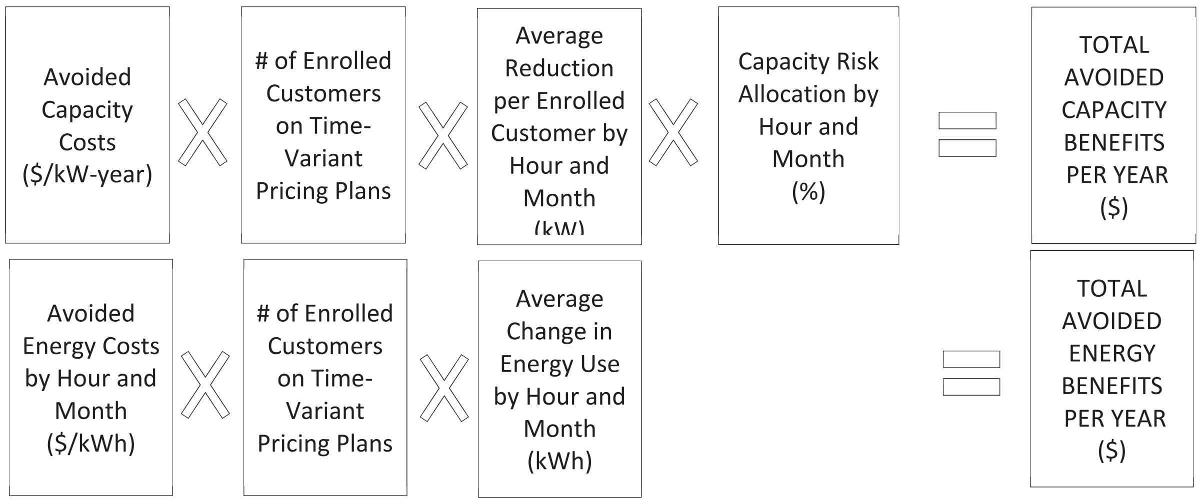
The primary benefits associated with time-variant pricing stem from a reduction in the need for new capacity additions and avoided wholesale energy costs due to reduced loads during high cost periods or shifting usage from higher to lower cost periods. Such pricing can also reduce the need for transmission and/or distribution investments but these benefits have not been included in the analysis conducted here.[51]

At the simplest level, avoided capacity and energy benefits are calculated as depicted in Figure 10-1. For capacity benefits, average load impacts by hour are multiplied by the number of enrolled customers to produce aggregate load reductions by time of day. The capacity risk allocation factor shown in the fourth box in the diagram is explained below but, in short, it is a way of recognizing that the risk of not having enough generation to meet demand is highly concentrated in relatively few hours of each year and few hours across multiple years. Put differently, it is a way of time-differentiating the capacity value

[51] As was true from the fact that we are relying on relatively cool, historical weather conditions rather than ex ante, extreme conditions, leaving out transmission and distribution benefits means that the values estimated here may understate the net benefits that can be realized from time-variant pricing. Including T&D benefits could increase net benefits by as much as 25%.

of demand reductions from time-variant rates so they can be compared with other capacity options. The benefits associated with avoided energy costs are calculated by multiplying the aggregate change in energy use in each hour by the avoided cost of energy production in each hour.

Figure 10-1: Cost-Effectiveness Calculations for Avoided Capacity and Energy Benefits



As mentioned above, a key factor in the capacity equation is the capacity risk allocation factor shown in the first equation. Time variant rates and other demand response (DR) resources, like peaking power plants, can be thought of as insurance against the rare situations in which demand would otherwise exceed the generation capacity of a utility. Continuing this insurance analogy, comparing the capacity benefits of time-variant rates to another resource (such as a single cycle gas turbine) is like comparing two car insurance quotes when the policies are different. When the car policy characteristics such as the deductible, bodily insurance limit, property damage limit and/or roadside assistance differ, the insurance quotes are not directly comparable. Similarly, different generators provide different types of insurance and different pricing plans and other types of DR provide different types of insurance. For example, the hours of the day and months of the year when high prices are in effect, and the maximum number of hours when they are in effect, are typically limited. Also, there are differences in the amount of resources that can be delivered by time-variant rates or other DR resources across specific hours and months. In SMUD's service territory, load reductions from time-variant rates are higher on high demand days when the value of the reductions are greatest. In order to make adequate comparisons, it is necessary to quantify how the insurance value varies by hour and month and factor in the extent to which resource availability coincides with the capacity value.

The capacity insurance value of a resource is directly linked to how it affects the risk of shortages in balancing demand and supply. All other factors being equal, a resource that can deliver when the risk of supply shortages is greatest should provide more insurance value than a resource that cannot. In most systems, extreme weather drives up the system demand, the likelihood of resource shortages and the need for additional capacity. Although unforeseen system shocks such as forced outages can occur during hours without extreme loads, the system is designed with sufficiently large operating reserves to absorb such contingencies and allow other installed resources to come online, ramp up, and meet demand.[52] At high system demand levels, it is more difficult to operate the system in general, and there is greater risk that unplanned outages will result in insufficient installed capacity. Put simply, the primary driver of additional capacity needs is demand.[53] This generally means that resources available in the summer mid-afternoon hours, when systems typically peak, have higher insurance value than resources available in shoulder or off-peak hours.

Figure 10-2 shows the load duration curves for the top 500 hours for SMUD for the years 2004-2013. The graph illustrates the fact that the top 10, 50 and 100 hours have substantially higher loads than all other hours. It also illustrates the fact that high system loads do not occur in each calendar year and, in the case of an extreme weather year, the risk of a resource shortage is increased. Nevertheless, the planning criteria for the supply system ensure that the likelihood of a resource shortage occurring on any given day is extremely low.[54] This equates to a very low likelihood that there are more than a few hours in a year in which resource shortages can occur.

Figure 10-3 shows a consolidated load duration curve for the same years, with the demand shown as the percentage of the highest peak demand from 2004-2013, 3,280 MW. Over 10 years there were only 12 hours in which demand was higher than 95% of the all-time system peak and only 71 total hours in which demand exceeded 90% of the all-time peak. This illustrates that reducing demand for a few hours, if targeted correctly, can significantly reduce the likelihood that system demand will come within 5% of the all-time system peak and will help avoid the need to procure additional generation capacity. Despite a relatively narrow, three-hour peak period and a limited number of event days (12), the SPO rates produce reductions for 36 hours per year (or 360 hours over 10 years), which is sufficient to reduce system peak loads and avoid the need for capacity additions.

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[52] Installed capacity shortages are altogether different than the ability to recover from system shocks, such as transmission or generation forced outages. Installed capacity includes operating reserves, generation online and generation off line. The system operator has separate criteria for adequate amounts of quick response operating and back-up reserves (ancillary services) to help balance the system and recover from any shocks.

[53] In some systems, scheduled outages for generator maintenance during shoulder months can also affect the likelihood of supply shortages. In incorporating scheduled outages, it is important to distinguish risk due to scheduling error from risk due to insufficient installed resources. In many systems, scheduling maintenance is a challenge, but it is also the case that, when done properly, the risk of a shortage in supply is relatively low in shoulder months compared to in the peaking months, which are usually during the summer.

[54] In other words, the Loss of Load Expectation (LOLE) is highly unlikely to exceed 20 or 50 hours, much less 100 hours, given the existing planning criteria.

Figure 10-2: SMUD Load Duration Curves for 2004 through 2013

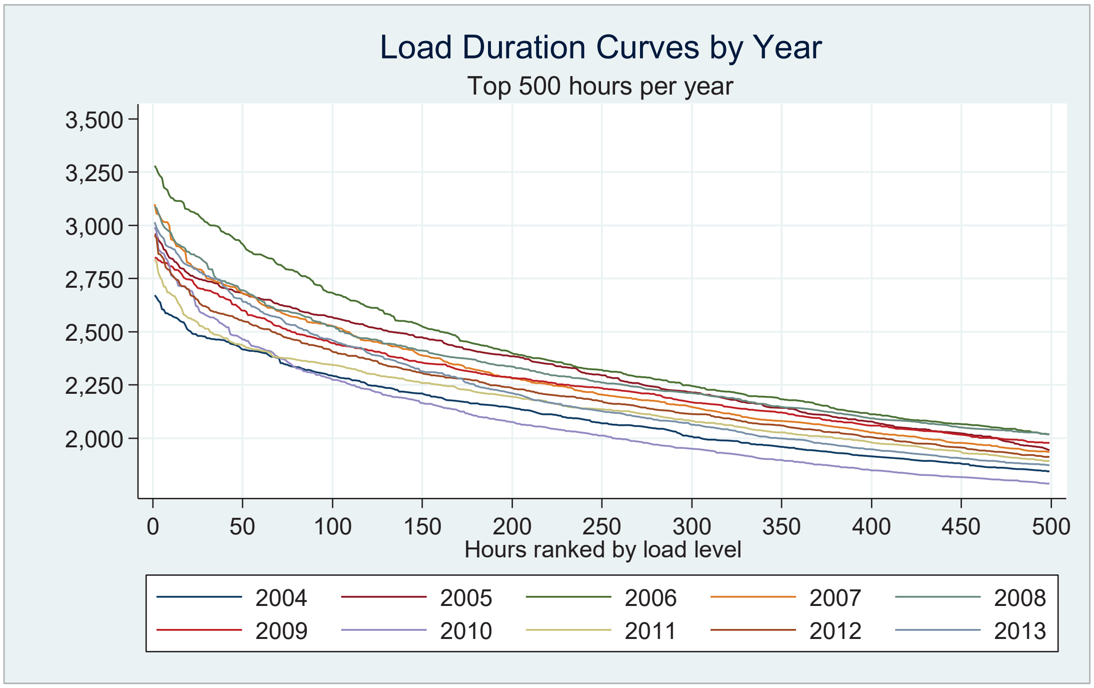
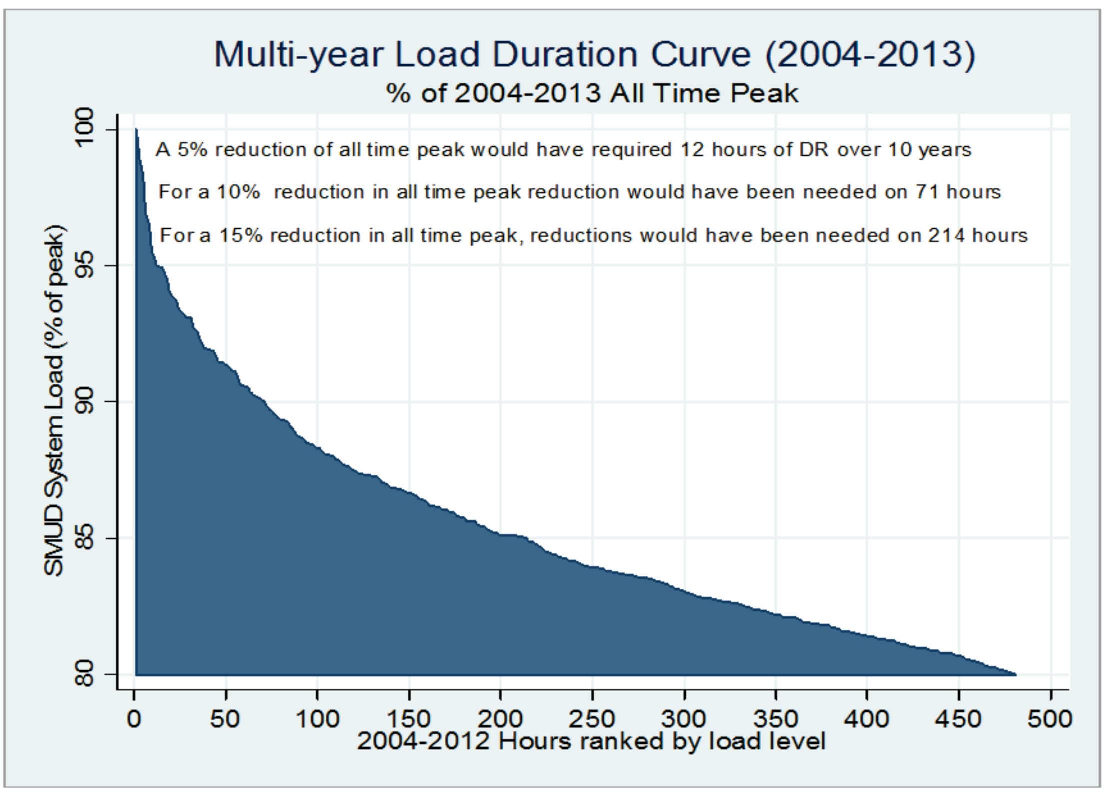


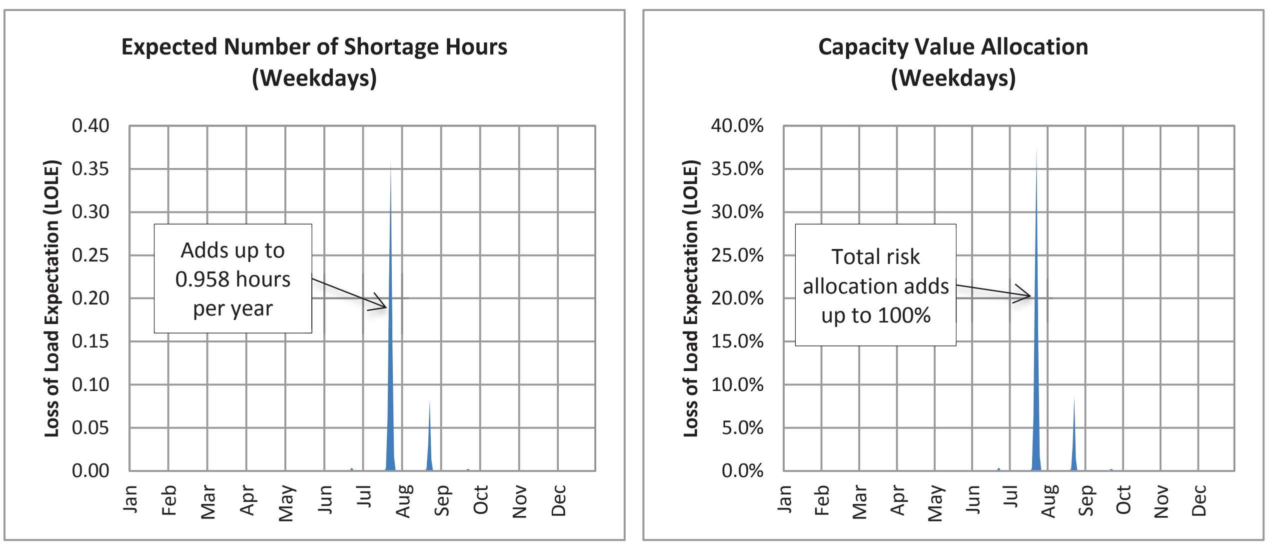
Figure 10-3: Number of Hours in Which Demand is Within X% of SMUD's All Time System Peak



Shortages in installed capacity typically occur when system loads are high or when multiple generators experience unforeseen outages at the same time. SMUD simulated the risk of shortages, taking into account the likelihood of extreme system loads and the probability of generator forced outages. The process is repeated thousands of times because loads for any given year are not known in advance and because there was a random component to forced outages. The goal is to estimate how many shortage hours can be expected on average – known as the Loss of Load Expectation (LOLE) – and when shortages are most likely to occur. This data on the concentration of risk can be used to calculate the concentration of the need for capacity and to time differentiate capacity value.

Figure 10-4 shows how the allocation of capacity value is developed. The left hand side of the figure shows the expected number of shortage hours (LOLE) by month and hour of day. The right hand side of the figure is identical except for the scale, which reflects the share of expected shortages in each combination of month and hour of day. Note that the total for the allocation of capacity need across all months and hours of the day adds up to 100%. As shown, the risk of high system loads is highly concentrated in summer months and in afternoon hours. The need for installed resource capacity to meet extreme system loads is similarly concentrated. Based on the risk allocation, one can say, for example, that 4.8% of the risk is concentrated in the hours from 3 PM to 4 PM in July.

Figure 10-4: Illustrative Example of Time Differentiated Risk Allocation for Capacity Need



This type of risk allocation of capacity need can be used to time-differentiate capacity value. For illustration, assume that the avoided cost of capacity is $120 per kW-year. If 4.8% of the overall risk allocation is concentrated in the 3 PM to 4 PM hour of the month of July, $5.76 of the total capacity value (4.8% x $120 = $5.76) is allocated to that time period. Load reductions that result from time-variant pricing during those hours would then be valued at an avoided cost of $5.76. Load reductions that occur during different hours, for example in September when the risk allocation is roughly 0.5%, would have a much lower value (e.g., (0.5)x$120 = $0.60).

Once the avoided capacity and energy costs have been calculated using the conceptual framework outlined above, the net benefits over time must be compared with the cost of achieving those benefit streams to determine net benefits (or the benefit-cost ratio) for each pricing plan. For modeling cost-effectiveness in this instance, costs have been estimated for the following four cost categories:

- *One-time costs not tied to enrollment.* These are mainly program set up costs incurred when a program is developed and initially launched. They are not recurring and are not tied to the number of enrollments. They include components such as developing IT systems for settlement, initial market research to inform program design and other similar components.
- *Recurring costs or incentives not tied to enrollment*. These costs are incurred annually and do not change materially with program expansion or contraction. They are often referred to as overhead costs. They typically include the personnel costs required to administer the program.
- *One-time costs or incentives tied to enrollment*. These are costs that are incurred when a customer is initially enrolled. They can be in the form of equipment and installation costs, acquisition costs, sign-up incentives or other costs. Their defining characteristic is that they do not recur annually.
- *Recurring costs or incentives tied to enrollment*. These costs are incurred annually but grow or decrease as enrollment changes. They can be in the form of recurring customer engagement costs, equipment monitoring or annual incentive payments.

The input values used to calculate costs and benefits are summarized in Section 10.2.

10.2 Overview of Input Values

This section contains a brief summary of the key inputs to the cost effectiveness model. Each of the scenarios summarized in Table 10-1 is assumed to go into effect starting in 2018. The net present value (NPV) of benefits and costs are compared over 10 years based on a nominal discount rate of 7.1%.

The load impact estimates used in the analysis are based on the two-year, ex post average impacts for each SPO pricing plan. As discussed in the introduction to this section, it would be better to use ex ante impact estimates for normal and extreme weather conditions. However, development of those estimates was not part of the work scope for this project. Thus, the analysis is based on the ex post values, which will understate the net benefits that would exist under normal and extreme weather since both 2012 and 2013 were below normal weather years. For simplicity, we have used only the changes in load during the peak period from 4 to 7 PM for all pricing plans. Changes in off-peak loads and energy conservation effects have not been factored into the analysis. For TOU pricing plans, estimated load reductions differ for CPP and non-CPP days, which produces a more accurate estimate of net benefits since so much of the capacity value is concentrated in a few hours on the hottest days. Using the average weekday values only would understate the benefits for TOU plans. For CPP plans, load impacts on non-CPP days are assumed to be zero, whereas load impacts for TOU rates equal the average impact on non-CPP day weekdays. The hourly impacts by month that are used in the analysis are contained in Appendices B and C and are consistent with the average impacts reported in Sections 4 and 5.

Load impacts for the three default scenarios that did not include an offer of an IHD were assumed to be the same as the SPO pricing plans that included the IHD offer. As discussed in Section 6.3, although there are statistically significant differences in load impacts between the opt-in TOU groups with and without the offer of an IHD, there is also a pretreatment difference between these two groups as was seen in Figure 6-1. This difference, when netted out, more than offsets the observed post treatment difference. Put another way, it is invalid to attribute the difference in impacts between the two groups to the presence of the IHD. As such, we are comfortable assuming that the load impacts are the same with and without an IHD.

As also discussed in Section 6.3, although there are very large differences in observed load shapes between default customers who requested an IHD and those who did not, and also between those who requested an IHD and had it connected all or some of the time during the 2013 summer and those who did not (see Figures 6-3 through 6-10), it is impossible to know whether any of these differences are due to selection effects or due to the influence of the IHD. The analysis in Section 6.2 shows clearly that customers who requested an IHD are much more engaged than those who did not, which is a clear indication of a strong selection effect.

The customer enrollment and attrition values used for the cost effectiveness analysis are taken directly from Tables 8-7 through 8-9 and 8-14 through 8-16. Each scenario assumes that the pricing plans are offered to SMUD's entire residential population and the acceptance and attrition rates found in the SPO apply to the entire residential class. The analysis also assumes that, for opt-in programs, customers who move from one location to another within SMUD's service territory will be defaulted onto the same rate that they had before moving. Given the high move rate in SMUD's service territory, any opt-in program that did not implement this business policy would have much higher recruitment costs, and much lower net benefits, than are shown in Section 10.3. Based on input from SMUD, we have assumed that 80% of customers who move each year relocate somewhere within SMUD's service territory and, therefore, remain on the same time-variant rate they were on before moving. Also based on input from SMUD, we assume that there is still a cost associated with setting these movers up on the same pricing plan after they relocate but this cost is much lower than the cost of recruiting a new customer to replace them. For default pricing plans, these setup costs are assumed to be 0.

The avoided capacity cost estimates were provided by SMUD. The estimated values for each year are confidential. Generally, they range from roughly $50 to $80/kW-year in the first few forecast years and increase to around $125/kW-year by the end of the forecast period. As discussed in Section 10.1, the avoided capacity costs are time differentiated using estimates of the loss of load probability provided by SMUD. LOLP on SMUD's system is highly concentrated in a few hours. The peak period hours from 4 to 7 PM in July and August capture 75% of the annual LOLP. As such, load reductions during these hours are much more highly valued than those at any other time of the year.

Avoided energy prices were also provided by SMUD and, like capacity values, are confidential. As discussed previously, for simplicity, we have only examined the load impacts during the peak period and, therefore, only energy prices for the hours from 4 to 7 PM are factored into the benefit calculation. Furthermore, only summer months are relevant since time-variant rates examined here are only in effect during the summer months. Generally, prices during the peak period range from $0.035 to $0.045/kWh on the average weekday and are 5 to 10% higher on the typical event day.

Table 10-2 summarizes the costs for each of the four primary cost categories that are used as input to the analysis. These are based on costs that were incurred for a variety of activities as part of the SPO and assumptions about how various costs would change if the pricing plans were offered to the entire residential population. As seen in the table, the biggest cost difference across pricing plans has to do with one-time equipment and acquisition costs for customers. Plans that do not offer an IHD have much lower costs than those that do and default plans have much lower acquisition costs than opt-in plans. Fixed costs vary somewhat across plans based primarily on differences in management costs for projects with and without IHDs and differences in notification costs for CPP versus TOU plans. One time fixed costs are higher for default CPP programs compared with opt-in programs because of required upgrades to the billing system to handle the larger volume of billing for CPP customers.

Table 10-3: Cost Inputs

Option	Fixed Costs (Non-volumetric)		Variable Costs (Per Enrollee)	
	One Time Costs ($000)	Recurring Annual Costs ($000)	One Time Costs	Recurring Annual Costs
Opt in TOU No IHD	$748	$245	Acquisition: $62.84	$4.60
Opt in TOU with IHD	$778	$245	Equipment: $131.20 Acquisition: $60.70	$4.66
Opt in CPP No IHD	$1,322	$335	Acquisition: $58.53	$7.88
Opt in CPP with IHD	$1,352	$445	Equipment: $131.20 Acquisition: $60.46	$7.47
Default TOU with IHD	$778	$245	Equipment: $131.20 Acquisition: $3.99	$2.18
Default CPP with IHD	$1,352	$445	Equipment: $131.20 Acquisition: $5.02	$5.33
Default TOU-CPP with IHD	$778	$445	Equipment: $131.20 Acquisition: $6.29	$5.33
Default TOU no IHD	$748	$155	Acquisition: $3.99	$2.18
Default CPP no IHD	$1,322	$335	Acquisition: $5.02	$5.33
Default TOU-CPP no IHD	$748	$335	Acquisition: $6.29	$5.33

10.3 Cost-Effectiveness Estimates and Sensitivity Analysis

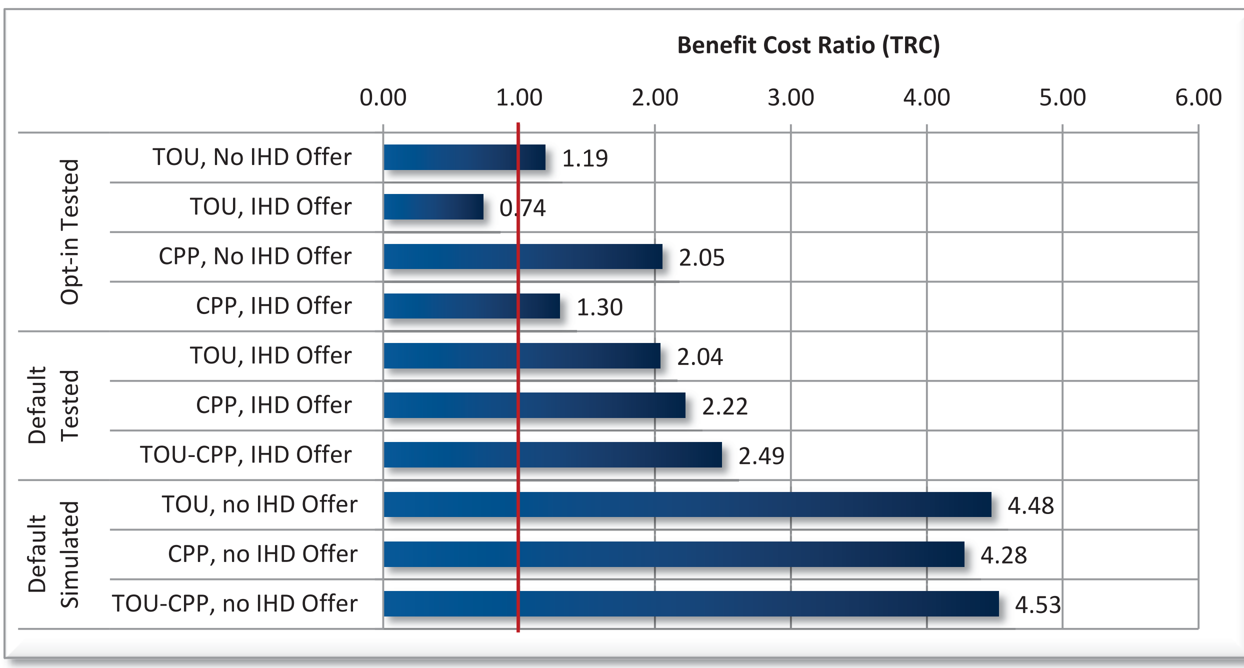
Table 10-3 shows the NPV of benefits and costs over a ten year period for each pricing plan, as well as the benefit-cost ratio for each plan, based on the inputs and methods described above. Figure 10-5 displays the benefit-cost ratios visually so it is easy to compare the values across pricing plans. The values in the table and figure are for overall cost-effectiveness which includes both start-up and ongoing costs and address the policy question of which plan would be most cost effective if it were to be implemented from scratch. The marginal cost effectiveness values are shown in Table 10-4 and Figure 10-9. These estimates address the policy question of whether it is cost effective to continue to enroll more customers onto a plan once it is up and running.

As seen in the table, all but one of the pricing plans, opt-in TOU with an IHD offer, are cost effective, but the magnitude of net benefits vary by almost a factor of 60 from the plans with the lowest and highest positive net benefits. Of the 7 pricing plans tested in the SPO, if they were to be extended to SMUD's entire residential population, the net benefits over 10 years would range from a low of roughly -$5.5 million for the opt-in TOU plan with the IHD offer to more than $86 million for the default TOU-CPP plan with an IHD offer.

Table 10-5: NPV of Benefits and Costs by Pricing Plan ($ millions)

Scenario Type	Scenario	Benefit/Cost Ratio	10 Year NPV for SMUD Territory		
			Benefits	Costs	Net Benefits
Opt-in Tested	TOU, No IHD Offer	1.19	$12.1	$10.2	$2.0
	TOU, IHD Offer	0.74	$15.5	$21.0	-$5.5
	CPP, No IHD Offer	2.05	$29.7	$14.4	$15.2
	CPP, IHD Offer	1.30	$34.3	$26.3	$7.9
Default Tested	TOU, IHD Offer	2.04	$66.9	$32.8	$34.1
	CPP, IHD Offer	2.22	$142.1	$63.9	$78.2
	TOU-CPP, IHD Offer	2.49	$144.8	$58.1	$86.7
Default Simulated	TOU, no IHD Offer	4.48	$66.9	$15.0	$52.0
	CPP, no IHD Offer	4.28	$142.1	$33.2	$109.0

Figure 10-5: Benefit Cost Ratios by Pricing Plan



Under the assumption that the IHD adds significantly to costs but provides no additional benefits (an assumption that is consistent with the empirical evidence from the SPO), pricing plans that include the offer of an IHD are all much less cost effective than the equivalent plan that does not offer an IHD. For the default plans without an IHD offer, the TOU plan has the lowest net benefits but still exceeds $50 million. The TOU-CPP plan is estimated to deliver net benefits that are more than twice as large as the TOU plan. In general, all CPP plans deliver net benefits that are roughly twice as large as the equivalent TOU plan. This stems from the fact that the LOLP and therefore the time-differentiated value of avoided capacity, is highly concentrated in relatively few hours, and the average load reductions for CPP plans are roughly twice what they are for the TOU plans during those hours.

The benefit cost ratios for the 10 scenarios examined range from 0.74 for the opt-in TOU plan with IHD offer, to 4.53 for the TOU-CPP plan with no IHD offer. For the same reasons discussed above, the ratios are much lower for opt-in plans than default plans, lower for default plans with an IHD offer than for those without, and lower for CPP plans compared with TOU plans.

Figures 10-6 through 10-8 show the results of sensitivity analysis that was done for three of the pricing plans: opt-in and default CPP and default TOU, all without an IHD offer. This analysis shows how the benefit-cost ratio varies with changes in input values. Each row in the figures, labeled on the Y axis, shows the change in the benefit-cost ratio given a change of plus or minus 20% in the base value used in the analysis. For example, for the opt-in CPP plan shown in Figure 10-6, the benefit-cost ratio of 1.67 was based on the load impact estimates discussed in Section 10-2. If the peak period load reduction for this pricing plan was 20% less than what was observed in the SPO, the benefit-cost ratio would fall to 1.31. If it was 20% larger than what was scene in the SPO, it would increase to 1.95. The variables shown at the top end of the vertical axis are much more significant drivers of net benefits than those at the bottom.

These figures show not only which variables are the most significant drivers of net benefits, but also illustrate how robust each pricing plan is to changes in input values and assumptions. If the benefit-cost ratio is above 1 in all cases, as it is for these three plans, or the value varies little when inputs vary, it is quite robust. If the ratio dips below 1 given changes in some input values, and if these values have a fair amount of uncertainty associated with them, pricing strategies based on those plans may or may not be sound depending on how things materialize over time.

For all three pricing plan scenarios, load impacts and avoided capacity costs are the most significant drivers of net benefits. Indeed, for the CPP plans, the variation in the benefit-cost ratio is identical given a plus or minus 20% change in either load reductions or avoided capacity costs. This is logical since the product of these two variables, weighted by the time-differentiated capacity value, produce about 99% of the benefit. For TOU rates, avoided energy costs outside the peak period also contribute to the benefit calculation so the variation in net benefits given changes in peak period load impacts and avoided capacity costs differ.

Looking at the other variables in each figure, recurring costs tied to enrollment are the third most important driver of net benefits for the default plans whereas for the opt-in plan, one-time costs tied to recruitment are more important.

Figure 10-6: Sensitivity Analysis for Opt-in CPP Pricing Plan (No IHD Offer)

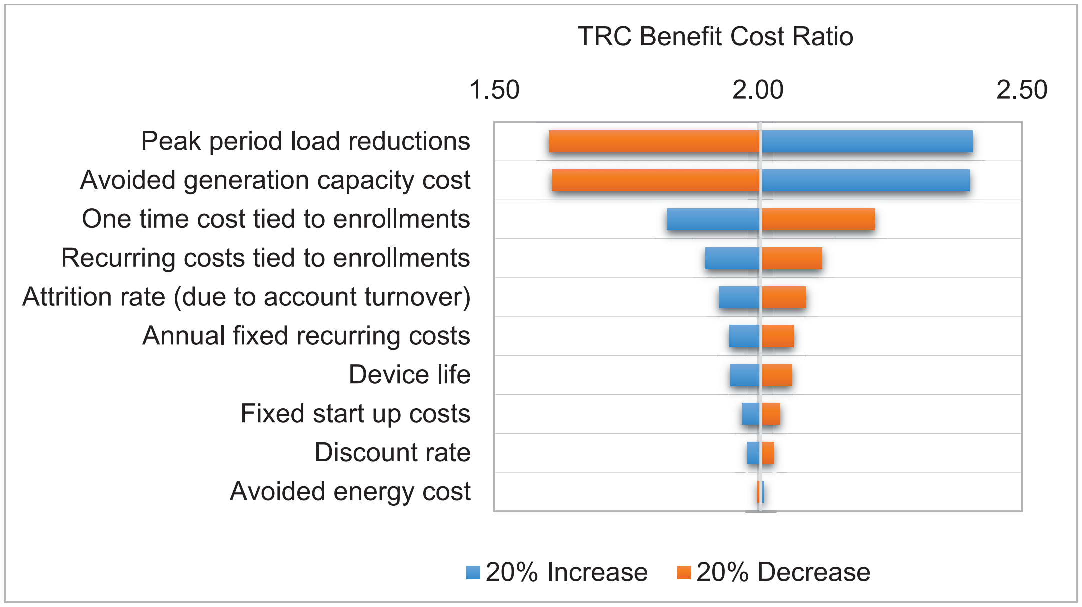


Figure 10-7: Sensitivity Analysis for Default TOU Pricing Plan (No IHD Offer)

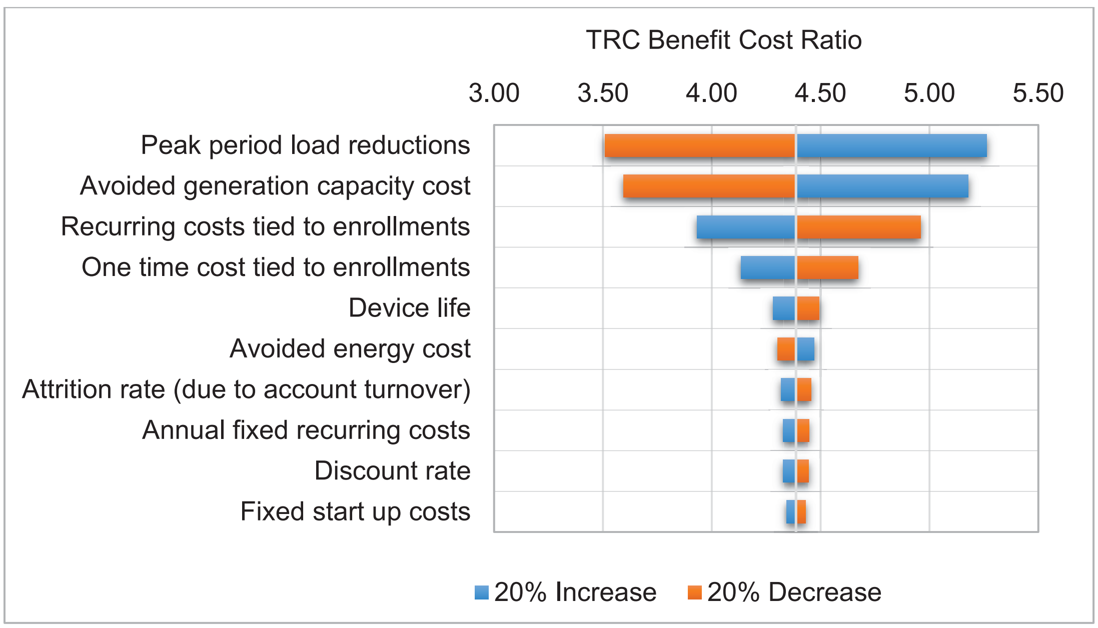


Figure 10-8: Sensitivity Analysis for Default CPP Pricing Plan (No IHD Offer)

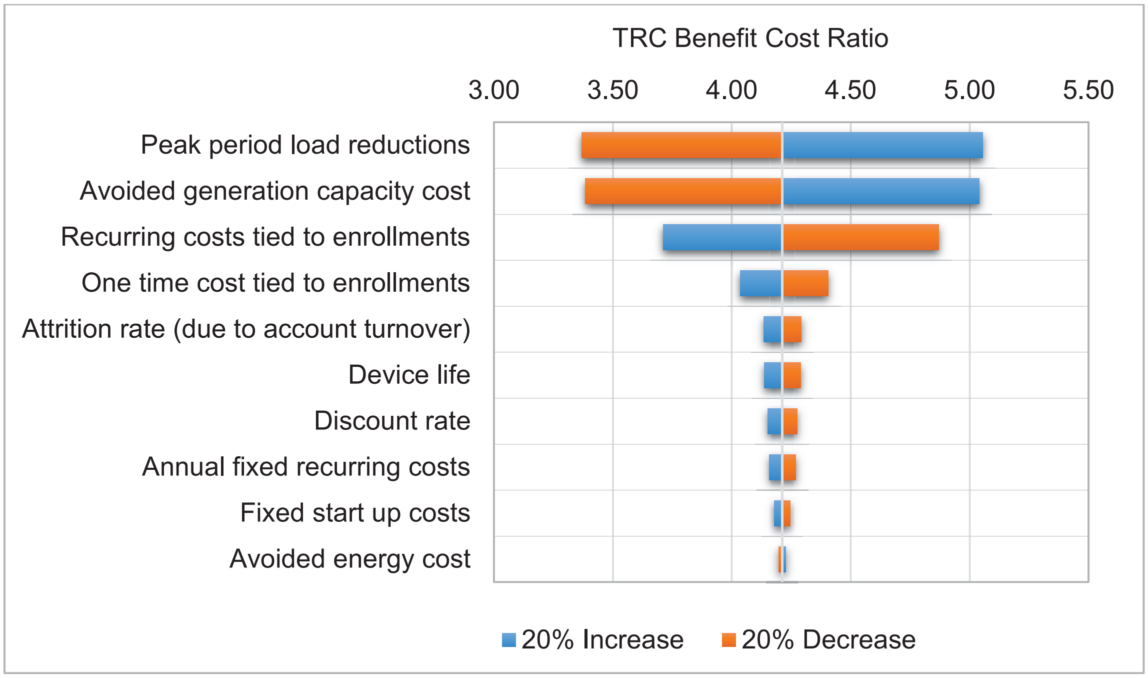
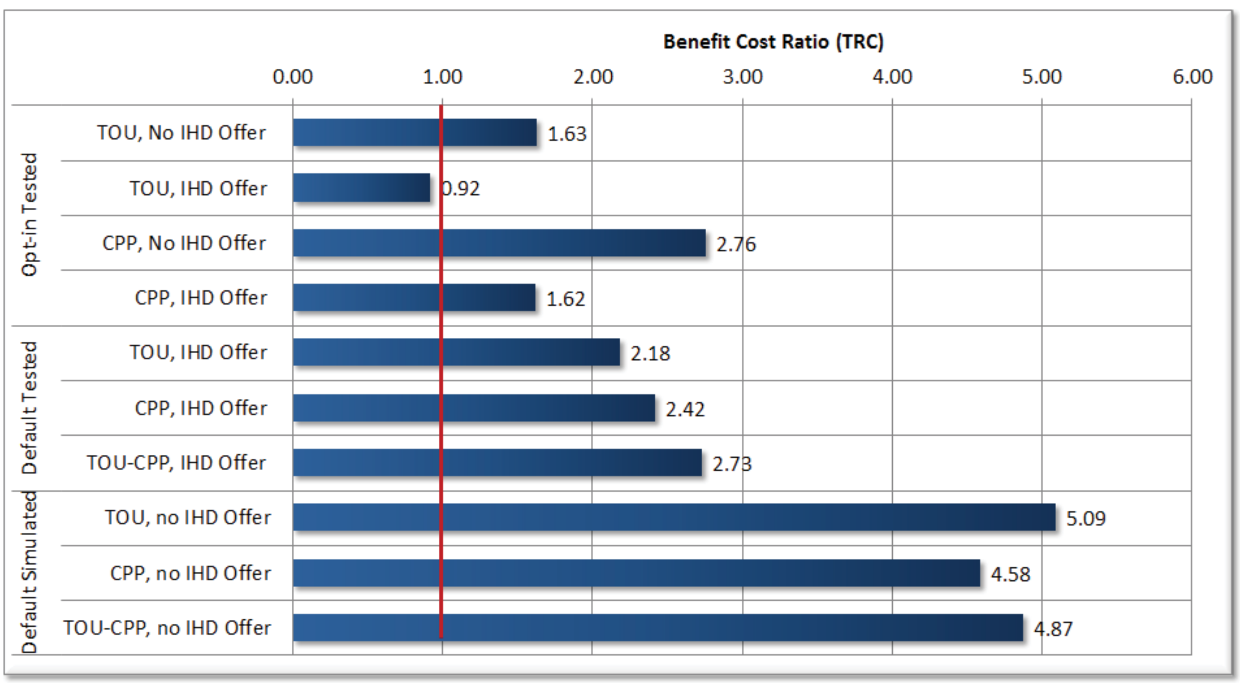


Table 10-4 and Figure 10-9 summarize the results of the marginal cost-effectiveness analysis for each pricing plan for the marginal customer, that is, the next customer to be enrolled. This analysis excludes the startup costs associated with each program and addresses the question of whether or not it is cost effective to expand an existing program, based largely on a comparison of incremental costs and benefits per customer. The analysis indicates that it would be cost effective to expand all of the pricing plans except the opt-in TOU rate with IHD offer, where the incremental costs exceed the incremental benefits because of the relatively low load impacts and the high cost of the IHD.

Table 10-4: NPV of Marginal Benefits and Costs by Pricing Plan for the Average Customer ($)

Scenario Type	Scenario	Benefit/Cost Ratio	10 Year NPV for SMUD Territory		
			Benefits	Costs	Net Benefits
Opt-in Tested	TOU, No IHD Offer	1.63	$142	$87	$55
	TOU, IHD Offer	0.92	$188	$206	-$17
	CPP, No IHD Offer	2.76	$268	$97	$171
	CPP, IHD Offer	1.62	$355	$219	$136
Default Tested	TOU, IHD Offer	2.18	$100	$46	$54
	CPP, IHD Offer	2.42	$153	$63	$90
	TOU-CPP, IHD Offer	2.73	$178	$65	$113
Default Simulated	TOU, no IHD Offer	5.09	$100	$20	$80
	CPP, no IHD Offer	4.58	$153	$34	$120
	TOU-CPP, no IHD Offer	4.87	$178	$37	$142

Figure 10-9: Marginal Benefit-Cost Ratios by Pricing Plan



11 End of Pilot Survey

This final report section summarizes the results from a survey that was done in the fall of 2013, after the end of the summer period, to obtain input among pilot participants on the following topics:

- Customer satisfaction with SMUD and with the pricing plan customers were on;
- Awareness of the attributes of each pricing plan;
- Perceptions about the pricing plan;
- Reasons for staying on the pricing plan;
- Awareness of events for the CPP pricing plans; and
- IHD use.

The survey questionnaire is contained in Appendix F. The survey was sent to all customers who were enrolled on a pricing plan (including those who actively dropped out but not those who moved) as well as a sample of control group and deferred customers. The survey was conducted using both online and hard copy questionnaires. The field work included the following multi-step process:

- Pre-announcement letter on SMUD letterhead;
- $2 with a letter sent by Nexant's market research group, Population Research Systems (PRS), on PRS letterhead with a URL link to where the survey could be completed;
- In addition to the above letter, customers for whom SMUD had email addresses were also sent a link via email for convenience;
- An email reminder was sent to non-respondents, with a URL link;
- A reminder letter with a hardcopy survey was sent to those who still had not responded to prior solicitations – this letter also contained a URL link to the questionnaire; and
- One more reminder email with a link; and
- Reminder postcard with URL link included.

The survey was in the field from November 13, 2013 through January 2, 2014. Table 11-1 shows the number of customers solicited by segment and the response rates for each group. As seen, there were 20 different customer groups included in the survey and the response rates varied across cells, with a low of 26% for those in the default, CPP-TOU treatment group who did not ask to receive an IHD to a high of 62% for the same default treatment group who did ask to receive an IHD. The overall response rate was 40%. Table 11-2 shows the survey topics covered for each survey cell.

Table 11-1: Number of Surveys Sent and Returned by Customer Segment

Group	Outcome	Group #	Population	Mailings	Completed Surveys	% Completed
Control Group		1	31,149	800	300	38%
Default CPP	No IHD Delivered	2	398	393	100	25%
	IHD Delivered	3	129	126	63	50%
	Actively Dropped Out	4	66	66	20	30%
Default TOU	No IHD Delivered	5	1,164	1,157	285	25%
	IHD Delivered	6	326	325	132	41%
	Actively Dropped Out	7	121	120	45	38%
Default CPP-TOU	No IHD Delivered	8	323	319	84	26%
	IHD Delivered	9	95	92	57	62%
	Actively Dropped Out	10	81	79	23	29%
Opt-in CPP	IHD Offered and Delivered	11	1,101	1,094	490	45%
	IHD Offered and Not Delivered	12	59	59	26	44%
	IHD Not Offered	13	145	143	60	42%
	Actively Dropped Out	14	142	140	57	41%
Opt-in TOU	IHD Offered and Delivered	15	1,476	1,475	660	45%
	IHD Offered and Not Delivered	16	59	59	25	42%
	IHD Not Offered	17	866	857	332	39%
	Actively Dropped Out	18	187	186	97	52%
Opt-in TOU - Deferred	IHD Offered	19	1,649	800	370	46%
	IHD Not Offered	20	984	800	366	46%
Total			**40,520**	**9,090**	**3,592**	**40%**

Table 11-2: Survey Topics Covered by Customer Segment

Set #	Set of Questions	Group #																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	General satisfaction with SMUD	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	Awareness and understanding of pricing plan features	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	Pricing plan expectations, Were expectations met?, Perception of savings, control and comfort impacts		X	X		X	X		X	X		X	X	X		X	X	X			
4	Behavioral changes and perceived difficulty		X	X		X	X		X	X		X	X	X		X	X	X			
5	Questions regarding opt outs at the beginning of 2013 summer				X			X			X				X				X		
6	Use, connectivity and perceived impact of IHDs (also as it relates the pricing plan and knowledge of appliance			X			X			X		X				X					
7	Reasons for Staying on the Pricing Plan		X	X		X	X		X	X		X	X	X		X	X	X			
8	Selected demographic questions	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

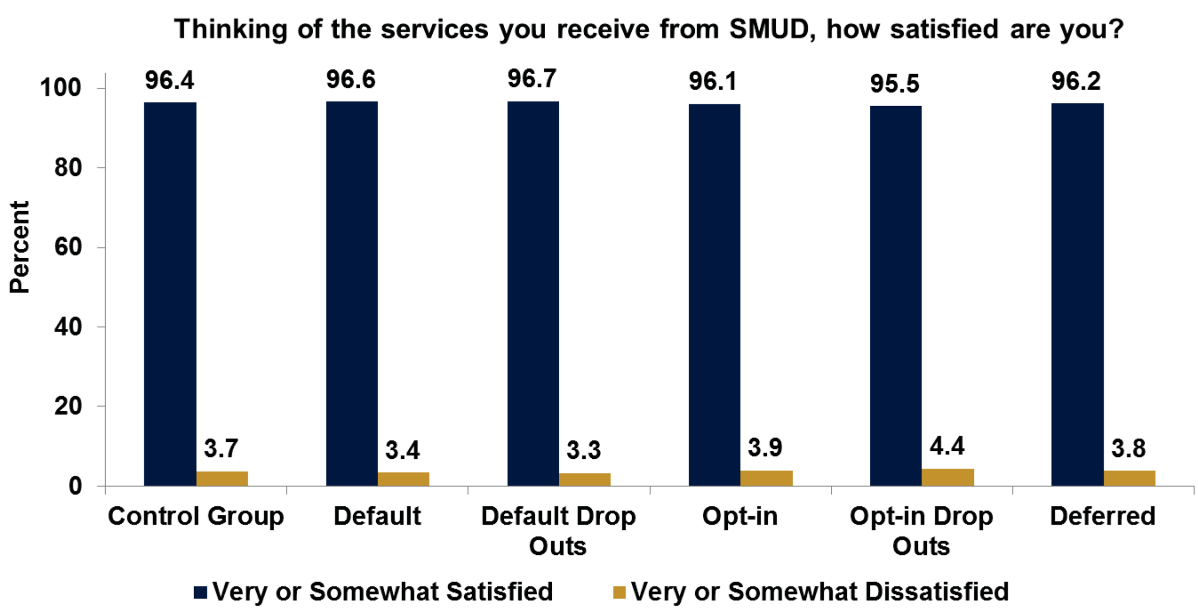
The differential response rates across customer segments shown in Table 11-1 mean that comparing survey responses across cells must be done carefully. For example, if we were to observe a significant difference in the response to a question between default CPP-TOU participants who did and did not ask for and receive an IHD, it would be difficult to know if this difference was due to differences in the responses of those two customer segments or due to differences in customers from the two segments who responded to the survey (e.g., differential response bias). Further investigation showed a relatively strong correlation between survey response and participation in selected treatment cells. For example, default customers (across all treatment groups) who responded to the survey were more than twice as likely to request an IHD (35%) compared with default customers who did not respond to the survey. Similarly, twice as many (20%) default customers who responded to the survey were enrolled in two or more other SMUD programs (e.g., Green Energy, EE Loan or Rebate, etc.) than customers who did not respond to the survey (9%). If those who requested an IHD and who participated in other SMUD programs are collectively defined as “engaged customers”, it is clear these engaged customers are more likely to respond to the survey, more likely to enroll on opt-in pricing plans (as was seen in Section 8) and more likely to request an IHD. As such, comparing responses between those who did and did not request an IHD among default customers is probably not appropriate. Similarly, it may not be appropriate to extrapolate from those who responded to the survey to all default customers since those who did not respond are much less likely to be engaged customers and may have different perceptions than those who do respond. On the other hand, it is less certain whether there is much differential response bias between opt-in customers who responded to the survey and default customers who responded to the survey, since both groups have higher concentrations of engaged customers. While these responses may not represent well the non-respondent population for opt-in or default segments, they may represent well the engaged default and engaged opt-in customers who are likely to produce most of the demand response associated with these pricing plans.

With these cautions in mind, the remainder of this discussion summarizes the key findings from the end of pilot survey. The summary touches most of the questions included in the survey. Those not covered in this section are summarized in Appendix G.

11.1 Customer Satisfaction with SMUD Services

Figure 11-1 summarizes survey responses to the question, "Thinking of all of the services you receive from SMUD, how satisfied are you?" A four point scale was used, where 1 = very satisfied, 2 = somewhat satisfied, 3 = somewhat dissatisfied and 4 = very dissatisfied. As seen in the figure, SMUD's overall satisfaction ratings are extremely high and vary very little across treatment groups. Not shown in the figure, but important to note, is that within the top-two scores shown, on average, 70% of respondents gave the highest rating of 4 and 30% gave a rating of 3. Very importantly, satisfaction ratings were nearly identical for survey respondents in the control group, the default pricing plans and the opt-in pricing plans. That is, defaulting customers onto a new pricing plan did not reduce customer satisfaction relative to those in the control group or in the opt-in pricing plans. Also important is that the group of opt-in customers who were deferred for two years in order to provide a valid control group for opt-in treatments also provided nearly identical satisfaction ratings as those who were not deferred. Finally, drop outs who responded to the survey also had nearly identical satisfaction ratings as those who stayed on the rate for both default and opt-in pricing plans. While it is always possible that only the most satisfied customers are willing to respond to surveys and, therefore, these ratings may have an upward bias, given the amazingly high and consistent ratings across all groups, it would be hard to imagine that the magnitude of any response bias would be large enough to change the general conclusion that all groups are highly satisfied with SMUD's services overall and that satisfaction ratings are very similar across the very diverse segments included in the survey.

Figure 11-1: Customer Satisfaction with SMUD Services



11.2 Customer Satisfaction with and Perceptions of Pricing Plans

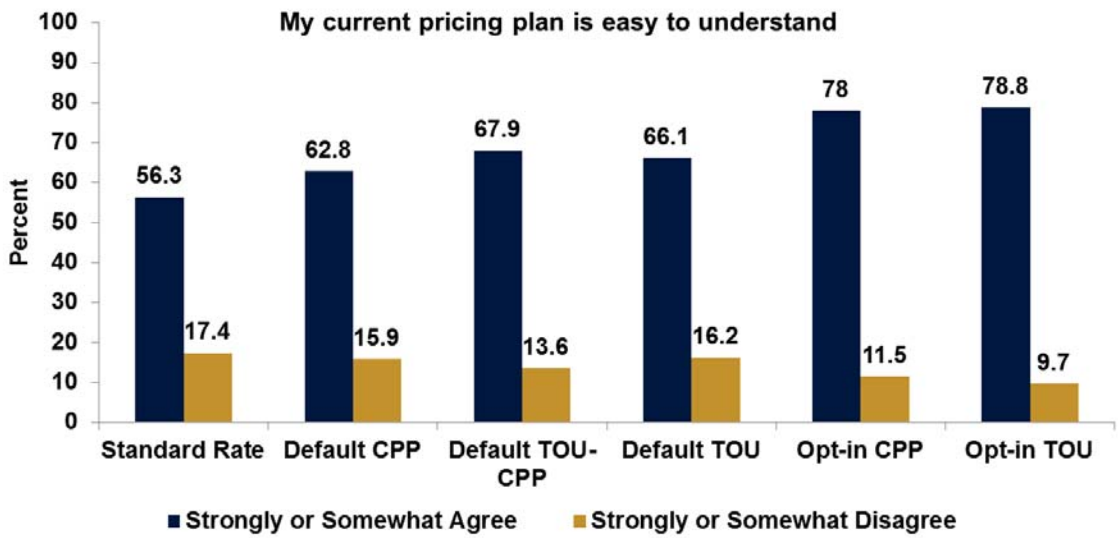
The survey included a number of questions designed to determine customer satisfaction with, understanding of, and perceptions about the pricing plans they were on. Table 11-3 summarizes the findings related to satisfaction with the pricing plan. The most common response across all plans, including the standard rate, was "somewhat satisfied", with a percent ranging from a low of 54% for the opt-in TOU plan to a high of 64% for the default CPP-TOU plan. Interestingly, the standard rate plan received more dissatisfied ratings than any of the other plans (with more than 20% of respondents rating the plan somewhat or very dissatisfied) and the lowest top-two-box scores among all the plans (with 80.3% scoring the standard plan either a 1 or a 2). Some of the additional survey results summarized below provide clues regarding why customers may rate time-variant pricing more highly than standard, tiered pricing in terms of overall satisfaction.

Table 11-3: Customer Satisfaction with Pricing Plans (%)
(1 = very satisfied; 2 = somewhat satisfied; 3 = somewhat dissatisfied; 4 = very dissatisfied)

Category	N	1	2	3	4
Control (standard rate)	300	20.3	60.0	15.0	4.7
Default CPP	163	30.1	57.0	10.6	2.3
Default CPP-TOU	141	22.1	63.9	10.4	3.6
Default TOU	417	22.9	61.5	13.6	2.1
Opt-in CPP	576	33.1	56.3	9.2	1.4
Opt-in TOU	1017	32.8	54.3	10.6	2.3

One reason why customers may be less satisfied with the standard rate than with time-variant pricing plans is that they feel the standard rate is more difficult to understand. Figure 11-2 shows the top-two and bottom-two box scores, on a five-point scale, to the question, "Please indicate whether you agree or disagree with the statement – my current pricing plan is easy to understand." The scale for this question is 1 = strongly agree; 2 = somewhat agree; 3 = no opinion; 4 = somewhat disagree; 5 = strongly disagree. On average, the "no opinion" response was given by about 20% of customers although only about 10% of opt-in customers gave this response. The difference between the sum of the two columns for each plan in Figure 11-2 and 100 is the percent of respondents indicating no opinion. As indicated in the figure, the standard pricing plan has the lowest agreement rating for this statement and the highest disagreement rating. The opt-in plans have higher agreement ratings than the default plans.

Figure 11-2: Perceived Ease of Understanding of Pricing Plans



Perception and reality are often different, especially for electricity tariffs with their fixed and variable components, different pricing tiers, and multi-part charges for distribution services, generation services and other cost components. While it may not be true that customers on time-variant rates actually understand the details better than those on the standard rate (especially time-variant rates that are an overlay on the standard tiered rate as was the case here), it is possible that customers feel like they do because of the educational material provided to them as part of the pilot, especially the graphical materials showing the low and high priced periods by time of day.

To explore this further, the survey asked customers a question designed to test their knowledge about the rate they were on. The question was as follows:

- Thinking only of the way you are charged for electricity in summer, which of the following best describes your household pricing plan? ***Check only one***
    1. Pay the same price for electricity no matter when you use it
    2. Pay a higher price for electricity used between 4:00 and 7:00 PM on all days
    3. Pay a higher price for electricity used between 4:00 and 7:00 PM on weekdays only
    4. Pay a much higher price for electricity used between 4:00 and 7:00 PM on 12 Conservation Days
    5. Pay a higher price for electricity used between 4:00 and 7:00 PM on weekdays **with** an even higher price on 12 days during the summer called Conservation Days
    6. Don't know

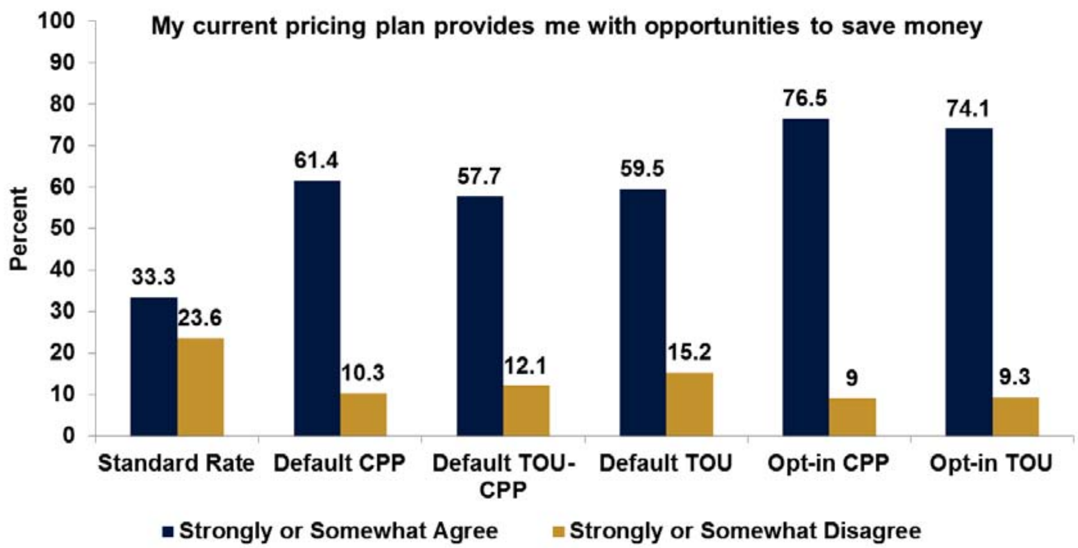
Table 11-4 summarizes the responses to this question. As seen, by far the greatest number of "don't' know" responses came from control customers on the standard rate plan, with 56% of respondents answering "don't know." Opt-in participants had by far the lowest number of "don't know" responses and the highest number of accurate responses. The accuracy of responses was similar for default and standard rate customers, although fewer default customers responded "don't know" than standard rate customers, indicating that they thought they knew the right answer. This finding is consistent with the higher perceived understanding by default customers compared with standard rate customers shown in Figure 11-2.

Table 11-4: Actual Understanding of Pricing Plans
(Correct answer circled in red)

Category	N	1	2	3	4	5	6
Control (standard rate)	300	25.7	8.7	4.7	0.3	4.7	56.0
Default CPP	163	15.9	7.2	4.9	19.6	13.7	38.6
Default CPP-TOU	141	9.9	12.8	10.4	7.9	21.4	37.6
Default TOU	417	13.2	16.1	29.9	1.6	5.9	33.1
Opt-in CPP	576	10.4	9.4	6.1	42.2	13.9	18.0
Opt-in TOU	1017	10.1	16.5	47.7	1.1	4.6	20.0

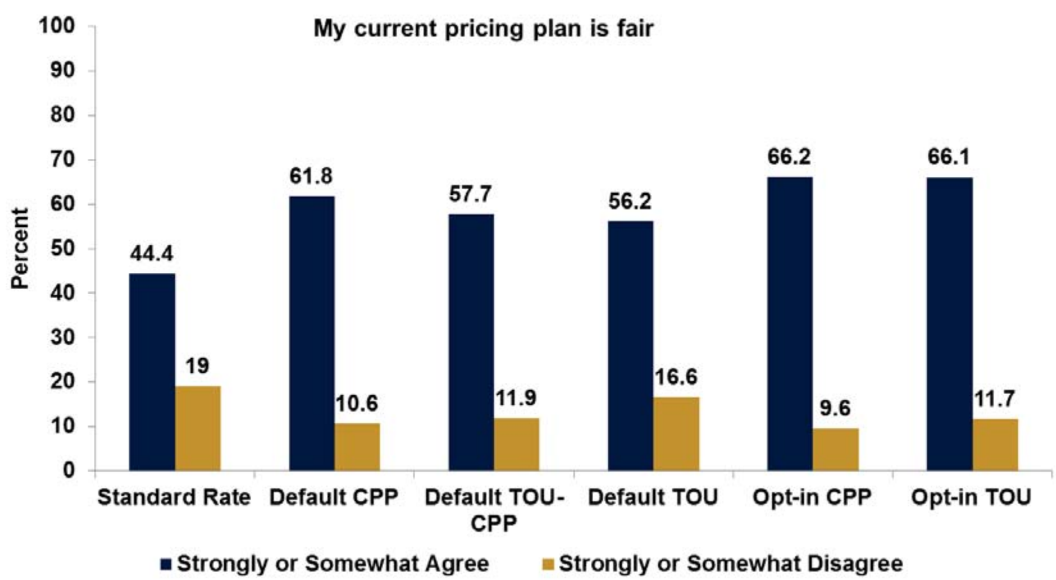
Another possible reason why respondents may be less satisfied with the standard rate than with time-variant pricing plans is that they don't feel the standard rate gives them as much opportunity to save money as do time-variant rates. Figure 11-3 shows the top and bottom two box scores, using the same five point agreement scale as in Figure 11-2, in response to the statement "My current pricing plan provides me with opportunities to save money." As seen, only about one third of standard rate plan respondents strongly or somewhat agreed with the statement whereas between one half and three quarters of respondents on time-variant pricing plans strongly or somewhat agreed with the statement. Roughly twice as many standard rate plan respondents somewhat or strongly disagreed with the statement compared with the other pricing plans. Not surprisingly, respondents on the opt-in pricing plans had the strongest agreement with the statement while respondents on default plans had agreement ratings in between those on the standard and opt-in plans. In a separate question, respondents were asked if they felt like they had more control over their energy costs on the time-variant plan compared with their prior tariff. Almost two thirds of default respondents and 80% of opt-in respondents answered yes.

Figure 11-3: Perceived Ability to Save Money by Pricing Plan



More survey respondents on time variant plans indicated that they thought their plan was fair than those on the standard rate, as indicated in Figure 11-4. Roughly 45% of control group customers on the standard rate strongly or somewhat agreed with the statement, "My current pricing plan is fair." Between 56% and 67% of respondents on time-variant pricing plans strongly or somewhat agreed with the statement. Default customers had slightly lower agreement than opt-in customers but the difference was not large.

Figure 11-4: Percent of Respondents Indicating They Think Their Pricing Plan is Fair



Other findings[55] from this portion of the survey include:

- Roughly 40% of customers on default time-variant pricing plans and about 57% of those on opt-in plans strongly or somewhat agreed with the statement, “My current pricing plan is better than my old pricing plan.”
- About 47% of customers on default plans, including the standard SMUD rate, strongly or somewhat agreed with the statement, “My current pricing plan fits my lifestyle.” Roughly 60% of opt-in customers strongly or somewhat agreed with that statement.
- Roughly the same percentages as in the prior statement apply to the question, “My current pricing plan is convenient.”
- Approximately 57% of respondents on all pricing plans strongly or somewhat agreed with the statement, “I sometimes feel uncomfortable inside my home on summer afternoons and evenings because it is too expensive to run my air conditioner.” Importantly, this same percentage was found for the standard rate so this is not a statement about high peak-period prices as much as it is about the perceived high cost of electricity regardless of the pricing plan. Roughly 25% of all respondents strongly or somewhat disagreed with the statement with the remaining respondents replying “no opinion.”
- Approximately two thirds of default customers and roughly 85% of opt-in customers strongly or somewhat agreed with the statement, “I understand why SMUD is offering the pricing plan I am on.”
- Almost half of default and roughly two thirds of opt-in respondents strongly or somewhat agreed with the statement, “I think the Sacramento community would be better off if everybody was on my pricing plan.”
- Almost 60% of default and 80% of opt-in respondents strongly or somewhat agreed with the statement, “I believe that I did something good for Sacramento by participating in my pricing plan.”
- Finally, roughly half of all default respondents and three quarters of opt-in respondents strongly or somewhat agreed with the statement, “I want to stay on my pricing plan.”

In summary, these survey results show strongly that, contrary to opinion held by many stakeholders in the debate about time-variant pricing, the majority of customers who experience these rates, including those defaulted onto them, feel the rates are fair, provide more opportunity to manage energy costs, are easier to understand than standard rates, feel they are doing something good for the community by enrolling on these rates and want to stay on the pricing plan. Importantly, reported discomfort from reducing air conditioning use in order to keep costs down in what is a very hot climate region is the same for customers on the standard rate as for those on time-variant rates.

11.3 Reported Behavioral Changes

As is evident from the estimated load impacts reported in Sections 4 and 5, on average, customers on all pricing plans reduced electricity usage during peak periods. Evidence of increased load during other time periods is less clear. The end of pilot survey asked customers whether they reduced or shifted load

[55] Tables showing the details underlying this high level summary are contained in Appendix G.

and, if so, the specific types of action taken. Figure 11-5 summarizes these responses using the same five-point agreement scale employed for many of the questions already discussed.

As seen in the figure, roughly 75% of default respondents and nearly 90% of opt-in respondents strongly or somewhat agreed with the statement, “I make sure I use as little electricity as possible between 4 and 7 PM.” Interestingly, roughly half of standard rate customers also agreed with that statement. California has had, for many years, an advertising campaign called Flex Your Power that encourages consumers to “give their appliances the afternoon off” on hot days when peak demand is high. Given this, it is not surprising to learn that customers on non-time variant rates are also conscious of keeping usage low in late afternoons and early evenings. It may also be the case that customers realize that air conditioning loads are significant contributors to electricity bills and have developed habits to reduce usage during the afternoon in order to keep bills down. Importantly, even if most control group customers reduce usage in the afternoon in response to advertising campaigns or overall daily price response, given the design of this pilot, the load impacts reported in Sections 4 and 5 are incremental to any load reductions that might be driven by these other factors.

Figure 11-5: Customer Perceptions about Peak Period Load Reductions

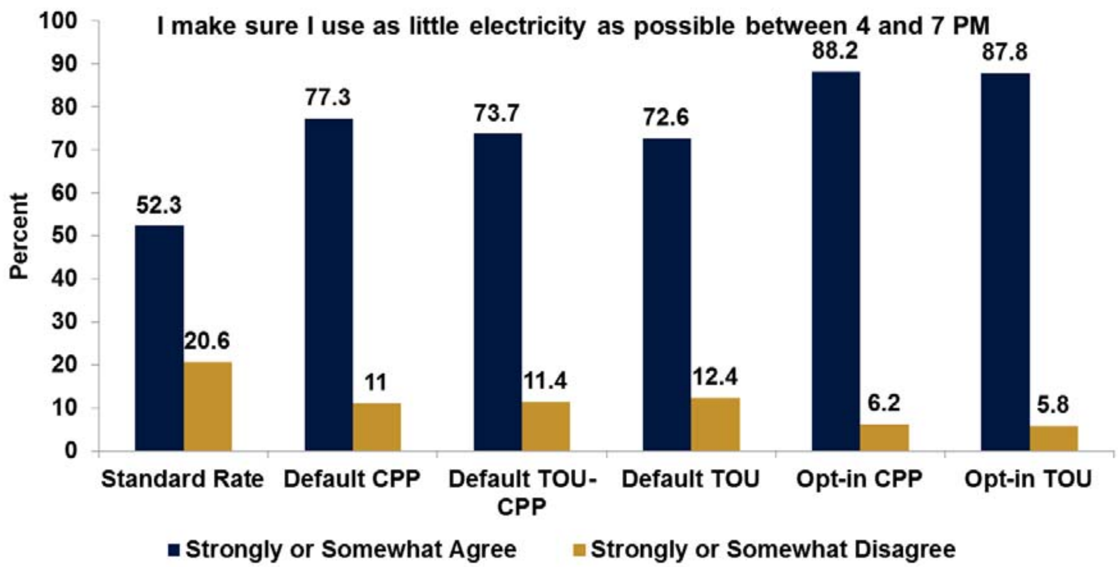
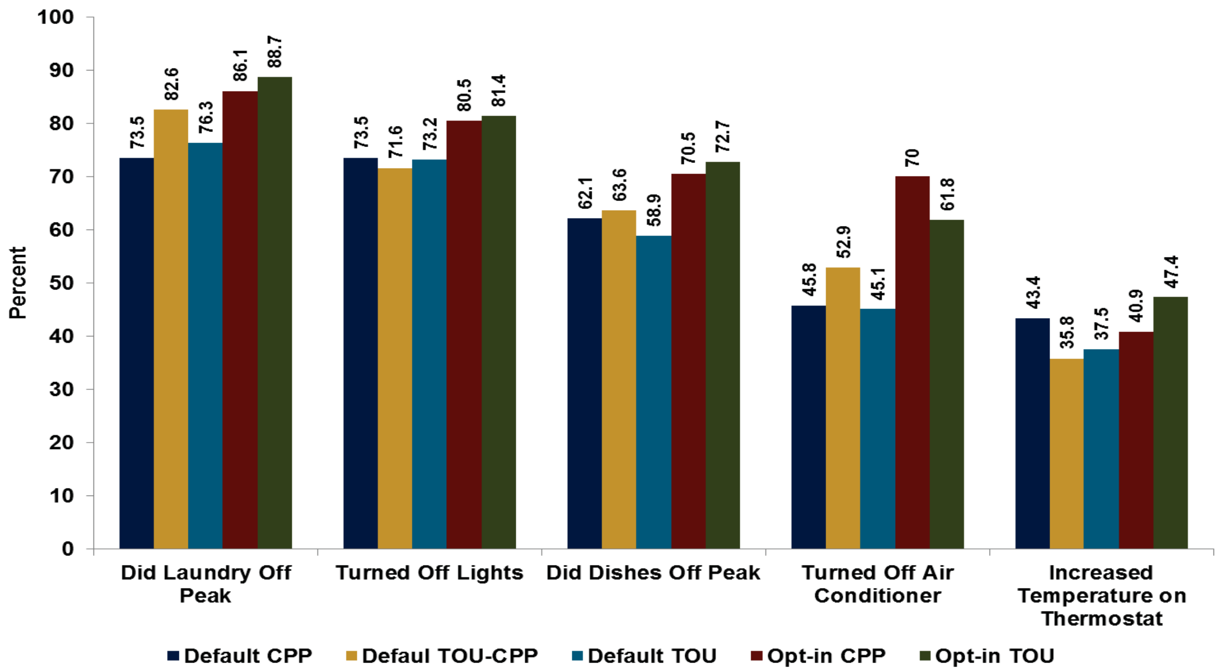
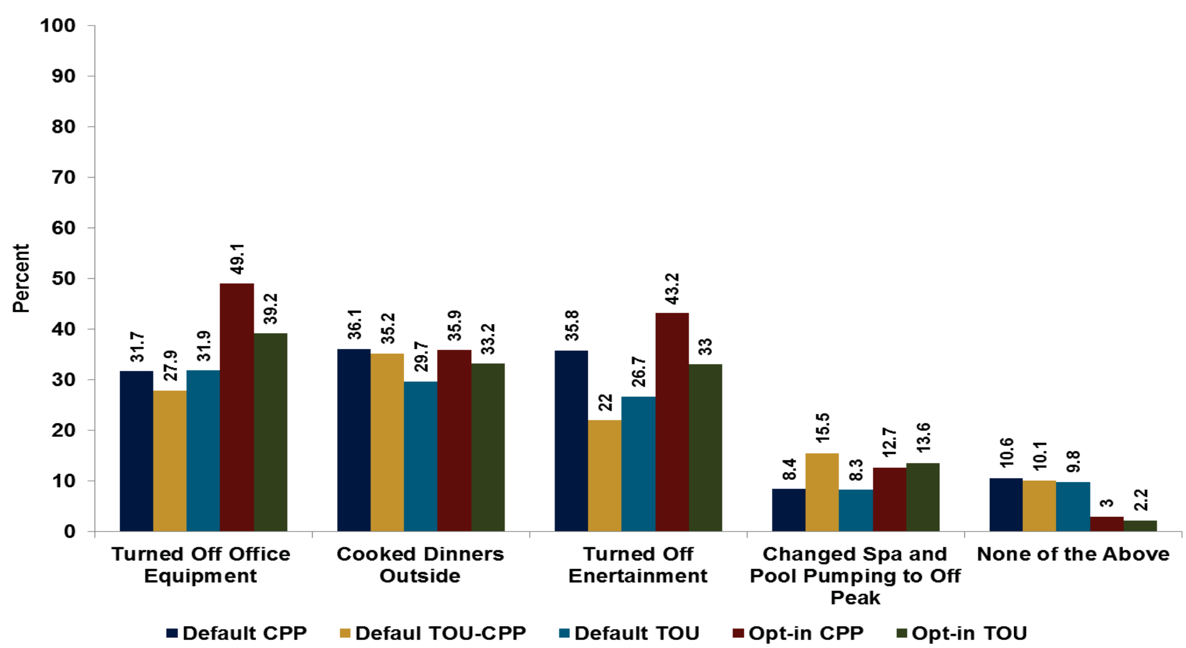


Figure 11-6 summarizes the actions that respondents reported taking to reduce load between 4 and 7 PM. In general, a higher percentage of respondents on opt-in pricing plans (the last two bars in each sequence) indicated that they took actions compared with those on default pricing plans but the differences are not large in most cases. Two of the top three actions reported, doing laundry and dishes during off-peak periods, suggest load shifting rather than conservation. The third and fourth most common action, turning off air conditioners and increasing thermostat settings, may or may not lead to overall energy savings depending on how much snap back electricity use occurs. As discussed in Sections 3 and 4, there does not appear to be much snapback effect observed for the pricing plans examined in the SPO. Turning off office and entertainment equipment during peak periods and cooking outside suggest some conservation impacts whereas shifting spa and pool pumping to the off-peak period is a load shifting action. Roughly 10% of default respondents and 2 to 3% of opt-in respondents indicated that they hadn't taken any of the specific actions listed in the survey.

The survey also asked respondents to the above question how difficult it was to make the changes identified above. Roughly two thirds responded that it "was not difficult at all" while nearly all of the remaining respondents indicated it was "somewhat difficult." On average, fewer than 3% of respondents said it was "very difficult" to make the changes.

Figure 11-6: Behavioral Actions Taken to Reduce Load Between 4 and 7 PM





11.4 Reasons for Staying on the Pricing Plan

Default customers were asked about why they did not opt-out prior to enrolling on the plan and also why they stayed on the plan after enrollment. Recall from Section 2 that those in the default treatment groups were notified in April 2012 that they would be placed on a new pricing plan as of June 1 if they did not notify SMUD that they wished to remain on their current plan. Recall from Section 8 that only between 3 and 8% of notified customers dropped out prior to enrollment and that a similarly small percent of those who enrolled actively dropped out over the course of the two summers of the SPO pilot. Understanding the reasons why such a high percent of customers did not opt-out prior to being enrolled on the default pricing plans is important for determining pricing strategy going forward.

Table 11-5 summarizes the reasons given for not opting out of the default pricing plans prior to being enrolled in June 2012. Respondents were asked to check only one option that “best describes the most important reason for staying on the new plan.” As seen, very few customers indicated that they planned to opt-out but never got around to it, so transaction costs do not appear to have much to do with the low dropout rate, at least for those who responded to the survey. Lack of awareness was identified as the primary reason by roughly one quarter of respondents although that seems to be a more important issue for CPP-TOU respondents than for the other pricing plans. It is not obvious why this would differ across pricing plans. Roughly 20% of respondents said that they did not know they could opt out. Roughly half of all respondents indicated that they either liked the plan when it was presented to them or wanted to try it before deciding whether it was the right plan for them.

Table 11-5: Reasons Why Default Customers Did Not Opt Out Prior to Going on the New Pricing Plan

Category	CPP	CPP-TOU	TOU
# of Respondents	163	141	417
Not aware that you had been assigned to the new plan	22.7%	35.5%	29.0%
Did not know that you could opt out	22.7%	17.5%	22.4%
Aware of the plan and felt that it was a good plan for you	25.7%	17.6%	20.8%
Not sure whether it was a good plan and wanted to try it before deciding to stay or revert to the original pricing plan	27.4%	28.5%	26.2%
Planned to opt out but never got around to it	1.5%	0.9%	1.6%

Default (and opt in) customers were also asked to indicate why they continued to stay on the new pricing plan after enrollment. This question consisted of a series of statements and respondents were asked to indicate how important each reason was in their decision to stay on the pricing plan. The question employed a four point scale where 1 = very important, 2 = somewhat important, 3 = somewhat unimportant and 4 = completely unimportant. Customers could also respond “don’t’ know.” Table 11-6 summarizes the percent of respondents who indicated that a reason was very or somewhat important for each default pricing plan and Table 11-7 summarizes the responses for the opt-in pricing plans.

Table 11-6: Percent of Default Plan Respondents Who Indicate the Reason Was Very or Somewhat Important to Their Decision to Stay on the Pricing Plan[56]

Category	CPP	CPP-TOU	TOU
# of Respondents	163	141	417
I like the pricing plan SMUD assigned me to	59.5%	54.1%	57.2%
I didn't know I was assigned to the new pricing plan	35.3%	39.4%	35.8%
I didn't know I was able to drop out of the new pricing plan	38.0%	43.3%	45.4%
I assume the default pricing plan SMUD selected for me is best for me	52.5%	49.2%	51.0%
I intended to drop out but never got around to it	12.1%	17.4%	13.2%
I'm not sure I would be any better off on the standard rate	44.7%	37.9%	38.4%
The more I got used to the pricing plan, the more I like it	45.8%	41.2%	38.6%

As seen in Table 11-6, for default customers, the most important reason for staying enrolled for all pricing plans was that respondents liked the pricing plan, with between 54% and 60% of respondents indicating that this reason was very or somewhat important to their decision. Nearly as many (49% to 53%) of respondents indicated that their belief that SMUD had selected the best plan for them was very or somewhat important. Between 38% and 45% of respondents indicated that "the more I got used to the pricing plan, the more I liked it" was somewhat or very important. About one third of respondents indicated that lack of awareness of being on the plan or not thinking they could drop off the plan were very or somewhat important reasons for staying on the pricing plan. Between 10 and 20% of respondents said that they intended to drop out but never got around to it. This measure of inertia is significantly higher than the percent of customers who identified this as the most important reason for not dropping out prior to enrolling on the rate as indicated in Table 11-5. Between 35% and 45% of respondents indicated that they stayed in part because they weren't certain they would be better off on the standard rate.

Table 11-7: Percent of Opt In Respondents Who Indicate the Reason Was Very or Somewhat Important to Their Decision to Stay on the Pricing Plan[57]

Category	CPP	TOU
# of Respondents	576	1,017
I like the pricing plan	80.8%	78.1%
I didn't know I was able to drop out of the pricing plan	32.4%	35.6%
I intended to drop out but never got around to it	15.8%	12.7%
I don't think I would be any better off on the standard rate	47.8%	41.6%
The more I got used to the pricing plan, the more I like it	63.5%	64.4%

[56] By far, the majority of respondents who did not indicate that a particular reason was somewhat or very important checked the "no opinion" option. Between 3 and 18% of respondents indicated that any of the reasons were somewhat or very unimportant.

[57] See prior footnote.

Table 11-7 summarizes the survey responses for opt in participants. A much larger share of respondents, roughly 80%, indicated that liking the pricing plan was very or somewhat important in deciding to stay on the plan. The second highest importance rating was for similar reasons, “the more I got used to the pricing plan, the more I liked it.” The percent of respondents who indicated that they intended to drop off but never got around to it was very similar to that for the default treatments. Roughly one third of respondents indicated that not knowing they could drop off the rate was somewhat or very important, and between 40% and 50% of respondents said that not knowing if they would be better off under the standard rate plan influenced their decision to stay.

11.5 In Home Displays

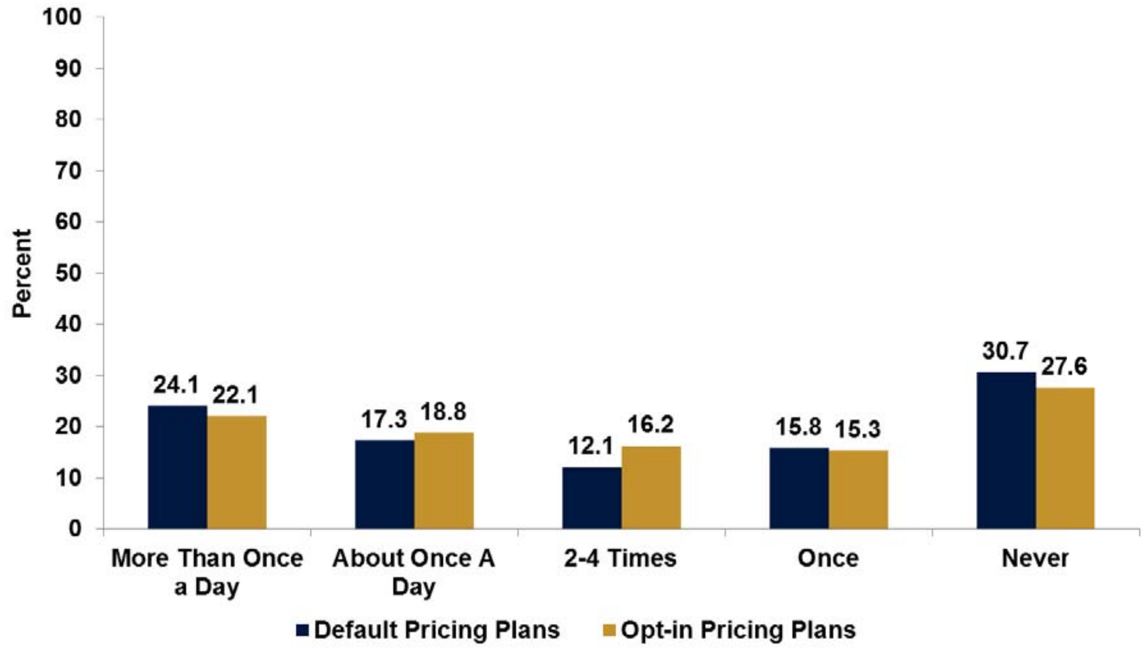
The survey also asked participants several questions about their use of IHDs. These questions were only asked of customers who were in treatment groups that had asked for and received an IHD (groups 3, 6, 9, 11 and 15 in Table 11-1). The first question asked respondents whether they remembered receiving an IHD. Between 80 and 90% of respondents said yes. The remaining questions pertain to this subset of customers who remembered receiving an IHD.

Respondents were asked whether they tried using the IHD once it was received. Recall from Section 6 that roughly twice as many default customers who asked for and received IHDs connected them to the meter compared with opt in participants. In response to this question about attempting to hook up the IHD to the meter, 90% of default respondents and almost 60% of opt in respondents said they had tried and succeeded in connecting the device. About 20% of default respondents and 30% of opt in respondents said they tried to connect the device but failed to do so. Roughly 8% of both groups said they did not try connecting the device and the remaining 2 to 3% of respondents said they couldn’t remember. When asked if the IHD was still working, almost 80% said it was and about 10% said it wasn’t. The remaining 10% weren’t sure or didn’t know.

Respondents were asked how often they had looked at the IHD in the last week prior to the survey. Figure 11-7 summarizes those responses. As seen, roughly 40% of both default and opt in respondents indicated they looked at the device more than once a day or about once a day. Recall that the survey was conducted in late fall 2013, which is 16 to 18 months after they would have received the IHD. About 30% of respondents said they had looked at the device between one and four times in the prior week, and the remaining 30% or so said they did not look at it at all. It should be noted that these estimates of use may be biased upward by the survey response bias discussed at the outset of this section. Default customers who requested IHDs and both default and opt-in customers that connected the devices are much more engaged in managing their energy use than those who did not, and these engaged customers are also more likely to respond to this survey.

Respondents were also asked if they had made any changes in their usage behavior based on information provided through the IHD. 60% of opt in and 67% of default respondents said yes, 12% of opt in and 15% of default respondents said no, and about 6% of each said they weren’t sure. In response to this question, nearly 23% of opt in respondents said that they never got the device to work whereas less than half that total (11%) of default respondents said they couldn’t get the device to work.

Figure 11-7: Frequency With Which Respondents Looked at Their IHD in the Prior Month



Appendix A Glossary of Terms for SPO Study Design

Control Group

The control group consists of customers who are identical to treatment customers except that they are not on the new rate. For treatments implemented using RED, control group customers are not offered the rate, but are randomly chosen from the same population as the treatment group. For the RCT design, control customers consist of customers who volunteered to go on the new rate but were assigned to the deferred group (and will go on the rate in 2014).

Customer Acceptance Rate

The customer acceptance rate consists of all customers who agreed to go on the rate divided by the number of customers who were offered the rate. This value will typically be larger than the enrollment rate (and can't be less than it) as it includes everyone who signed up for a rate even if they never went on the rate. For opt-in treatments, the numerator in the customer acceptance rate would include all customers who agreed to accept the rate, even if they were assigned to a control group leading to deferred enrollment. It would also include all customers who agreed to go on the rate but who may have never gone on it because, for example, they moved before the rate went into effect. It would also include customers who went on the rate but later dropped out. The denominator includes all customers in the original sample minus customers who moved before they received an offer. The customer acceptance rate is the best measure of the effectiveness of a marketing campaign. For default treatments, the numerator of the customer acceptance rate consists of all customers who were defaulted onto the rate and did not drop out prior to going on the rate. If a customer goes on the rate and later drops out of the program, they would still be included in the numerator of this rate. Only customers who drop out prior to going on the rate are excluded from the numerator. The denominator of the customer acceptance rate for default programs equals the number of customers who were defaulted onto the rate.

Decliners

A decliner is a customer that was offered a rate option but declined to accept the offer.
For opt-in treatments, the number of decliners equals the total number of customers marketed to minus the total number of customers who accepted the offer. For default treatments, the number of decliners equals the total number of customers defaulted onto the rate minus those who drop out prior to going on the rate. It does not include customers who actually are placed on the rate and then later dropped out.

Deferred RCT Customers

Customers recruited into the opt-in RCT treatments who are assigned to the control group, and therefore whose enrollment on the rate is deferred until after the end of the pilot in 2014.

Drop outs

Drop outs consist of customers who went on a rate at some point in time, but who later requested to be taken off the rate. It does not include customers who drop out due to changing their location (e.g., moving). These are called movers.

Enrolled Customers

Enrolled customers are customers who are on a new rate at a given point in time. For opt-in rates, this group consists of customers who accepted the marketing offer, were assigned to the treatment group (rather than the control group), did not change their mind or move prior to the rate going into effect, and are still on the rate (e.g., have not dropped out or moved) at the time that the enrollment snap shot is taken. For default enrollment, enrolled customers at a point in time are customers who did not opt-out prior to or after going on the rate, or did not move or leave the rate for any reason between when they were initially enrolled and when the enrollment is reported.

Enrollment Rate

The enrollment rate consists of all customers who were ever actually on a rate for some period of time divided by the number of customers who were offered the rate. This is different from the customer acceptance rate, as defined below.

General Population

All residential customers in SMUD's service territory (approximately 530,000 customers). This differs from the SPO eligible population, as defined below.

Movers

Movers are customers who were either defaulted onto a new rate or accepted a rate offer on an opt-in basis, but subsequently moved and, therefore, are no longer enrolled on the rate. A mover may or may not have ever actually gone on the new rate. For example, some customers may have accepted the new rate offer several months prior to the new rate going into effect and may have moved before they were placed on the rate. Similarly, default customers may have not consciously declined the default option but may have moved between the time they were notified that a rate change would be going into effect and when the rate actually went into effect.

Randomized Control Trial (RCT)

RCT refers to a research strategy in which customers who volunteer for a treatment are randomly assigned to treatment and control conditions. This method ensures that the only difference between treatment and control customers, other than differences due to random sampling variation, is that one group receives the treatment and the other does not. An RCT design ensures that impact estimates are not affected by selection bias or other potential explanations for observed differences between the two groups of customers. In practice, randomization can be achieved using either a *recruit and deny* process, or a *recruit and delay* process. In the former, control customers are never given the treatment whereas in the latter, customers assigned to the control group are placed on the treatment after the end of the trial measurement period. Prior to that time, they act as the control group against which treatment effects are measured. SMUD used the recruit and delay method. Deferred customers will be placed on the new rate in 2014.

Randomized Encouragement Design (RED)

RED refers to a research design in which two groups of customers are selected from the same population at random and one is offered a treatment while the other is not. Not all customers offered the treatment are expected to take it but, for analysis purposes, all those who are offered the treatment are considered to be in the treatment group. Treatment impacts are estimated initially by comparing the change in usage between the treatment and control groups before and after the treatment goes into effect. This first stage impact estimate—referred to as an intent-to-treat estimate—reflects a weighted average of those who were offered the treatment and took it and those who were offered the treatment and declined. A second stage calculation can be done to determine the impact only for those customers who accepted the treatment offer. This estimate—referred to as the treatment effect on the treated—will be unbiased by selection effects.

In another variation on RED, two groups may be subject to differing levels of encouragement to take a treatment, such as in a comparison of a group offered a rate on an opt-in basis to a group offered a rate on a default basis. In this case, intent-to-treat and treatment effect on the treated estimates are developed in the same way, with the treatment effect on the treated being equal to the effect of the treatment on customers who would respond to the higher level of encouragement (e.g., rate by default) but who would not respond to the lower level of encouragement (e.g., an opt-in offer).

SPO Eligible Population

The SPO treatments were offered to a subset of SMUD’s general population, consisting of the approximately 260,000 customers who had interval meters installed prior to June 2011, but excluding customers who were participating in SMUD’s Air Conditioning Load Management (ACLM) program, Summer Solutions study (a separate dynamic pricing study), medical assistance program, master metered accounts, budget billing and PV solar programs. After these exclusions, there were approximately 176,000 customers eligible for inclusion in the pilot.

Treatment Group

The treatment group consists of customers who were either offered the new rate option (under RED) or who took it and were assigned to the treatment group rather than the control group (under an RCT design). Under RED, not every treatment customer is actually on the new rate. Under the RCT design, all treatment customers are on the new rate.

Within-subjects Design

A within-subjects design does not rely on an external control group to estimate impacts. Instead, it compares usage for customers who accept a treatment under treatment and non-treatment conditions. A within-subjects design is not as strong as RCT or RED in terms of clearly establishing causality between usage changes and treatments because other factors may affect usage (e.g., weather conditions) and be the cause of the observed change. As such, analysis based on a within-subjects design typically must use statistical models to control for the potential influence of other factors. Estimates based on a within-subjects design typically are best when impacts are expected to be reasonably large and when differences in other exogenous factors are small under treatment and non-treatment conditions. For these reasons, a within-subjects design is better suited to estimating impacts for a CPP for which the treatment is in effect on one day and not the next and for which impacts are expected to be relatively large, for a TOU rate, for which the pretreatment period consists of an entire summer of usage and occurs 12 months prior to the treatment summer, and where impacts are expected to be relatively small.

Appendix B Hourly Load Impacts by Month for TOU Pricing Plans

Table B-1: Average Hourly Impacts by Month for Opt-in TOU Groups

Treatment	Month	Hour	Estimated Impact	SE	95% CI Lower	95% CI Upper
Opt-in TOU, Without IHD Offer	June	4-5 PM	0.12	0.02	0.08	0.17
		5-6 PM	0.16	0.03	0.11	0.21
		6-7 PM	0.16	0.03	0.11	0.21
	July	4-5 PM	0.16	0.03	0.10	0.22
		5-6 PM	0.22	0.03	0.16	0.29
		6-7 PM	0.23	0.03	0.17	0.29
	August	4-5 PM	0.17	0.03	0.11	0.23
		5-6 PM	0.23	0.03	0.17	0.30
		6-7 PM	0.21	0.03	0.15	0.27
	September	4-5 PM	0.07	0.03	0.00	0.13
		5-6 PM	0.10	0.03	0.03	0.16
		6-7 PM	0.07	0.03	0.02	0.13
	Overall		**0.16**	**0.02**	**0.12**	**0.21**
Opt-in TOU, with IHD Offer	June	4-5 PM	0.14	0.02	0.11	0.18
		5-6 PM	0.18	0.02	0.15	0.22
		6-7 PM	0.18	0.02	0.14	0.22
	July	4-5 PM	0.26	0.02	0.21	0.30
		5-6 PM	0.30	0.02	0.25	0.35
		6-7 PM	0.27	0.02	0.22	0.31
	August	4-5 PM	0.24	0.02	0.19	0.29
		5-6 PM	0.29	0.03	0.24	0.34
		6-7 PM	0.27	0.02	0.22	0.32
	September	4-5 PM	0.13	0.02	0.08	0.18
		5-6 PM	0.16	0.03	0.11	0.21
		6-7 PM	0.14	0.02	0.10	0.19
	Overall		**0.21**	**0.02**	**0.18**	**0.25**

Table B-2: Average Hourly Impacts by Month for Default TOU Groups

Treatment	Month	Hour	Estimated Impact	SE	95% CI Lower	95% CI Upper
Default TOU with IHD Offer	June	4-5 PM	0.08	0.02	0.05	0.11
		5-6 PM	0.11	0.02	0.07	0.14
		6-7 PM	0.11	0.02	0.07	0.14
	July	4-5 PM	0.10	0.02	0.07	0.14
		5-6 PM	0.13	0.02	0.10	0.17
		6-7 PM	0.12	0.02	0.08	0.16
	August	4-5 PM	0.13	0.02	0.09	0.17
		5-6 PM	0.15	0.02	0.11	0.19
		6-7 PM	0.14	0.02	0.10	0.18
	September	4-5 PM	0.06	0.02	0.02	0.10
		5-6 PM	0.09	0.02	0.05	0.13
		6-7 PM	0.07	0.02	0.03	0.11
	Overall		**0.11**	**0.01**	**0.08**	**0.14**
Default TOU & CPP with IHD Offer	June	4-5 PM	0.10	0.03	0.05	0.15
		5-6 PM	0.15	0.03	0.10	0.21
		6-7 PM	0.16	0.03	0.10	0.21
	July	4-5 PM	0.17	0.03	0.10	0.23
		5-6 PM	0.20	0.04	0.13	0.28
		6-7 PM	0.20	0.04	0.13	0.27
	August	4-5 PM	0.16	0.04	0.08	0.23
		5-6 PM	0.22	0.04	0.15	0.30
		6-7 PM	0.22	0.04	0.15	0.29
	September	4-5 PM	0.12	0.04	0.05	0.19
		5-6 PM	0.17	0.04	0.09	0.24
		6-7 PM	0.13	0.04	0.06	0.20
	Overall		**0.17**	**0.03**	**0.11**	**0.22**

Appendix C Hourly Load Impacts for Each Event for CPP Pricing Plans

Table C-1: Average Hourly Impacts by CPP Day for Opt-in CPP without IHD Offer

Date	Hour	Estimated Impact	SE	95% CI Lower	95% CI Upper
6/28/2013	4-5 PM	0.55	0.30	-0.03	1.13
	5-6 PM	0.69	0.31	0.08	1.30
	6-7 PM	0.45	0.30	-0.13	1.04
7/2/2013	4-5 PM	0.75	0.30	0.17	1.34
	5-6 PM	0.91	0.29	0.33	1.48
	6-7 PM	0.82	0.28	0.27	1.37
7/3/2013	4-5 PM	0.48	0.31	-0.12	1.08
	5-6 PM	0.84	0.31	0.22	1.45
	6-7 PM	0.84	0.31	0.24	1.44
7/19/2013	4-5 PM	0.43	0.28	-0.12	0.99
	5-6 PM	0.86	0.28	0.32	1.40
	6-7 PM	0.83	0.27	0.31	1.35
8/15/2013	4-5 PM	0.11	0.26	-0.40	0.61
	5-6 PM	0.35	0.26	-0.16	0.85
	6-7 PM	0.28	0.25	-0.22	0.77
8/19/2013	4-5 PM	1.00	0.29	0.43	1.58
	5-6 PM	0.99	0.29	0.41	1.56
	6-7 PM	0.76	0.28	0.21	1.32
9/6/2013	4-5 PM	0.07	0.25	-0.41	0.56
	5-6 PM	-0.03	0.26	-0.53	0.48
	6-7 PM	0.07	0.26	-0.43	0.57
9/9/2013	4-5 PM	0.65	0.27	0.13	1.18
	5-6 PM	0.63	0.28	0.08	1.18
	6-7 PM	0.60	0.28	0.06	1.15
9/10/2013	4-5 PM	0.06	0.25	-0.44	0.55
	5-6 PM	0.40	0.26	-0.10	0.90
	6-7 PM	0.29	0.25	-0.20	0.77
9/13/2013	4-5 PM	0.17	0.27	-0.36	0.70
	5-6 PM	0.08	0.29	-0.48	0.65
	6-7 PM	-0.03	0.27	-0.55	0.50
9/19/2013	4-5 PM	0.30	0.26	-0.21	0.80
	5-6 PM	0.66	0.28	0.11	1.20
	6-7 PM	0.20	0.25	-0.29	0.70
9/30/2013	4-5 PM	0.31	0.27	-0.21	0.84
	5-6 PM	0.35	0.27	-0.19	0.89
	6-7 PM	0.02	0.26	-0.48	0.53
Overall		**0.46**	**0.15**	**0.16**	**0.77**

Table C-2: Average Hourly Impacts by CPP Day for Opt-in CPP with IHD Offer

Date	Hour	Estimated Impact	SE	95% CI Lower	95% CI Upper
6/28/2013	4-5 PM	0.57	0.12	0.34	0.80
	5-6 PM	0.73	0.12	0.50	0.96
	6-7 PM	0.73	0.12	0.51	0.96
7/2/2013	4-5 PM	0.95	0.12	0.72	1.18
	5-6 PM	1.01	0.11	0.79	1.24
	6-7 PM	0.87	0.11	0.66	1.08
7/3/2013	4-5 PM	0.87	0.12	0.63	1.10
	5-6 PM	0.89	0.12	0.65	1.13
	6-7 PM	1.06	0.12	0.84	1.29
7/19/2013	4-5 PM	0.57	0.11	0.36	0.79
	5-6 PM	0.75	0.11	0.54	0.96
	6-7 PM	0.72	0.11	0.51	0.93
8/15/2013	4-5 PM	0.47	0.10	0.27	0.67
	5-6 PM	0.53	0.10	0.33	0.74
	6-7 PM	0.60	0.10	0.40	0.80
8/19/2013	4-5 PM	0.57	0.11	0.35	0.79
	5-6 PM	0.79	0.11	0.56	1.01
	6-7 PM	0.79	0.11	0.57	1.02
9/6/2013	4-5 PM	0.48	0.10	0.29	0.67
	5-6 PM	0.49	0.10	0.29	0.68
	6-7 PM	0.43	0.10	0.23	0.62
9/9/2013	4-5 PM	0.69	0.11	0.48	0.90
	5-6 PM	0.81	0.11	0.59	1.02
	6-7 PM	0.71	0.11	0.50	0.92
9/10/2013	4-5 PM	0.62	0.10	0.44	0.81
	5-6 PM	0.55	0.10	0.36	0.74
	6-7 PM	0.46	0.09	0.28	0.65
9/13/2013	4-5 PM	0.33	0.10	0.13	0.53
	5-6 PM	0.34	0.10	0.14	0.54
	6-7 PM	0.37	0.10	0.17	0.56
9/19/2013	4-5 PM	0.26	0.10	0.07	0.45
	5-6 PM	0.36	0.10	0.17	0.56
	6-7 PM	0.39	0.10	0.19	0.58
9/30/2013	4-5 PM	0.25	0.10	0.05	0.44
	5-6 PM	0.25	0.10	0.05	0.45
	6-7 PM	0.19	0.10	0.00	0.39
Overall		**0.60**	**0.06**	**0.48**	**0.72**

Table C-3: Average Hourly Impacts by CPP Day for Default CPP with IHD Offer

Date	Hour	Estimated Impact	SE	95% CI Lower	95% CI Upper
6/28/2013	4-5 PM	0.40	0.08	0.25	0.55
	5-6 PM	0.43	0.08	0.28	0.59
	6-7 PM	0.49	0.08	0.34	0.64
7/2/2013	4-5 PM	0.43	0.08	0.28	0.58
	5-6 PM	0.45	0.07	0.30	0.59
	6-7 PM	0.46	0.07	0.32	0.60
7/3/2013	4-5 PM	0.49	0.08	0.33	0.65
	5-6 PM	0.50	0.08	0.34	0.67
	6-7 PM	0.50	0.08	0.35	0.66
7/19/2013	4-5 PM	0.37	0.07	0.24	0.51
	5-6 PM	0.36	0.07	0.22	0.49
	6-7 PM	0.32	0.07	0.18	0.46
8/15/2013	4-5 PM	0.39	0.07	0.25	0.52
	5-6 PM	0.41	0.07	0.27	0.55
	6-7 PM	0.44	0.07	0.30	0.58
8/19/2013	4-5 PM	0.49	0.08	0.34	0.64
	5-6 PM	0.64	0.08	0.48	0.79
	6-7 PM	0.68	0.08	0.53	0.83
9/6/2013	4-5 PM	0.35	0.07	0.22	0.48
	5-6 PM	0.40	0.06	0.27	0.53
	6-7 PM	0.34	0.06	0.21	0.47
9/9/2013	4-5 PM	0.40	0.07	0.26	0.54
	5-6 PM	0.49	0.07	0.34	0.63
	6-7 PM	0.47	0.07	0.32	0.61
9/10/2013	4-5 PM	0.43	0.07	0.30	0.56
	5-6 PM	0.46	0.07	0.33	0.59
	6-7 PM	0.34	0.07	0.21	0.47
9/13/2013	4-5 PM	0.35	0.07	0.22	0.48
	5-6 PM	0.43	0.07	0.30	0.57
	6-7 PM	0.37	0.07	0.24	0.50
9/19/2013	4-5 PM	0.29	0.06	0.16	0.42
	5-6 PM	0.35	0.07	0.22	0.48
	6-7 PM	0.27	0.07	0.14	0.40
9/30/2013	4-5 PM	0.18	0.07	0.05	0.32
	5-6 PM	0.20	0.07	0.08	0.33
	6-7 PM	0.17	0.07	0.04	0.30
Overall		**0.41**	**0.05**	**0.32**	**0.50**

Table C-4: Average Hourly Impacts by CPP Day for Default TOU-CPP with IHD Offer

Date	Hour	Estimated Impact	SE	95% CI Lower	95% CI Upper
6/28/2013	4-5 PM	0.41	0.08	0.26	0.57
	5-6 PM	0.46	0.08	0.29	0.63
	6-7 PM	0.43	0.09	0.25	0.60
7/2/2013	4-5 PM	0.33	0.08	0.16	0.49
	5-6 PM	0.50	0.08	0.34	0.66
	6-7 PM	0.42	0.08	0.27	0.57
7/3/2013	4-5 PM	0.35	0.09	0.17	0.53
	5-6 PM	0.35	0.09	0.17	0.53
	6-7 PM	0.40	0.09	0.23	0.56
7/19/2013	4-5 PM	0.36	0.08	0.21	0.52
	5-6 PM	0.42	0.08	0.26	0.57
	6-7 PM	0.42	0.08	0.26	0.58
8/15/2013	4-5 PM	0.27	0.07	0.12	0.42
	5-6 PM	0.34	0.08	0.18	0.49
	6-7 PM	0.18	0.08	0.02	0.33
8/19/2013	4-5 PM	0.35	0.08	0.19	0.52
	5-6 PM	0.38	0.08	0.23	0.54
	6-7 PM	0.40	0.08	0.24	0.56
9/6/2013	4-5 PM	0.19	0.07	0.05	0.33
	5-6 PM	0.30	0.07	0.16	0.45
	6-7 PM	0.27	0.07	0.12	0.42
9/9/2013	4-5 PM	0.24	0.07	0.10	0.39
	5-6 PM	0.31	0.08	0.15	0.46
	6-7 PM	0.31	0.08	0.16	0.46
9/10/2013	4-5 PM	0.23	0.07	0.10	0.36
	5-6 PM	0.32	0.07	0.17	0.46
	6-7 PM	0.19	0.07	0.05	0.34
9/13/2013	4-5 PM	0.18	0.08	0.03	0.34
	5-6 PM	0.12	0.08	-0.04	0.27
	6-7 PM	0.15	0.07	0.01	0.30
9/19/2013	4-5 PM	0.12	0.07	-0.02	0.25
	5-6 PM	0.19	0.07	0.05	0.34
	6-7 PM	0.15	0.08	0.01	0.30
9/30/2013	4-5 PM	0.06	0.07	-0.08	0.20
	5-6 PM	0.11	0.08	-0.04	0.26
	6-7 PM	0.08	0.07	-0.06	0.22
Overall		**0.29**	**0.05**	**0.20**	**0.38**

Appendix D Customer Behavior and Characteristics for Study Populations in the Conjoint Survey

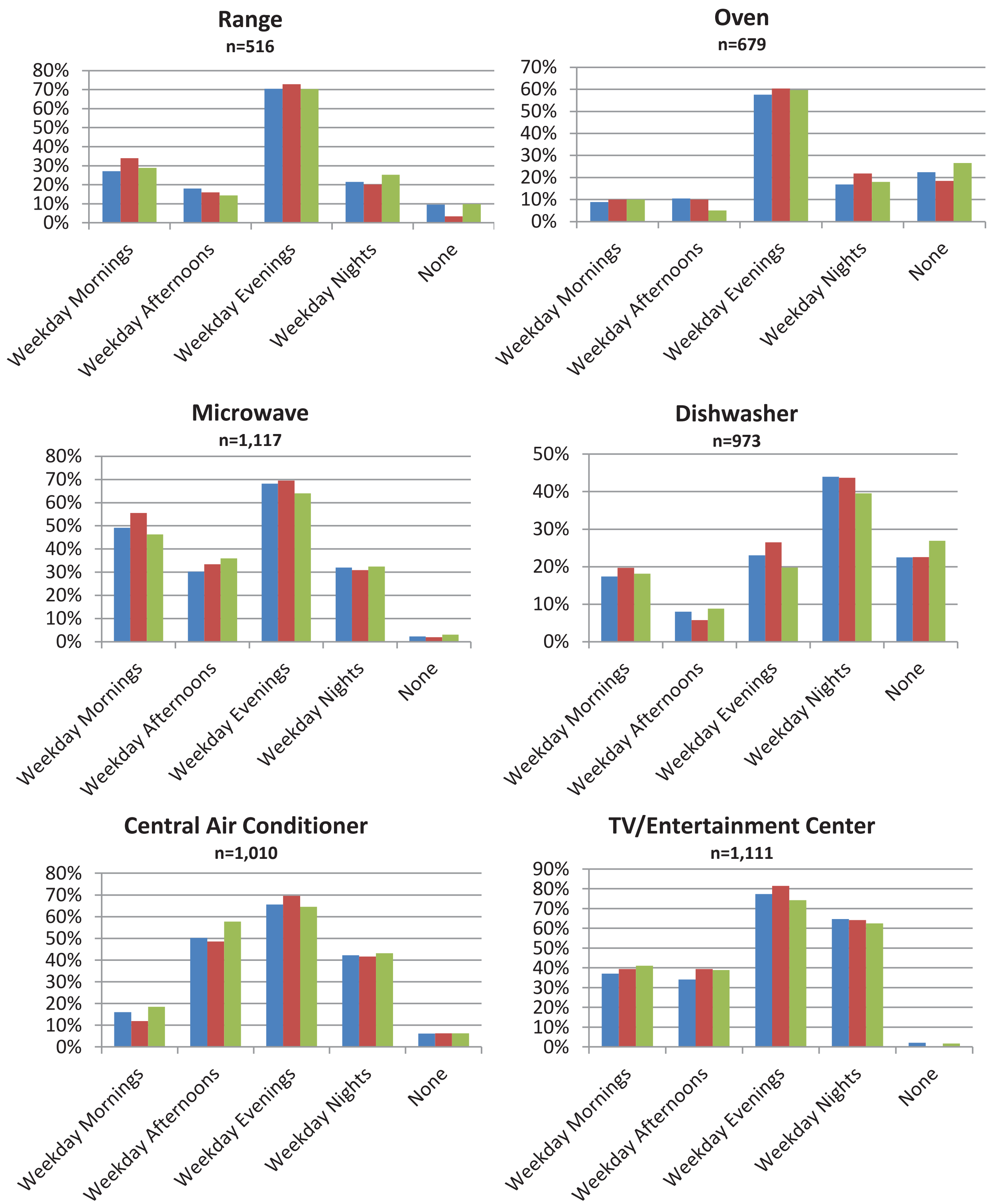
This appendix compares the characteristics of the three different study populations that were included in the conjoint survey discussed in Section 9.

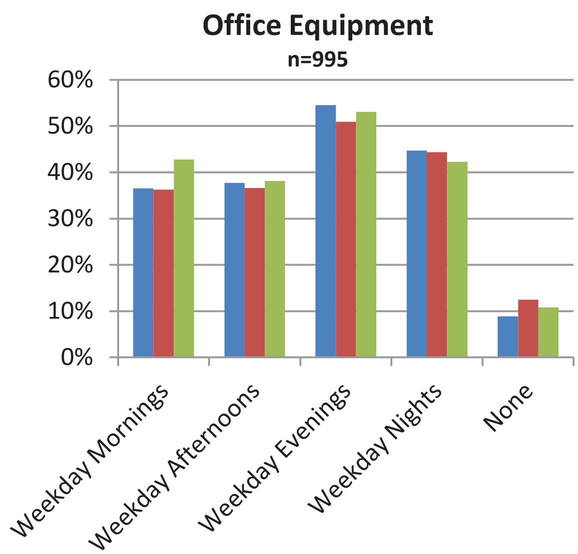
Customers first reported whether their appliances were exclusively powered by electricity. The results are summarized in Table D-1. The microwave was most commonly described as exclusively electric while the range was the least common. Customers then checked what time of day they use these exclusively electric products, choosing amongst "Weekday Mornings", "Weekday Afternoons", "Weekday Evenings", and "Weekday Nights". Participants were able to select more than one time for each appliance and these percentages are represented graphically in Figure D-1. The results are very similar across all three study groups.

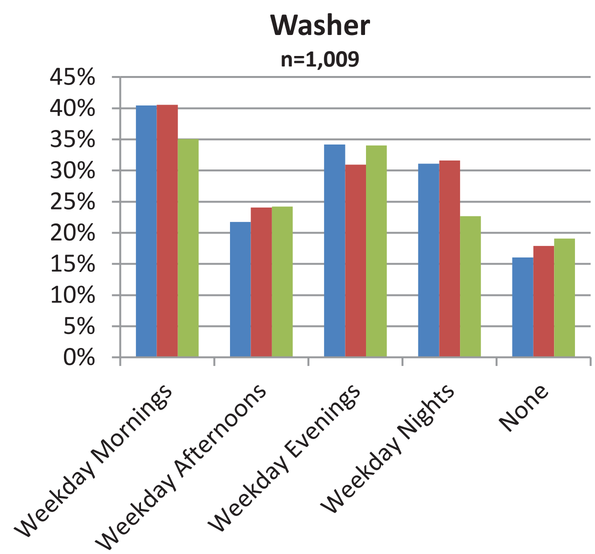
Table D-1: Percent of Appliances Reported as Powered Exclusively By Electricity (n=1,152)

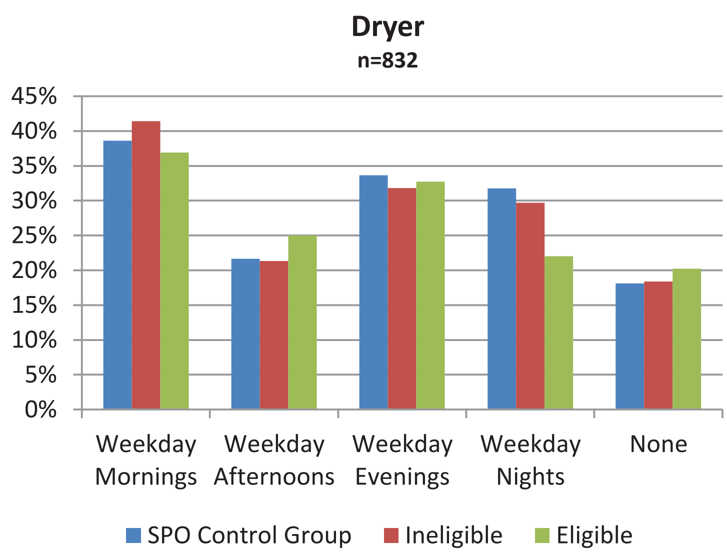
Appliances	SPO Control Group n=590	Ineligible n=313	Eligible n=239
Range	44%	46%	46%
Oven	61%	57%	58%
Microwave	98%	98%	97%
Dishwasher	87%	89%	76%
Central Air Conditioner	88%	91%	86%
TV/Entertainment Center	97%	98%	96%
Office Equipment	89%	87%	81%
Washer	89%	93%	81%
Dryer	72%	76%	70%

Figure D-1: Typical Time of Use of Exclusively Electrically Powered Appliances




Office Equipment
n=995
60%
50%
40%
30%
20%
10%
0%
Weekday Mornings
Weekday Afternoons
Weekday Evenings
Weekday Nights
None


Washer
n=1,009
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Weekday Mornings
Weekday Afternoons
Weekday Evenings
Weekday Nights
None


Dryer
n=832
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Weekday Mornings
Weekday Afternoons
Weekday Evenings
Weekday Nights
None
SPO Control Group
Ineligible
Eligible

As seen in Figure D-2, the most common number of thermostats in each household was one. Answers were very similar between groups, with the average number of thermostats being 1.2 for all three groups. The majority of these thermostats are programmable, shown in Figure D-3. Again there was no real difference between those in the SPO control group, ineligible group, and eligible group.

Figure D-2: Number of Thermostats (n=1,142)

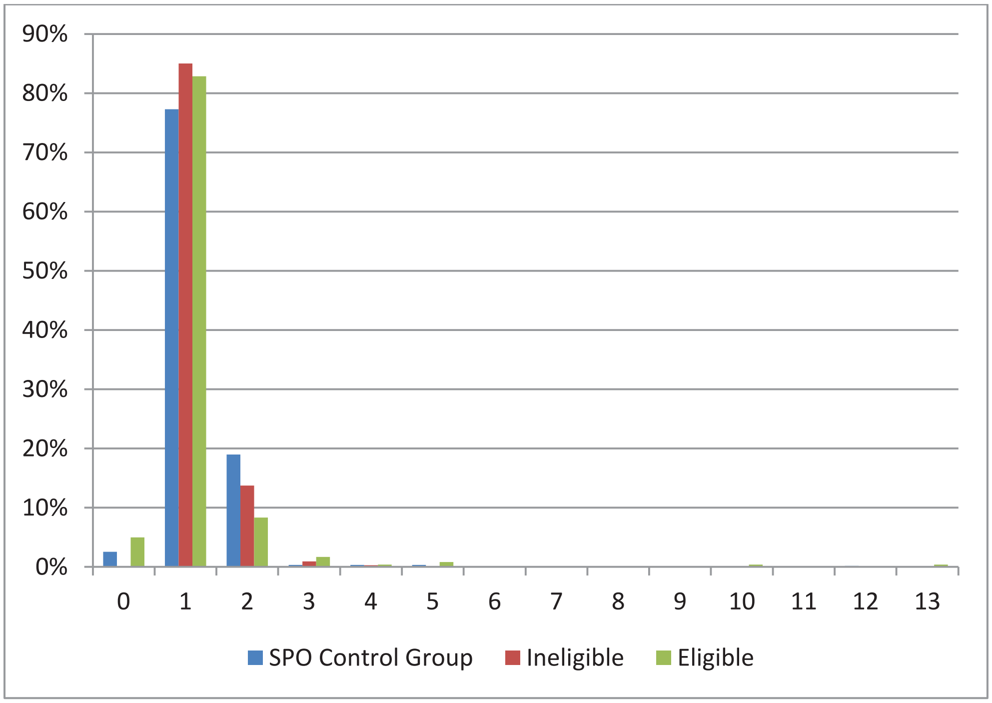


Figure D-3: Percent of Thermostats that are Programmable (n=1,115)

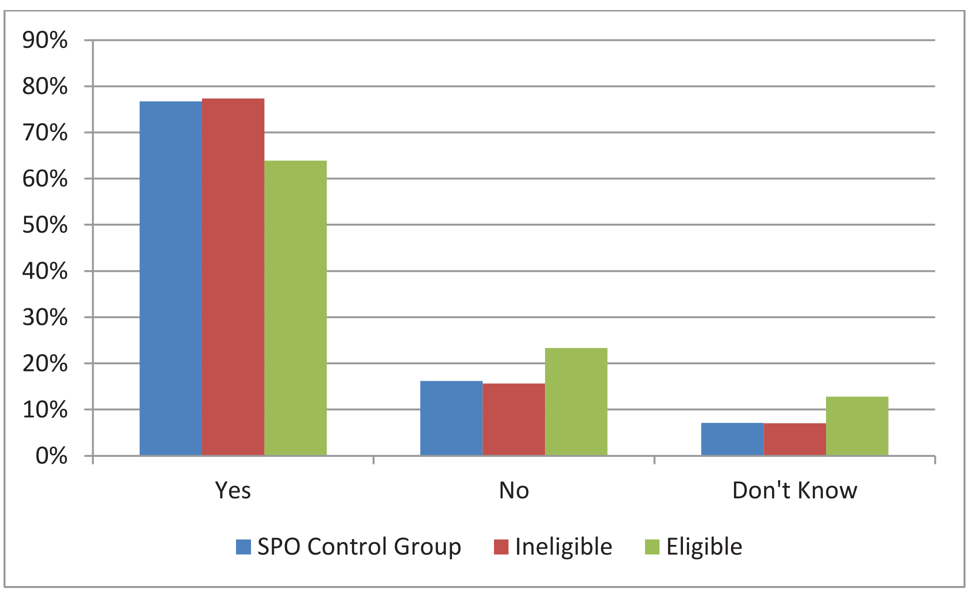


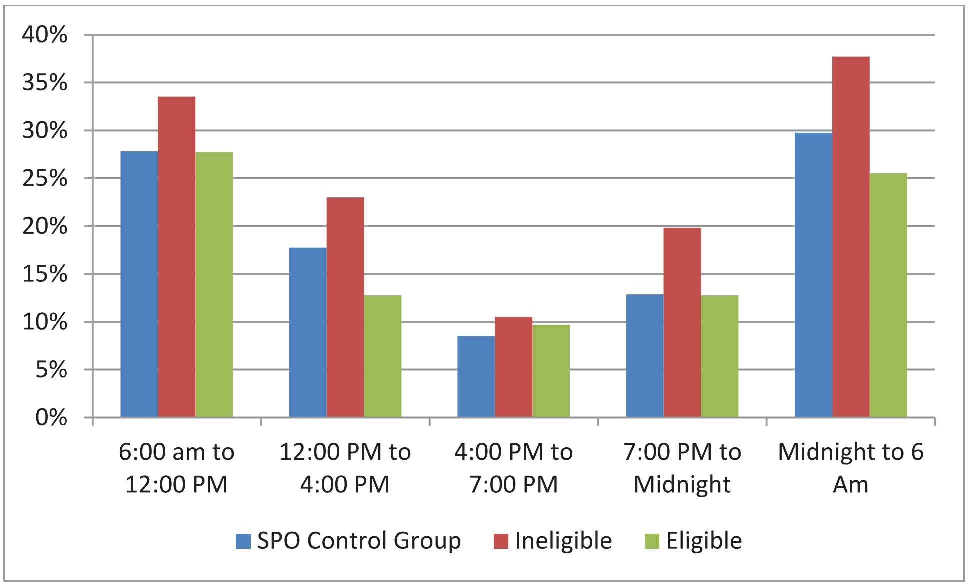
Table D-2 includes the average set temperature for the thermostats for different times of day. The numbers don't vary much between the groups, hovering between 73°F and 75°F for all times of day.

Participants also had the option in the survey to write that their thermostat was off at a given time, instead of set to a particular temperature. Figure D-4 summarizes the percentages of the thermostats set to off during each time period within each group.

Table D-2: Average Set Temperature of Programmable Thermostat at Varying Times of Day

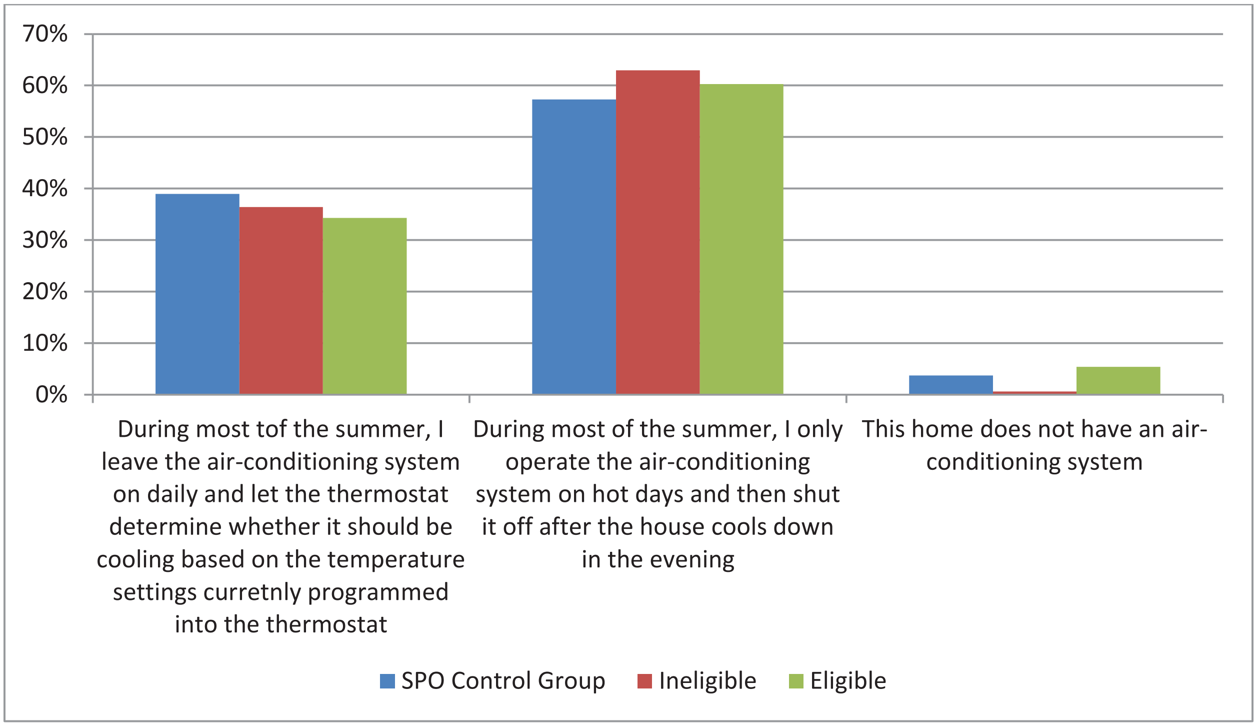
Study Group	6:00 am to 12:00 PM	12:00 PM to 4:00 PM	4:00 PM to 7:00 PM	7:00 PM to Midnight	Midnight to 6 Am
SPO Control Group	75.4	75.2	74.3	74.3	74.8
Ineligible	75.5	75.5	74.6	74.6	75.3
Eligible	74.3	74.2	74.0	73.5	73.3

Figure D-4: Percent of Thermostats Set to Off at a Given Time of Day (n=1,115)



The survey next presented the consumers with three choices of how they use their air conditioning, asking that they select one. The most popular answer involved turning off the air conditioner when it was not hot and thus not necessary for cooling. These results can be found in Figure D-5.

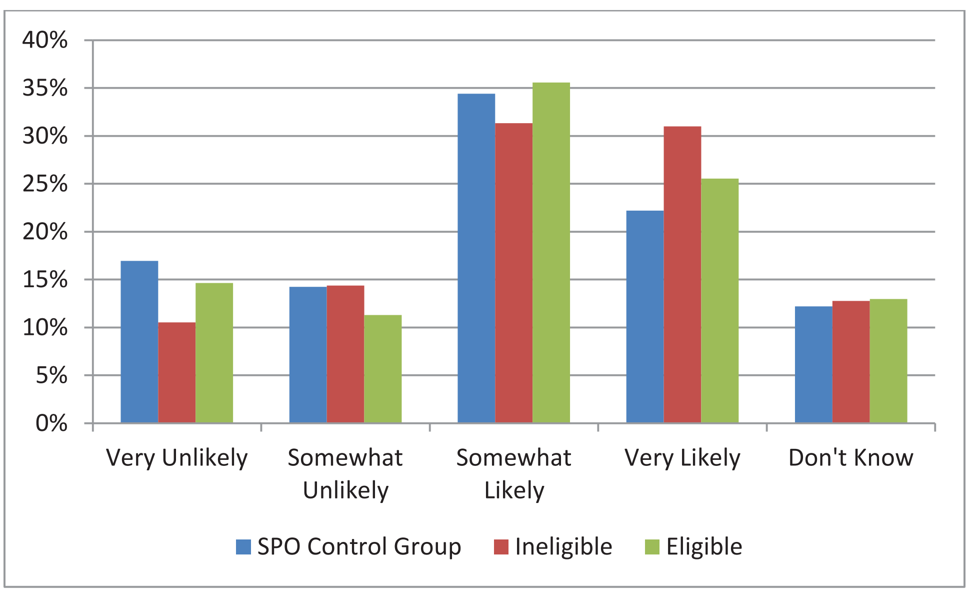
Figure D-5: Description of How Consumers Use Their Air Conditioners (n=1,142)



Again there was not much difference between the groups when it came to the likelihood of taking advantage of SMUD-sponsored energy efficiency programs. The plurality of consumers indicated that they were somewhat likely to take advantage of these programs, as seen in Figure D-6.

Figure

D-6: Likelihood of Customers to Take Advantage of SMUD-Sponsored Energy Efficiency Programs (Such as Rebates or Home Energy Audit Services) (n=1,142)



The majority of consumers rated their satisfaction with SMUD at a minimum of 8, shown in Figure D-7. Very few customers selected the lower spectrum, below 4. Figure D-8 indicates how much importance customers place on reducing home energy use in general. The majority find it to be at least somewhat important, if not very important. The vast majority of consumers chose saving money as their primary motivator in saving energy use, represented in Figure D-9.

Figure D-7: Overall Satisfaction with SMUD
(1 ="Completely Dissatisfied" and 10 ="Completely Satisfied") (n=1,141)

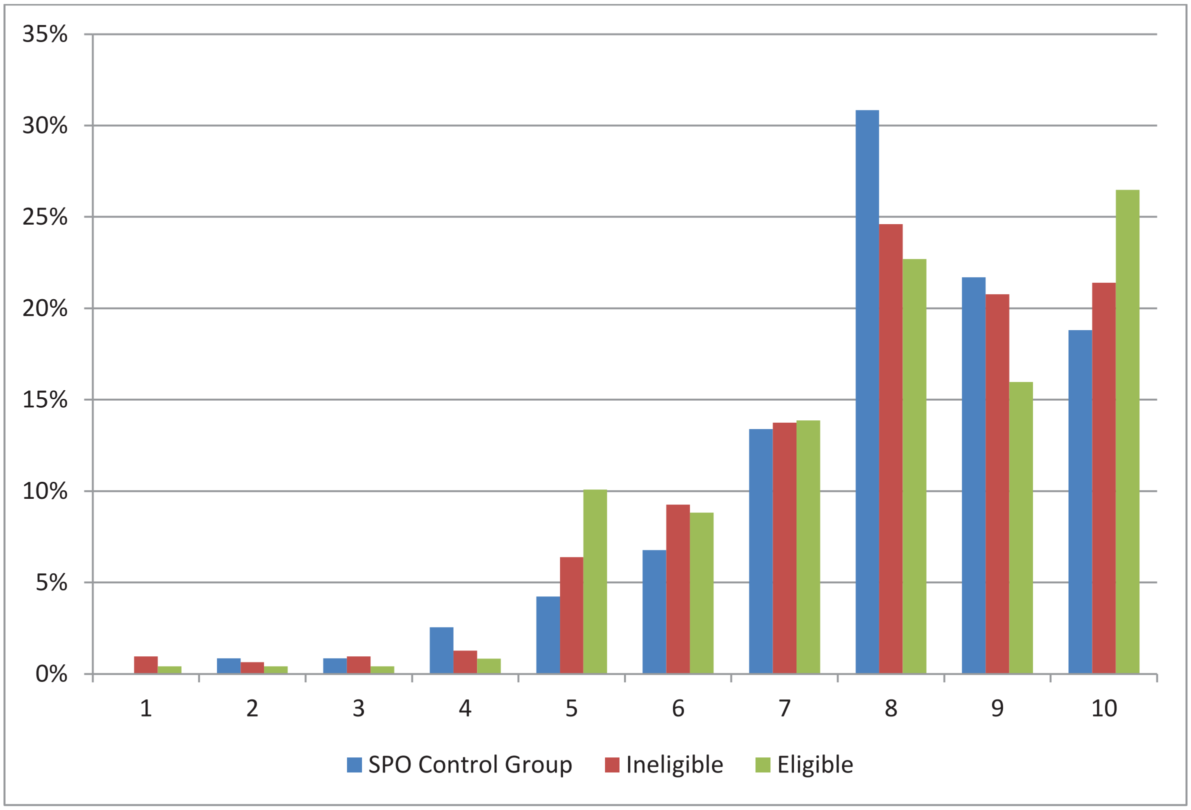


Figure D-8: Importance of Reducing Home Energy Use (n=1,142)

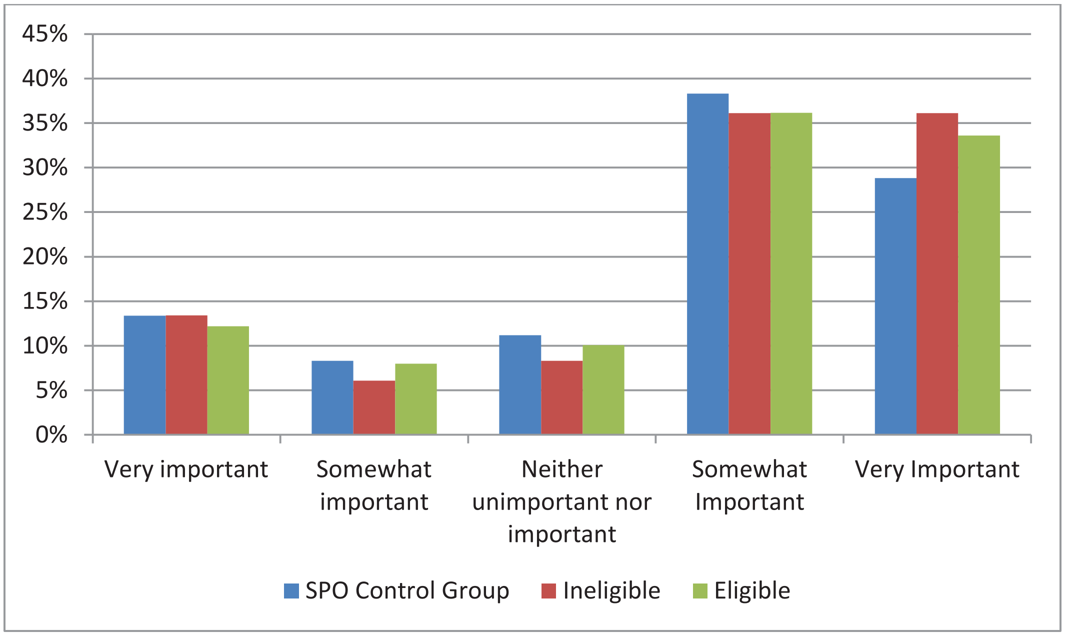
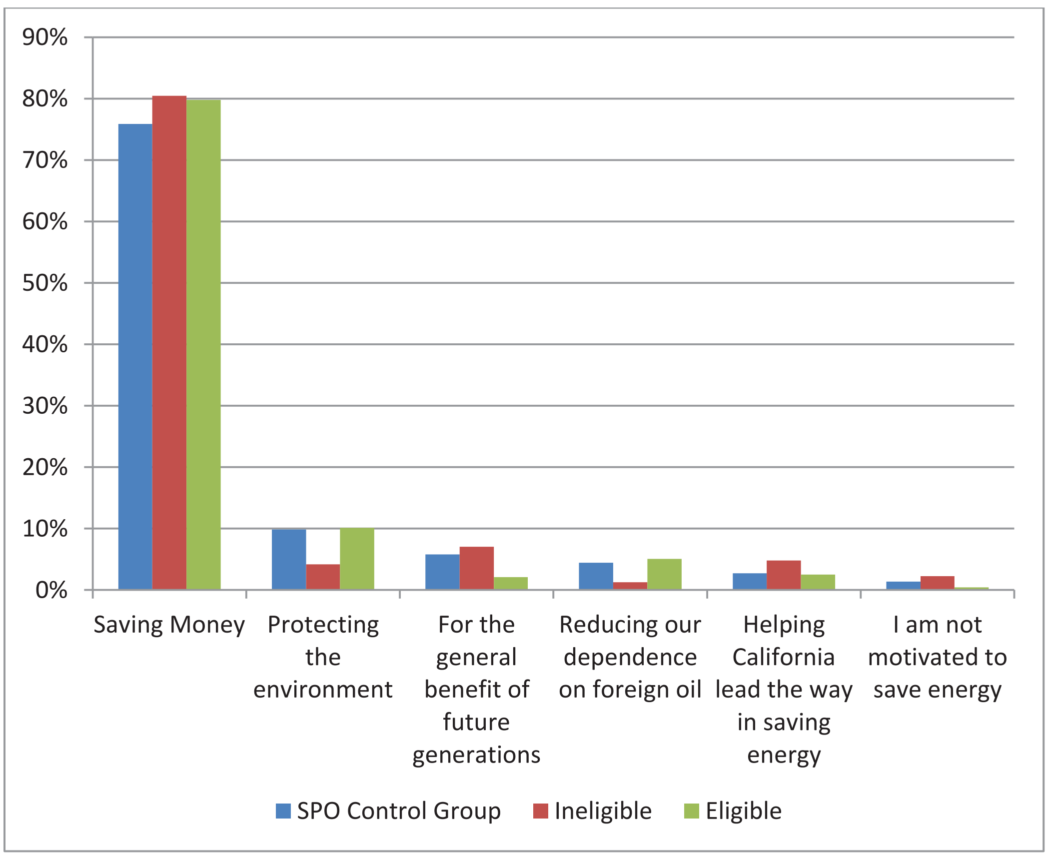


Figure D-9: Largest Motivation to Save Energy (n=1,142)



The survey then moved on from energy use habits and beliefs to more simple demographics. The majority of residences in all three groups were single family homes, seen in Figure D-10. The majority of customers own their homes in the SPO control and ineligible groups but a higher percentage of customers rent their homes in the eligible group. This can be confirmed in Figure D-11.

Figure D-10: Type of Residence (n=1,142)

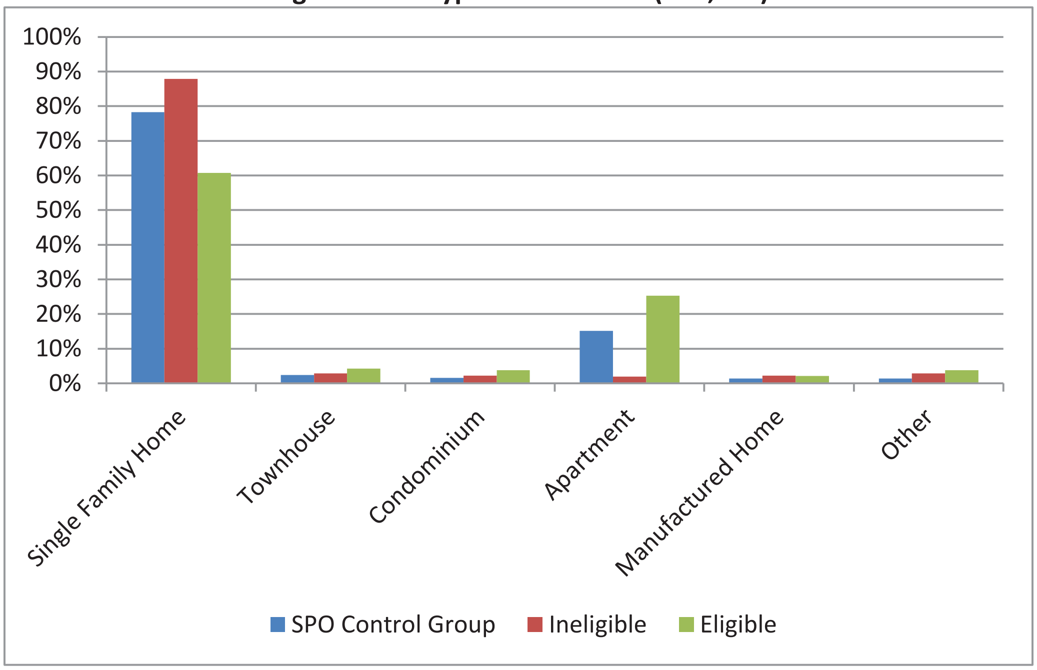
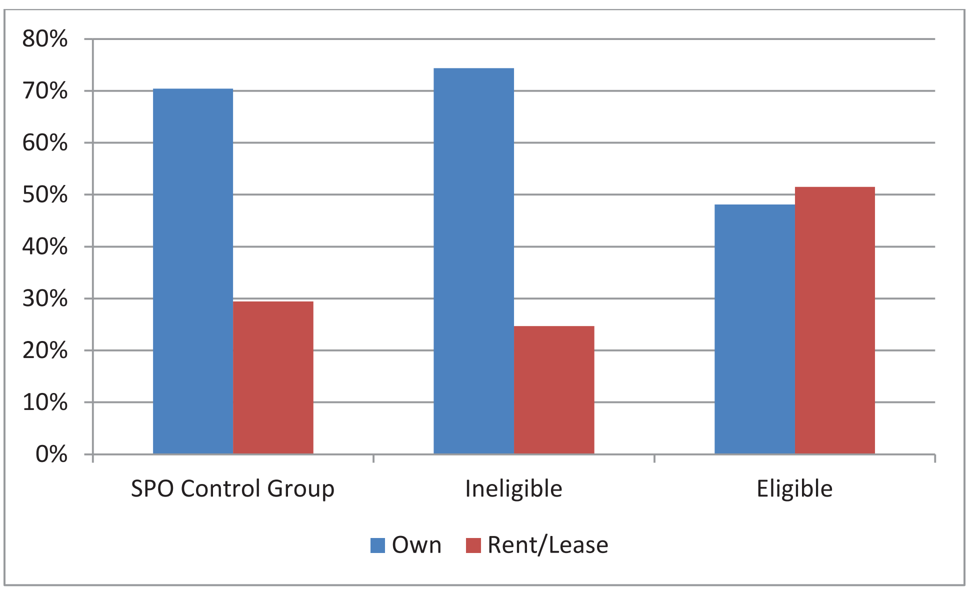
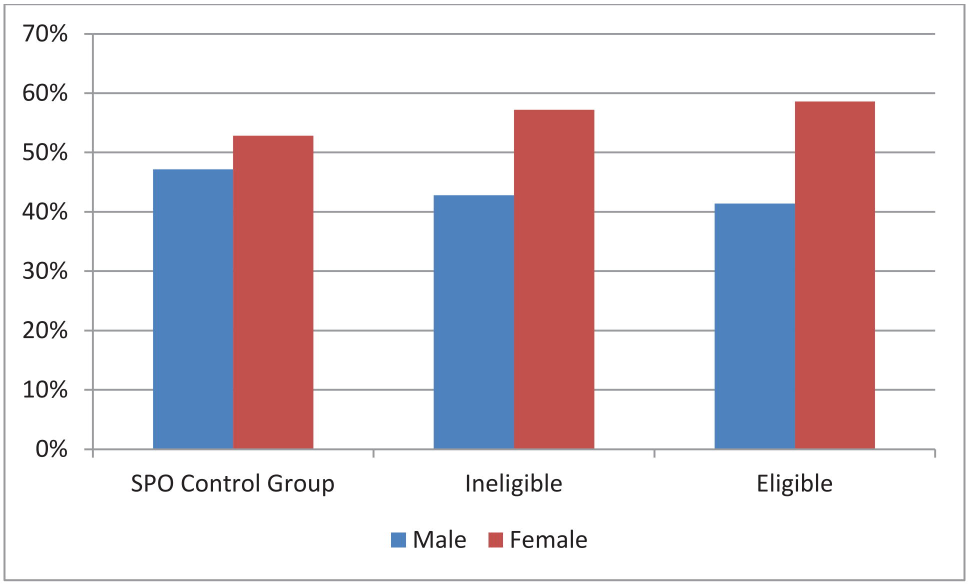


Figure D-11: Home Ownership Status (n=1,142)



There was a higher percentage of females for all three groups, as shown in Figure D-11.

Figure D-11: Gender Distribution (n=1,142)



The mean age of the eligible group was the lowest, at 47.0 years, followed by the SPO control group at 51.8 years and ineligible group at 53.1 years. Figure D-12 shows the age distribution in more detail. The age of other residents in the household were also of interest. Figure D-13 shows the number of adults over the age of 18 living in the household, including the respondent, with two being the most common answer. The average for all three groups was also 2. Zero was a more common answer for the number of children under the age of 18, seen in Figure D-14. The average number ranged from 0.6, for the ineligible group, to 0.9 for the eligible group.

Figure D-12: Age Distribution (n=1,142)

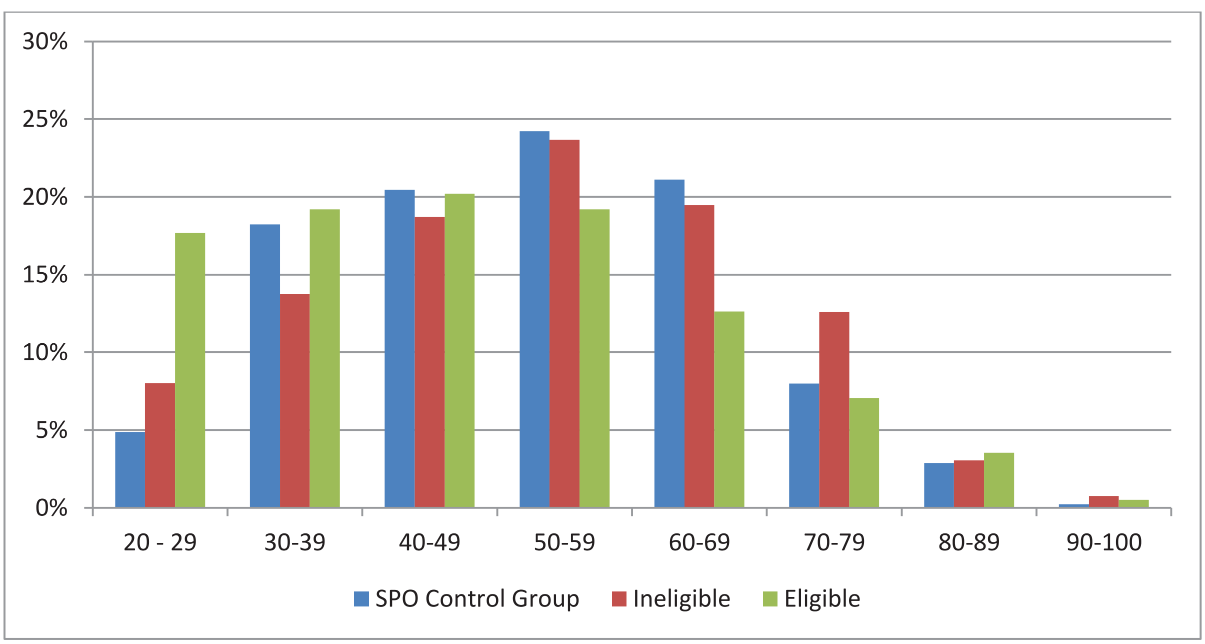


Figure D-13: Number of Adults Over 18 Who Reside in Household (n-1,142)

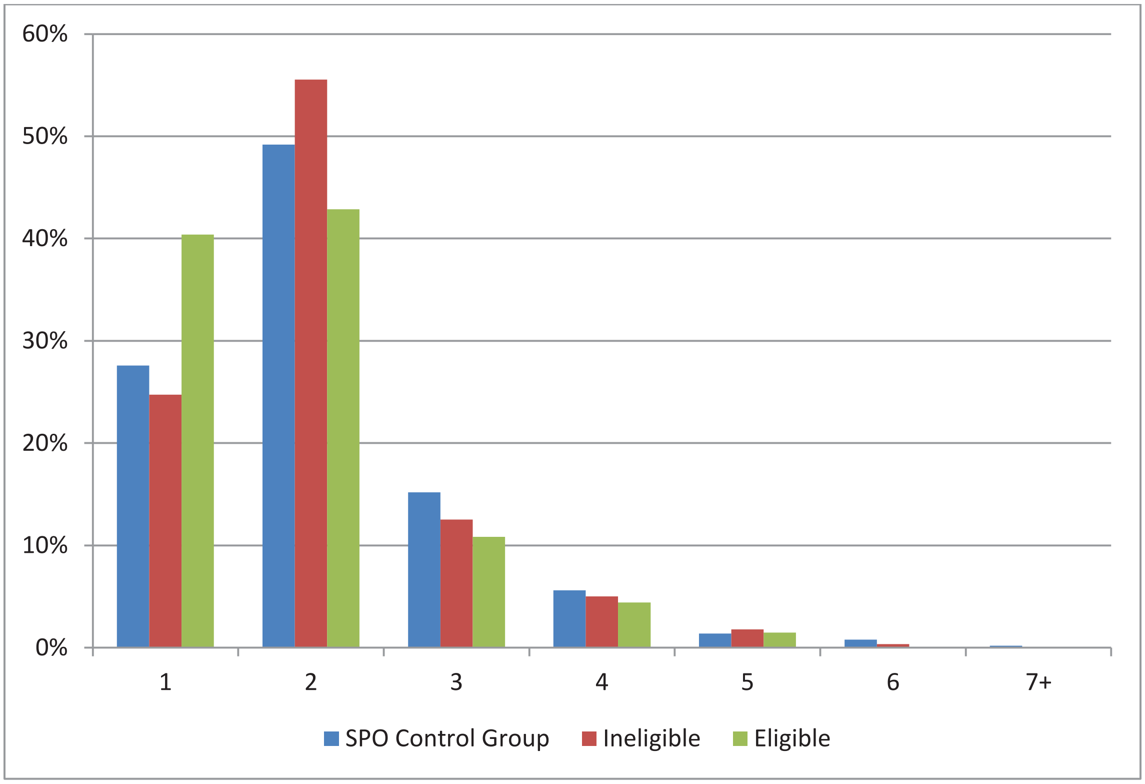
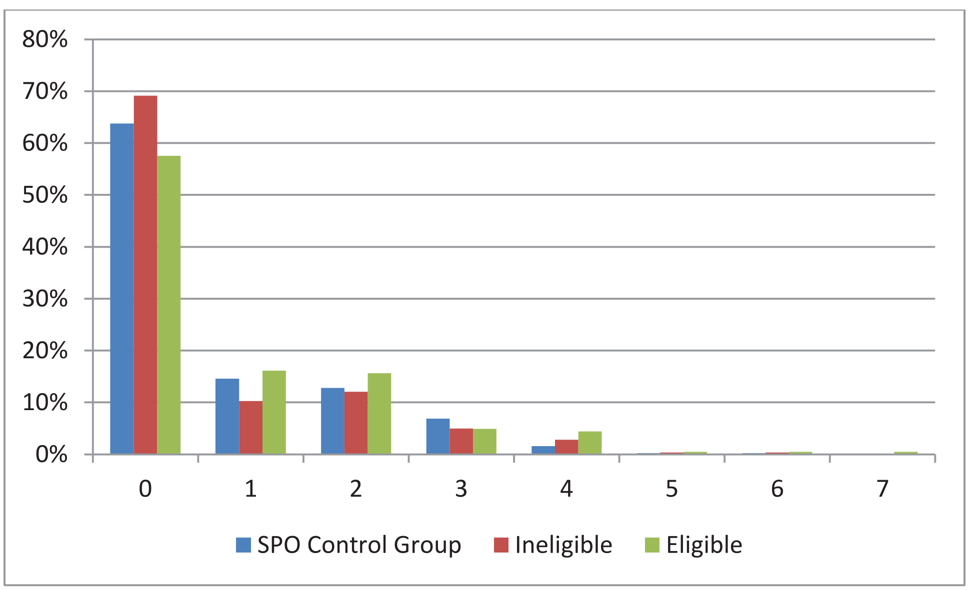


Figure D-14: Number of Children Under 18 Reside in Household (n=1,142)



Racially, the groups were very similar, with the majority being Caucasian/White, presented in Figure D-15. Figure D-16 has the levels of education for the consumers, with the most popular being some college to college degree. The final question looked at income. That distribution is shown in Figure D-17. There was a lot of variation, thus small differences (of less than 10%) appear to be fairly large. Scale must be taken into account.

Figure D-15: Distribution of Race (n=1,142)

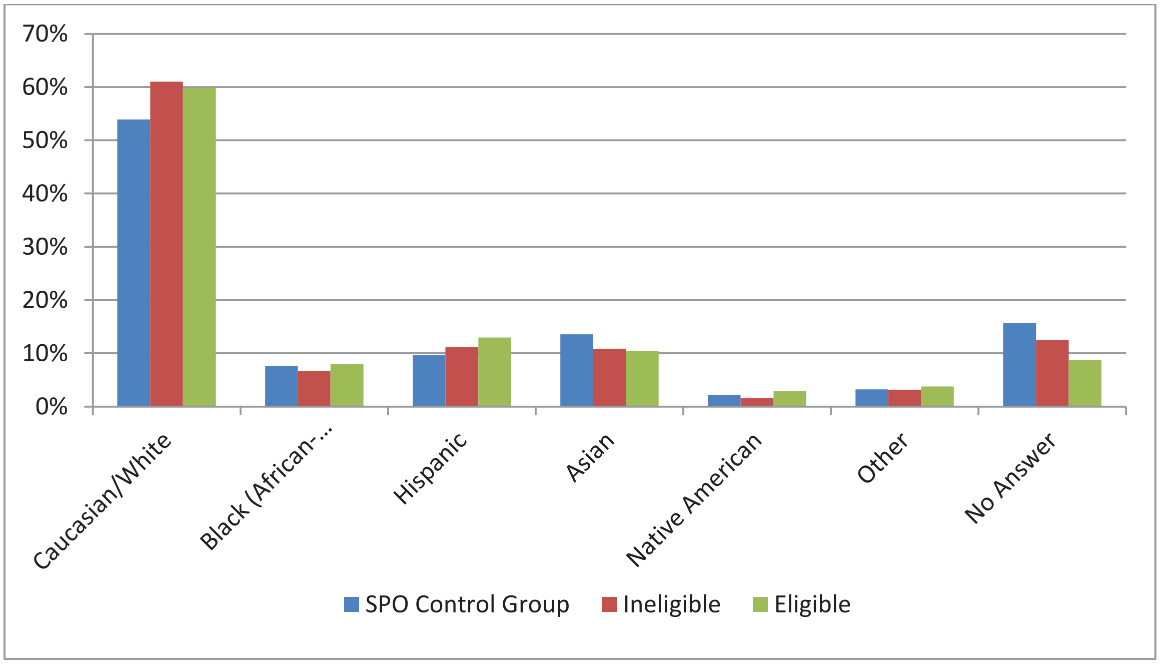


Figure D-16: Highest Level of Education Achieved (n=1,142)

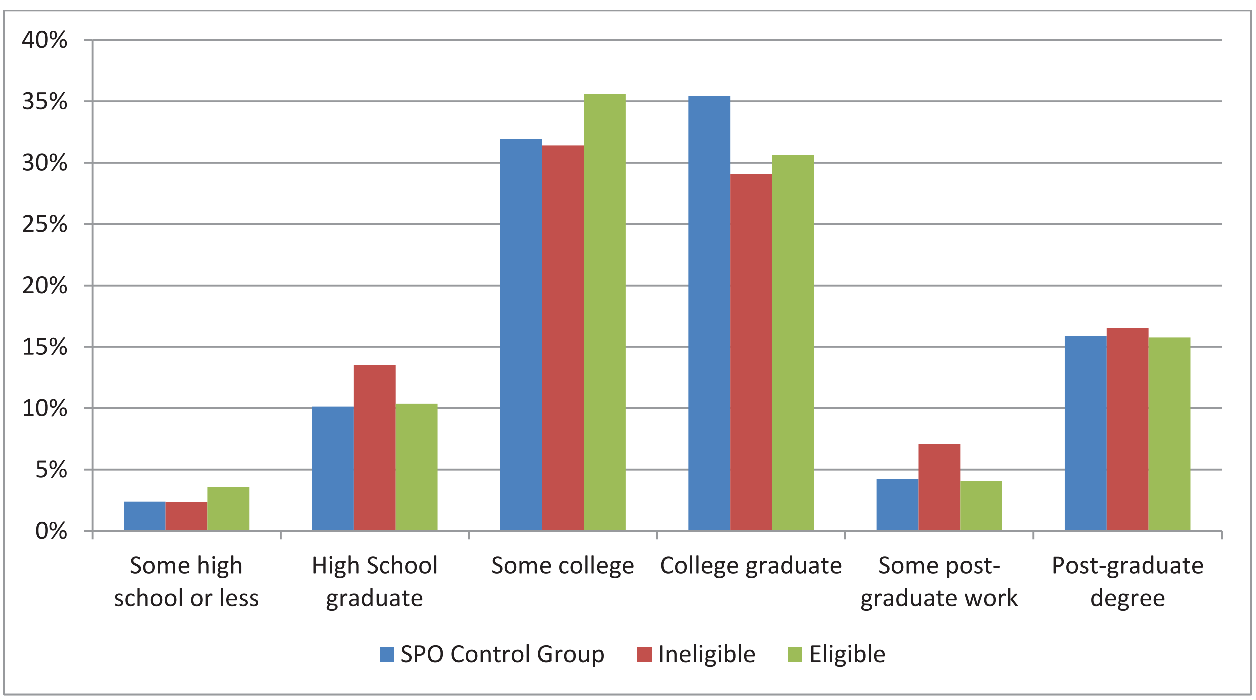
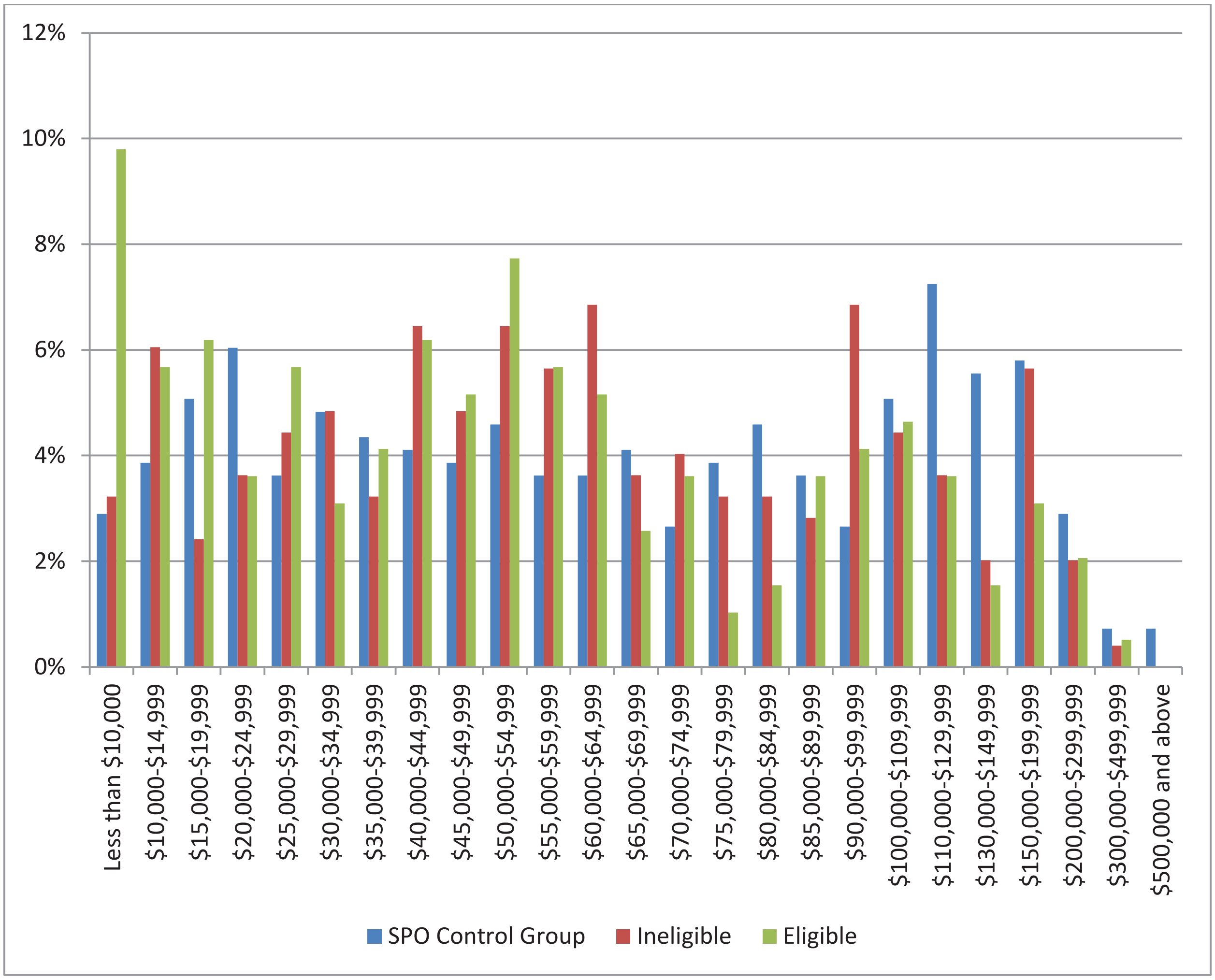


Figure D-17: Annual Household Income (n=1,142)



Appendix E Steps for Developing Choice Dataset for the Conjoint Survey

In the conjoint section of the survey, each respondent viewed 27 randomly selected choice options (9 sets of 3) and made 9 choices in total. To populate the 27 choice options for each respondent, FSC implemented the following steps:

1. Randomly assigned one of four plan types – Standard, TOU, CPP or CPP-TOU
2. Randomly assigned one of two tier structures – with or without
3. Within each of these 8 combinations, randomly selected from a dataset of revenue-neutral rates, which populated the following plan options:
   - Tier 1 price for each plan
   - Tier 2 price for each plan (equal to tier 1 if there were no tiers)
   - On-peak period associated with each plan – 1-7 PM, 3-7 PM or 4-7 PM (if applicable)
   - Number of CPP days associated with each plan – 6, 12, 18 or 24 (if applicable)
   - TOU on-peak price for each plan (if applicable)
   - CPP on-peak price for each plan (if applicable)
4. Randomly selected one of three technology options – none, IHD or PCT
5. Independently for each price component (tier 1, tier 2, TOU on-peak and CPP on-peak), randomly added noise by increasing the price by 12.5%, keeping the price equal or decreasing the price by 12.5% (with limits to avoid nonsensical prices such as a tier 2 price that is less than a tier 1 price or an on-peak price that is less than a tier 2 price)
6. To identify dominant choices, one of the three options in a choice set had to be clearly equal to or better than another for all rate components (i.e., lower prices, shorter on-peak period, fewer CPP days and more technology). When there was a dominant choice, FSC started from step 1 again until there weren't any dominant choices. FSC had to rerun from step 1 for roughly 11% of choice sets.

Step 5 was necessary because, without adding random noise to the prices, the price components would be so highly correlated with each other that it would prevent the ability to estimate the marginal effects for each variable.

Appendix F End of Pilot Survey Questionnaire

Question Set #1 (Satisfaction)

1. Thinking of all of the services you receive from SMUD, how satisfied are you? Select only one answer

   ☐ Very satisfied
   ☐ Somewhat satisfied
   ☐ Somewhat dissatisfied
   ☐ Very dissatisfied

2. Overall, how would you rate SMUD in comparison to the other providers of utilities in your community? Would you say SMUD is…

	Much Better	Somewhat Better	About the Same	Somewhat Worse	Much Worse
Cable/Satellite	☐	☐	☐	☐	☐
Water /Sewer	☐	☐	☐	☐	☐
Garbage	☐	☐	☐	☐	☐
Cell Phone	☐	☐	☐	☐	☐
Gas	☐	☐	☐	☐	☐

3. How would you rate SMUD as an environmental steward in comparison with the other providers of utilities in your community? Would you say SMUD is…

	Much Better	Somewhat Better	About the Same	Somewhat Worse	Much Worse
Cable/Satellite	☐	☐	☐	☐	☐
Water /Sewer	☐	☐	☐	☐	☐
Garbage	☐	☐	☐	☐	☐
Cell Phone	☐	☐	☐	☐	☐
Gas	☐	☐	☐	☐	☐

4. How would rate you SMUD as a corporate citizen in comparison with the other providers of utilities in your community? Would you say SMUD is…

	Much Better	Somewhat Better	About the Same	Somewhat Worse	Much Worse
Cable/Satellite	☐	☐	☐	☐	☐
Water /Sewer	☐	☐	☐	☐	☐
Garbage	☐	☐	☐	☐	☐
Cell Phone	☐	☐	☐	☐	☐
Gas	☐	☐	☐	☐	☐

5. At any time during the past two years have you had occasion to call SMUD?
   - ☐ Yes
   - ☐ No
   - ☐ Not-sure

6. (If Q5 = Yes) What was the purpose of your call? ***Check all that apply***
   - ☐ Obtain information about my pricing plan
   - ☐ Obtain information about other aspects of service
   - ☐ Sign up for a new pricing plan
   - ☐ Make an appointment for a service technician
   - ☐ Report an outage
   - ☐ Inquire about my bill
   - ☐ Other

7. (if Q5 = Yes) How would you rate your experience on these calls

	Excellent	Good	Fair	Poor	No Opinion
Obtain information about my pricing plan	☐	☐	☐	☐	☐
Obtain information about other aspects of service	☐	☐	☐	☐	☐
Sign up for a new pricing plan	☐	☐	☐	☐	☐
Make an appointment for a service technician	☐	☐	☐	☐	☐
Report an Outage	☐	☐	☐	☐	☐
Inquire about my bill	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐

Question Set #2 (Awareness)

The following questions ask for your opinions about pricing plans offered by SMUD. A pricing plan is the arrangement you have with SMUD for the price you pay for electricity.

8. Thinking only of the way you are charged for electricity in summer, which of the following best describes your household pricing plan? ***Check only one***

   - ☐ Pay the same price for electricity no matter when you use it
   - ☐ Pay a higher price for electricity used between 4:00 and 7:00 PM on all days
   - ☐ Pay a higher price for electricity used between 4:00 and 7:00 PM on weekdays only
   - ☐ Pay a much higher price for electricity used between 4:00 and 7:00 PM on 12 Conservation Days
   - ☐ Pay a higher price for electricity used between 4:00 and 7:00 PM on weekdays **with** an even higher price on 12 days during the summer called Conservation Days
   - ☐ Don't know

9. How satisfied are you with your current electricity pricing plan? ***Check only one***

   - ☐ Very satisfied
   - ☐ Somewhat satisfied
   - ☐ Somewhat dissatisfied
   - ☐ Very dissatisfied

10. Please indicate whether you agree or disagree with the following statements.

	Strongly Agree	Somewhat Agree	No Opinion	Somewhat Disagree	Strongly Disagree
My current pricing plan is easy to understand	☐	☐	☐	☐	☐
My current pricing plan is fair	☐	☐	☐	☐	☐
My current pricing plan provides me with opportunities to save money	☐	☐	☐	☐	☐
My current pricing plan is better than my old plan (*ask only of participants*)	☐	☐	☐	☐	☐
My current pricing plan fits my lifestyle	☐	☐	☐	☐	☐
I sometimes feel uncomfortable inside my home on summer afternoons and evenings because it is too expensive to run my air conditioner	☐	☐	☐	☐	☐
My current pricing plan is convenient	☐	☐	☐	☐	☐
I make sure I use as little electricity as possible between 4:00 and 7:00 PM	☐	☐	☐	☐	☐

Control and TOU Deferred Groups → Q50, Opt-outs → Q36

Question Set #3 (Expectation and Perception)

11. (*Ask only for opt-in customers)* According to our records, your household enrolled in a new pricing plan called (insert plan name) on (insert date) as part of SMUD's SmartPricing Options Pilot. Do you recall this happening?

☐ Yes
☐ No
☐ Not-sure

12. (*Ask only for default customers*) According to our records, your household is receiving service under a new pricing plan called (insert plan name) on (insert date) as part of SMUD's SmartPricing Options Pilot. Do you recall receiving notice of this service change?
    - ☐ Yes
    - ☐ No
    - ☐ Not-sure

13. (Ask only if 12 = yes) At the time you were switched to the new pricing plan you were offered a free in-home Electricity Use Display capable of displaying the amount of electricity your household was using in real time. Do you recall receiving that offer?
    - ☐ Yes
    - ☐ No
    - ☐ Not-sure

14. (Ask only if 12=yes and customer did not request the IHD) What were your reasons for not requesting the in-home Electricity Use Display ? ***Check all that apply***
    - ☐ I did not want it
    - ☐ I wanted it but forgot to order it
    - ☐ I thought I would be charged for it
    - ☐ I couldn't understand how it would help me
    - ☐ I ordered it but it never came

15. (*Ask only for default customers*) You had an opportunity to switch back to your original pricing plan before going on the new plan. Which of the following best describes your most important reason for staying on the new plan? ***Check only one***
    - ☐ You were not aware that you had been assigned to the new plan
    - ☐ You did not know that you could opt out of the new pricing plan
    - ☐ You were aware of the plan and felt that it was a good plan for you
    - ☐ You were not sure whether it was a good plan for you but wanted to give it a try before deciding whether to stay or revert to your original plan
    - ☐ You planned to opt out but never got around to it

16. (Ask only of TOU customers) Under this rate plan you receive a discount during most of the hours in the summer except for summer weekday afternoons between 4:00 PM and 7:00 PM when the price is about three times as high as it is at other times. Does that sound familiar?
    - ☐ Yes
    - ☐ No
    - ☐ Not-sure

17. (Ask only of CPP customers) Under this rate plan you receive a discount during most of the hours in the summer except on 12 summer days called Conservation Days between 4:00 PM and 7:00 PM when the price is about seven times higher than it is during other hours. Does that sound familiar?
    - ☐ Yes
    - ☐ No
    - ☐ Not-sure

18. (Ask only of TOU/CPP customers) Under this rate plan you receive a discount during most of the hours in the summer. However on weekday afternoons between 4:00 PM and 7:00 PM the price is about three times as high as it is during other hours and on 12 summer afternoons called Conservation Days between 4:00 PM and 7:00 PM the price is about seven times higher. Does that sound familiar?
    - ☐ Yes
    - ☐ No
    - ☐ Not-sure

19. (Ask only for CPP or CPP/TOU customers) As part of your pricing plan you were to receive notice by email, text or phone on the day prior to each Conservation Day. Do you recall receiving notice that there would be any Conservation Days?
    - ☐ Yes
    - ☐ No
    - ☐ Not-sure

20. (If Q19 = Yes) On about how many days last summer did you receive notice that the next day would be a Conservation Day?

    _____ number of days

21. (if Q19 = Yes) Which of the following best describes your opinion about the amount of notice you received of impending Conservation Days: ***Check only one***
    - ☐ I needed more notice (if so how much notice do you need - hours / days _____)
    - ☐ The amount of notice was just right
    - ☐ There was more than enough notice (if so, what is the minimum amount of time that you require for notice of impending Conservation Days hours/days_____)

22. (*Ask only for opt-in customers*) Do you think you saved any money as a result of selecting this rate plan?
    - ☐ Yes
    - ☐ No
    - ☐ Not-sure

23. (*Ask only for default customers*) Do you think you saved any money as a result of receiving service under this rate plan?
    - ☐ Yes
    - ☐ No
    - ☐ Not-sure

24. (If Q22 or Q23= Yes) How much money do you think you saved on a monthly basis? _____$

25. (Ask only for program participants) Compared to your old rate plan, how would you rate the convenience of this rate plan? ***Check only one***
    - ☐ A lot more convenient than my old rate plan
    - ☐ Somewhat more convenient than my old rate plan
    - ☐ About as convenient as my old rate plan
    - ☐ Somewhat less convenient than my old rate plan
    - ☐ A lot less convenient than my old rate plan

26. (Ask only program participants) Compared to when you were under your old rate plan, how would you rate the comfort of your home on summer afternoons and evenings? Was it… ***Check one***
    - ☐ A lot more comfortable than it was under your old rate plan
    - ☐ Somewhat more comfortable than it was under your old rate plan
    - ☐ About as comfortable as it was under your old rate plan
    - ☐ Somewhat less comfortable than it was under your old rate plan
    - ☐ A lot less comfortable than it was under your old rate plan

27. (Ask only of program participants) As part of the SmartPricing Options Pilot, SMUD provided you with access to a website containing tips and helpful hints for how to save money under your new pricing plan. Do you recall ever looking at this website?
    - ☐ Yes
    - ☐ No
    - ☐ Not-sure

28. (If Q27 = Yes) About how often did you look at this website during the first summer you were on the new pricing plan? ***Check only one***

- ☐ Only once
- ☐ A few times during the summer
- ☐ Every week during the summer
- ☐ Every day during the summer

29. (If Q27 = Yes) How about last summer? ***Check only one***

- ☐ Only once
- ☐ A few times during the summer
- ☐ Every week during the summer
- ☐ Every day during the summer

30. (if Q27 = Yes) Below are some things you can do at the website. Please indicate whether you tried them and if so, how much you liked or disliked them.

	Tried or used	Liked a lot	Liked a little	Disliked a little	Disliked a lot	No Opinion
Reviewed the conditions of my pricing plan	☐	☐	☐	☐	☐	☐
Read about tips for lowering my cost	☐	☐	☐	☐	☐	☐
Joined Facebook Groups	☐	☐	☐	☐	☐	☐
Played games	☐	☐	☐	☐	☐	☐
Entered sweepstakes	☐	☐	☐	☐	☐	☐
Looked at my usage	☐	☐	☐	☐	☐	☐

31. (Ask only for program participants) Please indicate how much you agree or disagree with the following statements about your pricing plan:

	Strongly Agree	Somewhat Agree	No Opinion	Somewhat Disagree	Strongly Disagree
I understand why SMUD is offering the pricing plan I am on	☐	☐	☐	☐	☐
SMUD should be offering the pricing plan I am on to all of its customers	☐	☐	☐	☐	☐
I believe that I did something good for Sacramento by participating in my pricing plan	☐	☐	☐	☐	☐
I think the Sacramento community would be better off if everybody was on my pricing plan	☐	☐	☐	☐	☐
I remember receiving a Welcome Back kit in the mail this summer from SMUD	☐	☐	☐	☐	☐
SMUD answered all my questions about my pricing plan	☐	☐	☐	☐	☐
I want to stay on my pricing plan	☐	☐	☐	☐	☐

32. Overall, how satisfied are you with your new pricing plan? ***Check only one***

- ☐ Very satisfied
- ☐ Somewhat satisfied
- ☐ Somewhat dissatisfied
- ☐ Very dissatisfied

Question Set #4 (Behavioral Changes and Perceived Difficultly)

33. As a result of participating in (insert plan name) as part of SMUD's SmartPricing Options Pilot, did you have more control over your household's electricity cost?

- ☐ Yes
- ☐ No

34. Please identify any actions that you or other members of your household may have taken to lower your electricity consumption between 4:00 PM and 7:00 PM? ***Check all that apply***

- ☐ Turned off lights not in use during the peak period
- ☐ Turned off office equipment during the peak period
- ☐ Turned off entertainment systems during the peak period
- ☐ Increased the temperature of my thermostat during the peak period
- ☐ Turned off air conditioning during the peak period
- ☐ Did laundry off peak
- ☐ Did dishes off peak
- ☐ Cooked dinners outside
- ☐ Changed spa and pool pumping to off-peak hours
- ☐ None of the above – Skip over Q35

35. How difficult were these changes to make?

- ☐ Not difficult at all
- ☐ Somewhat difficult
- ☐ Very difficult

Question Set #5 (Opt-out Questions)

36. (Ask only of drop out customers) Our records indicate that you elected to return to your standard rate on (drop date). Below is a list of reasons why you may have left the (insert plan name) as part of SMUD's SmartPricing Options Pilot. Please indicate how important each reason was to you in deciding to leave the (insert plan name).

	Very Important	Somewhat Important	No Opinion	Somewhat Unimportant	Completely Unimportant
I was not aware that I was on the (insert plan name) until I received the letter in May	☐	☐	☐	☐	☐
I was not saving money	☐	☐	☐	☐	☐
The (insert plan name) did not give me more control over my bill	☐	☐	☐	☐	☐
I do not want to worry about when I use electricity	☐	☐	☐	☐	☐
I found it too difficult to limit my usage to off-peak times	☐	☐	☐	☐	☐
Other	specify				

Question Set #6 (IHDs)

37. Last year, after you enrolled in (insert plan name) as part of the SmartPricing Options Pilot, SMUD sent you an Electricity Use Display that shows up-to-the-minute information about electricity cost and usage for your entire home. Do you recall receiving the Electricity Use Display in the mail?
    - ☐ Yes
    - ☐ No ➔(skip to Q49)

38. Did you try to use the Electricity Use Display?
    - ☐ Yes, and succeeded
    - ☐ Yes, but couldn't get it to work ➔(skip to Q43)
    - ☐ No – ➔(skip to Q49)
    - ☐ Not sure / Don't remember (skip to Q49)

39. Is the Electricity Use Display you received still working?
    - ☐ Yes ➔(Skip to Q44)
    - ☐ No
    - ☐ Not sure or don't know ➔(Skip to Q44)

40. Approximately when did it stop working?
- ☐ Within a month or two of receiving it
- ☐ A few days ago
- ☐ A few weeks ago
- ☐ A few months ago
- ☐ Not sure or don't know

41. When you noticed that it stopped working, did you attempt to restart it?
- ☐ Yes
- ☐ No – Why not? ______ ➔(Skip to Q49)

42. What actions did you take to try to restart the Electricity Use Display? ***Check all that apply***
- ☐ Turned it off and then on
- ☐ Removed the battery and replaced it
- ☐ Moved its location
- ☐ Called the customer service line
- ☐ Other – Specify ______

43. Have you discarded the Electricity Use Display or is it still in your home? ***Check only one***
- ☐ Discarded ➔ (Skip to Q47)
- ☐ Still in the home ➔ (Skip to Q47)
- ☐ Not sure or don't know ➔ (Skip to Q47)

44. Where is your Electricity Use Display currently located? ***Check only one***
- ☐ Kitchen
- ☐ Family room
- ☐ Living room
- ☐ Office
- ☐ Dining room
- ☐ Other – Specify

45. In the past week, about how often did you look at your Electricity Use Display? ***Check only one***
- ☐ More than once a day
- ☐ About once a day
- ☐ 2-4 times
- ☐ Once
- ☐ Never

46. Did you discuss your home's energy use with anyone else inside or outside your home based on information obtained through the Electricity Use Display **in the last 30 days**?

- ☐ No
- ☐ Yes, discussed energy use with other adults in the household
- ☐ Yes, discussed energy use with guests or other adults outside the household
- ☐ Yes, discussed energy use with children
- ☐ I stopped using or discarded the device more than 30 days ago.

47. Have you made any changes to the way you use electricity in your home based on the information provided by the Electricity Use Display?

- ☐ Yes
- ☐ No
- ☐ Not sure
- ☐ I never got the Electricity Use Display to work

48. Based on your experience with the Electricity Use Display, would you recommend to a friend that they get one?

- ☐ Yes
- ☐ No
- ☐ Not sure

49. (Ask of all customers in all surveys) Please describe any changes in the ways in which you use electricity that you or others in your household may have made over the past 24 months. ***Check all that apply***

- ☐ Installed a smart power strip to control "vampire" loads
- ☐ Installed compact fluorescent lights (CFLs) or LEDs.
- ☐ Bought an energy-efficient appliance
- ☐ Replaced my air conditioner with a more efficient one
- ☐ Repaired or serviced my air conditioner
- ☐ Set my thermostat to a higher temperature to use less electricity
- ☐ Avoided using my air conditioner as much as possible
- ☐ Did fewer but larger loads of laundry
- ☐ Did fewer but larger loads of dishes
- ☐ Only used cold water when doing laundry/dishes
- ☐ Other – Specify
- ☐ None of the above

Question Set #7 (DOE/LBNL Questions)

50. (Ask only for those in the opt-in treatment) Since 2012 you have been receiving electric service under the (insert plan name) as part of SMUD's SmartPricing Options Pilot. Below are some reasons why people say they continue to stay on the (Insert pricing plan). Please tell us how important these reasons are to you in staying on the pricing plan.

	Very Important	Somewhat Important	Somewhat Unimportant	Completely Unimportant	Don't Know
I like the pricing plan	☐	☐	☐	☐	☐
I didn't know I was able to drop out of the pricing plan	☐	☐	☐	☐	☐
I intended to drop out of the pricing plan, but never got around to it	☐	☐	☐	☐	☐
I don't think I would be any better off on the standard rate	☐	☐	☐	☐	☐
The more I got used to the pricing plan, the more I liked it	☐	☐	☐	☐	☐

51. (Ask only for those who did not opt out of the default treatment) Since 2012 you were assigned to a new pricing plan called the (insert plan name), as part of SMUD's SmartPricing Options Pilot. Below are some reasons why people say they continue to subscribe to (Insert pricing plan). Please tell us how important these reasons are to you in staying on the pricing plan.

	Very Important	Somewhat Important	Somewhat Unimportant	Completely Unimportant	Don't Know
I like the pricing plan SMUD assigned me to	☐	☐	☐	☐	☐
I didn't know I was assigned to the new pricing plan	☐	☐	☐	☐	☐

I didn't know I was able to drop out of the new pricing plan	☐	☐	☐	☐	☐
I assume the default pricing plan SMUD selected for me is best for me	☐	☐	☐	☐	☐
I intended to drop out of the pricing plan, but never got around to it	☐	☐	☐	☐	☐
I'm not sure I would be any better off on the standard rate	☐	☐	☐	☐	☐
The more I got used to the pricing plan, the more I liked it	☐	☐	☐	☐	☐

Question Set #8 (About Your Household)

52. What type of home is this? ***Check one***

- ☐ A single family house detached from any other house
- ☐ A residential building with 2 to 4 apartments or condominiums
- ☐ A residential building with 5 to 10 apartments or condominiums
- ☐ A building with more than 10 apartments or condominiums
- ☐ A mobile or manufactured home

53. Do you own or rent your home? ***Check one***

- ☐ Own / Buying (Skip to question 55)
- ☐ Rent / Leasing

54. If you rent / lease your home, which of the following services are paid for by your landlord, property management, or building association? ***Check all that apply***

☐ None ☐ Electricity ☐ Gas ☐ Water

55. For each of the following age groups, how many people, including you, live in this home for more than half of the year?

Age	Number of People
5 and under	_____
6 - 18	_____
19 - 34	_____
35 - 54	_____
55 - 64	_____
65 and over	_____

56. How many adults in your household work outside the home on most days?

Number of People

_____

57. How many adults in your household work exclusively at home on most days?

Number of People

_____

58. What is the highest grade of schooling anyone in your household has completed? (Select only one answer)

- ☐ Elementary or middle school
- ☐ Some high school, no diploma
- ☐ High school graduate
- ☐ Trade or technical school
- ☐ Some college, no degree
- ☐ Two-year college graduate
- ☐ Four-year college graduate
- ☐ Graduate degree or higher

59. Which of the following best describes your total household income from all sources in 2012, before taxes? ***Check one***

- ☐ Less than $15,000
- ☐ $15,000 - $24,999
- ☐ $25,000 - $49,999
- ☐ $50,000 - $74,999
- ☐ $75,000 - $99,999
- ☐ $100,000 - $124,999
- ☐ $125,000 or more

Appendix G End of Pilot Survey Results

Q1 - Thinking of all of the services you receive from SMUD, how satisfied are you?

1 Very satisfied
2 Somewhat satisfied
3 Somewhat dissatisfied
4 Very dissatisfied

Category	N	1	2	3	4
control	300	63.7	32.7	0.7	3.0
default_(no_drop_outs)	721	65.7	30.9	1.3	2.1
default_drop_outs	88	55.2	41.5	1.0	2.3
deferred	736	68.6	27.6	0.9	2.9
opt_in_(not_deferred)_(no_drop_outs)	1593	68.8	27.3	1.7	2.2
opt_in_drop_outs	154	58.7	36.8	3.1	1.3

Q8 - Thinking only of the way you are charged for electricity in summer, which of the following best describes your household pri

1 Pay the same price for electricity no matter when you use it
2 Pay a higher price for electricity used between 4:00 and 7:00 PM on all days
3 Pay a higher price for electricity used between 4:00 and 7:00 PM on weekdays only
4 Pay a much higher price for electricity used between 4:00 and 7:00 PM on 12 Conservation Days
5 Pay a higher price for electricity used between 4:00 and 7:00 PM on weekdays with an even higher price on 12 days during the s
6 Don’t know

Category	N	1	2	3	4	5	6
control	300	25.7	8.7	4.7	0.3	4.7	56.0
default_CPP_(no_drop_outs)	163	15.9	7.2	4.9	19.6	13.7	38.6
default_CPP_TOU_(no_drop_outs)	141	9.9	12.8	10.4	7.9	21.4	37.6
default_TOU_(no_drop_outs)	417	13.2	16.1	29.9	1.6	5.9	33.1
deferred	736	27.0	12.7	14.3	1.7	2.9	41.4
opt_in_CPP_(no_drop_outs)	576	10.4	9.4	6.1	42.2	13.9	18.0
opt_in_TOU_(no_drop_outs)	1017	10.1	16.5	47.7	1.1	4.6	20.0

Q9 - How satisfied are you with your current electricity pricing plan?

1 Very satisfied
2 Somewhat satisfied
3 Somewhat dissatisfied
4 Very dissatisfied

Category	N	1	2	3	4
control	300	20.3	60.0	15.0	4.7
default_CPP_(no_drop_outs)	163	30.1	57.0	10.6	2.3
default_CPP_TOU_(no_drop_outs)	141	22.1	63.9	10.4	3.6
default_TOU_(no_drop_outs)	417	22.9	61.5	13.6	2.1
deferred	736	23.3	58.5	13.6	4.6
opt_in_CPP_(no_drop_outs)	576	33.1	56.3	9.2	1.4
opt_in_TOU_(no_drop_outs)	1017	32.8	54.3	10.6	2.3

Q10 - Please indicate whether you agree or disagree with the following statements.

1 Strongly agree
2 Somewhat agree
3 No opinion
4 Somewhat disagree
5 Strongly disagree

My current pricing plan is easy to understand

Category	N	1	2	3	4	5
control	300	25.0	31.3	26.3	13.7	3.7
default_CPP_(no_drop_outs)	163	24.7	38.1	21.2	11.0	4.9
default_CPP_TOU_(no_drop_outs)	141	25.6	42.3	18.6	12.3	1.3
default_TOU_(no_drop_outs)	417	27.5	38.6	17.7	13.4	2.8
deferred	736	25.8	41.9	20.4	8.9	3.1
opt_in_CPP_(no_drop_outs)	576	30.9	47.1	10.6	9.9	1.6
opt_in_TOU_(no_drop_outs)	1017	35.0	43.8	11.8	7.5	2.0

My current pricing plan is fair

Category	N	1	2	3	4	5
control	300	16.7	27.7	36.7	14.3	4.7
default_CPP_(no_drop_outs)	163	22.5	39.3	27.6	8.7	1.9
default_CPP_TOU_(no_drop_outs)	141	16.7	41.0	30.5	8.7	3.2
default_TOU_(no_drop_outs)	417	18.2	38.0	27.2	13.7	2.9
deferred	736	19.6	33.3	31.3	12.1	3.8
opt_in_CPP_(no_drop_outs)	576	25.5	40.7	24.1	7.9	1.7
opt_in_TOU_(no_drop_outs)	1017	26.5	39.6	22.1	9.4	2.3

My current pricing plan provides me with opportunities to save money

Category	N	1	2	3	4	5
control	300	11.3	22.0	43.0	17.3	6.3
default_CPP_(no_drop_outs)	163	25.6	35.8	28.4	9.9	0.4
default_CPP_TOU_(no_drop_outs)	141	25.3	32.4	30.1	7.5	4.6
default_TOU_(no_drop_outs)	417	21.4	38.1	25.4	11.7	3.5
deferred	736	20.1	26.7	30.8	16.3	6.1
opt_in_CPP_(no_drop_outs)	576	34.6	41.9	14.5	7.3	1.7
opt_in_TOU_(no_drop_outs)	1017	32.2	41.9	16.6	5.9	3.4

My current pricing plan is better than my old plan

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	19.1	25.1	46.7	6.4	2.7
default_CPP_TOU_(no_drop_outs)	141	15.3	22.9	51.9	4.9	5.0
default_TOU_(no_drop_outs)	417	16.1	21.6	49.6	10.2	2.5
opt_in_CPP_(no_drop_outs)	576	26.7	30.1	34.4	7.6	1.2
opt_in_TOU_(no_drop_outs)	1017	27.5	30.7	32.6	7.2	2.1

My current pricing plan fits my lifestyle

Category	N	1	2	3	4	5
control	300	16.0	30.7	34.3	12.3	6.7
default_CPP_(no_drop_outs)	163	21.0	28.6	35.2	12.2	3.1
default_CPP_TOU_(no_drop_outs)	141	16.2	30.2	38.9	7.9	6.8
default_TOU_(no_drop_outs)	417	17.8	30.1	32.6	15.0	4.5
deferred	736	18.3	31.1	30.6	15.1	4.9
opt_in_CPP_(no_drop_outs)	576	23.5	38.2	23.4	11.6	3.3
opt_in_TOU_(no_drop_outs)	1017	21.3	38.1	22.6	13.9	4.1

I sometimes feel uncomfortable inside my home on summer afternoons and evenings because it is too expensive to run my air cond

Category	N	1	2	3	4	5
control	300	22.0	31.0	22.7	16.7	7.7
default_CPP_(no_drop_outs)	163	20.2	36.1	18.6	16.0	9.1
default_CPP_TOU_(no_drop_outs)	141	25.2	31.9	19.0	12.8	11.2
default_TOU_(no_drop_outs)	417	22.0	33.7	19.2	16.8	8.4
deferred	736	24.4	34.2	18.8	13.9	8.8
opt_in_CPP_(no_drop_outs)	576	25.7	32.1	14.3	17.0	10.9
opt_in_TOU_(no_drop_outs)	1017	27.8	34.6	14.3	16.7	6.6

My current pricing plan is convenient

Category	N	1	2	3	4	5
control	300	15.3	26.7	42.7	12.3	3.0
default_CPP_(no_drop_outs)	163	16.0	33.6	35.6	13.7	1.2
default_CPP_TOU_(no_drop_outs)	141	13.7	32.0	39.9	9.4	5.0
default_TOU_(no_drop_outs)	417	18.5	28.8	36.8	13.0	3.0
deferred	736	16.7	32.3	35.9	10.4	4.6
opt_in_CPP_(no_drop_outs)	576	21.8	36.9	24.8	13.0	3.5
opt_in_TOU_(no_drop_outs)	1017	20.5	38.1	27.7	11.3	2.4

I make sure I use as little electricity as possible between 4:00 and 7:00 PM

Category	N	1	2	3	4	5
control	300	22.3	30.3	26.7	14.3	6.3
default_CPP_(no_drop_outs)	163	45.0	32.3	11.7	9.1	1.9
default_CPP_TOU_(no_drop_outs)	141	38.7	35.0	15.0	8.2	3.2
default_TOU_(no_drop_outs)	417	36.2	36.4	14.9	9.8	2.6
deferred	736	35.3	35.0	17.6	8.9	3.3
opt_in_CPP_(no_drop_outs)	576	54.4	33.8	5.6	4.5	1.7
opt_in_TOU_(no_drop_outs)	1017	56.9	30.9	6.4	4.6	1.2

Q11 - According to our records, your household enrolled in a new pricing plan called the [plan] as of [date] as part of SMUD's SmartPricing Options Pilot. Do you recall this happening?

1 Yes
2 No
3 Not sure

Category	N	1	2	3
opt_in_CPP_(no_drop_outs)	576	87.3	3.5	9.2
opt_in_TOU_(no_drop_outs)	1017	83.0	4.1	12.9

Q12 - According to our records, your household is receiving service under a new pricing plan called [plan] as of [date] as part of SMUD's SmartPricing Options Pilot. Do you recall receiving notice of this service change?

1 Yes
2 No
3 Not sure

Category	N	1	2	3
default_CPP_(no_drop_outs)	163	55.3	11.4	33.3
default_CPP_TOU_(no_drop_outs)	141	55.1	17.6	27.2
default_TOU_(no_drop_outs)	417	57.6	14.2	28.2

Q13 - At the time you were switched to the new pricing plan you were offered a free in-home Electricity Use Display capable of displaying the amount of electricity your household was using in real time. Do you recall receiving that offer?

1 Yes
2 No
3 Not sure

Group	Outcome	Group #	N	1	2	3
Default CPP	No IHD Delivered	2	100	38.3	34.0	27.7
	IHD Delivered	3	63	98.0	0.0	2.0
Default TOU	No IHD Delivered	5	285	43.6	28.2	28.2
	IHD Delivered	6	132	89.1	3.0	7.9
Default CPP-TOU	No IHD Delivered	8	84	45.0	15.0	40.0
	IHD Delivered	9	57	97.8	0.0	2.2
Total			**721**	65.9	15.4	18.7

Q14 - What were your reasons for not requesting the in-home Electricity Use Display? (Check all that apply)

1 I did not want it
2 I wanted it but forgot to order it
3 I thought I would be charged for it
4 I couldn't understand how it would help me
5 I ordered it but it never came

Group	Outcome	Group #	N	1	2	3
Default CPP	No IHD Delivered	2	100	23.4	27.7	14.9
	IHD Delivered	3	63	9.8	19.6	25.5
Default TOU	No IHD Delivered	5	285	27.5	36.2	14.8
	IHD Delivered	6	132	16.8	21.8	15.8
Default CPP-TOU	No IHD Delivered	8	84	25.0	27.5	10.0
	IHD Delivered	9	57	17.4	8.7	6.5
Total			**721**	21.2	26.3	15.0

Q15 - You had an opportunity to switch back to your original pricing plan before going on the new plan. Which of the following best describes your most important reason for staying on the new plan?

1 You were not aware that you had been assigned to the new plan
2 You did not know that you could opt out of the new pricing plan
3 You were aware of the plan and felt that it was a good plan for you
4 You were not sure whether it was a good plan for you but wanted to give it a try before deciding whether to stay or revert to your original plan
5 You planned to opt out but never got around to it

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	22.7	22.7	25.7	27.4	1.5
default_CPP_TOU_(no_drop_outs)	141	35.5	17.5	17.6	28.5	0.9
default_TOU_(no_drop_outs)	417	29.0	22.4	20.8	26.2	1.6

Q16 - Under this rate plan you receive a discount during most of the hours in the summer except for summer weekday afternoons between 4:00 PM and 7:00 PM when the price is about three times as high as it is at other times. Does that sound familiar?

1 Yes
2 No
3 Not sure

Category	N	1	2	3
default_TOU_(no_drop_outs)	417	60.7	15.0	24.3
opt_in_TOU_(no_drop_outs)	1017	84.8	4.3	10.9

Q17 - Under this rate plan you receive a discount during most of the hours in the summer except on 12 summer days called Conservation Days between 4:00 PM and 7:00 PM when the price is about seven times higher than it is during other hours. Does that sound familiar?

1 Yes
2 No
3 Not sure

Category	N	1	2	3
default_CPP_(no_drop_outs)	163	59.1	17.8	23.1
opt_in_CPP_(no_drop_outs)	576	86.9	3.3	9.8

Q18 - Under this rate plan you receive a discount during most of the hours in the summer. However on weekday afternoons between 4:00 PM and 7:00 PM the price is about three times as high as it is during other hours and on 12 summer afternoons called Conservation Days between 4:00 PM and 7:00 PM the price is about seven times higher. Does that sound familiar?

1 Yes
2 No
3 Not sure

Category	N	1	2	3
default_CPP_TOU_(no_drop_outs)	141	54.7391	19.472	25.7889

Q19 - As part of your pricing plan you were to receive notice by email, text or phone on the day prior to each Conservation Day. Do you recall receiving notice that there would be any Conservation Days?

1 Yes
2 No
3 Not sure

Category	N	1	2	3
default_CPP_(no_drop_outs)	163	62.2	20.1	17.8
default_CPP_TOU_(no_drop_outs)	141	60.5	24.5	15.0
opt_in_CPP_(no_drop_outs)	576	86.4	6.8	6.8

Q21 - Which of the following best describes your opinion about the amount of notice you received of impending Conservation Days?

1 I needed more notice
2 The amount of notice was just right
3 There was more than enough notice

Category	N	1	2	3
default_CPP_(no_drop_outs)	109	8.0	74.2	17.8
default_CPP_TOU_(no_drop_outs)	93	10.7	72.7	16.6
opt_in_CPP_(no_drop_outs)	498	10.4	75.0	14.6

How much notice do you need? Please specify your answer in either hours or days. Type 0 in the other box.

Hours

Category	N	0	1	2	3	4	5	6	7	8	10	12	14	18	20	24	30	40	48	72
default_CPP_(no_drop_outs)	6	11.3	11.3			22.0										11.3			44.0	
opt_in_CPP_(no_drop_outs)	11	18.1										9.0		9.0					54.8	9.0

Days

Category	N	0	1	2	3	4	5	6	7	8	10	12	14
default_CPP_(no_drop_outs)	5			60.0	20.0	20.0							
default_CPP_TOU_(no_drop_outs)	10			61.9	38.1								
opt_in_CPP_(no_drop_outs)	44		9.1	68.1	11.3			2.3	6.8				2.4

What is the minimum amount of time that you require for notice of impending Conservation Day? Please specify your answer in either hours or days. Type 0 in the other box.

Hours

Category	N	0	1	2	3	4	5	6	7	8	10	12	14	18	20	24	30	40	48
default_CPP_(no_drop_outs)	7	29.9			19.8											50.3			
default_CPP_TOU_(no_drop_outs)	6	20.5						20.5		8.9		8.9				41.1			
opt_in_CPP_(no_drop_outs)	29	10.2	3.4		3.4	3.4		3.7		6.8		13.7				48.6		3.4	3.4

Days

Category	N	0	1	2	3	4	5	6	7	8	10	12	14	18	20	24	30	40	48	72	100
default_CPP_(no_drop_outs)	17		83.9	8.1													7.9				
default_CPP_TOU_(no_drop_outs)	11		85.8		14.2																
opt_in_CPP_(no_drop_outs)	48	2.1	79.1	10.4			2.1				2.1				2.1						2.1

Q22 - Do you think you saved any money as a result of selecting this rate plan?

1 Yes
2 No
3 Not sure

Category	N	1	2	3
opt_in_CPP_(no_drop_outs)	576	48.1	11.0	40.9
opt_in_TOU_(no_drop_outs)	1017	46.2	14.1	39.8

Q23 - Do you think you saved any money as a result of receiving service under this rate plan?

1 Yes
2 No
3 Not sure

Category	N	1	2	3
default_CPP_(no_drop_outs)	163	27.9	13.3	58.8
default_CPP_TOU_(no_drop_outs)	141	26.7	24.6	48.7
default_TOU_(no_drop_outs)	417	28.5	18.5	53.0

Q25 - Compared to your old rate plan, how would you rate the convenience of this rate plan?

1 A lot more convenient than my old rate plan
2 Somewhat more convenient than my old rate plan
3 About as convenient as my old rate plan
4 Somewhat less convenient than my old rate plan
5 A lot less convenient than my old plan

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	12.1	20.1	44.5	19.1	4.2
default_CPP_TOU_(no_drop_outs)	141	8.8	14.5	50.3	16.6	9.8
default_TOU_(no_drop_outs)	417	8.7	21.4	50.3	12.4	7.1
opt_in_CPP_(no_drop_outs)	576	17.4	26.2	32.8	18.6	5.0
opt_in_TOU_(no_drop_outs)	1017	15.9	30.7	30.6	18.8	4.0

Q27 - As part of the SmartPricing Options Pilot, SMUD provided you with access to a website containing tips and helpful hints for how to save money under your new pricing plan. Do you recall ever looking at this website?

1 Yes
2 No
3 Not sure

Category	N	1	2	3
default_(no_drop_outs)	721	21.1	63.3	15.6
opt_in_(not_deferred)_(no_drop_outs)	1593	41.5	43.4	15.1

Please indicate how much you agree or disagree with the following statements about your pricing plan.

1 Strongly agree
2 Somewhat agree
3 No opinion
4 Somewhat disagree
5 Strongly disagree

I understand why SMUD is offering the pricing plan I am on

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	27.9	39.2	25.0	3.0	4.9
default_CPP_TOU_(no_drop_outs)	141	25.6	36.5	25.8	9.0	3.2
default_TOU_(no_drop_outs)	417	28.1	34.0	26.8	6.9	4.3
opt_in_CPP_(no_drop_outs)	576	50.4	35.1	10.3	3.2	1.0
opt_in_TOU_(no_drop_outs)	1017	45.6	37.4	12.4	3.5	1.0

SMUD should be offering the pricing plan I am on to all of its customers

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	29.3	29.3	38.6	1.1	1.5
default_CPP_TOU_(no_drop_outs)	141	21.1	27.9	47.3	1.8	1.8
default_TOU_(no_drop_outs)	417	25.7	28.0	42.8	1.9	1.7
opt_in_CPP_(no_drop_outs)	576	40.7	30.0	27.1	1.5	0.7
opt_in_TOU_(no_drop_outs)	1017	41.9	30.1	25.5	2.3	0.2

I believe that I did something good for Sacramento by participating in my pricing plan

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	33.2	30.0	31.1	3.0	2.7
default_CPP_TOU_(no_drop_outs)	141	22.6	31.2	40.0	2.5	3.7
default_TOU_(no_drop_outs)	417	22.5	33.1	39.1	3.5	1.8
opt_in_CPP_(no_drop_outs)	576	47.8	34.3	15.5	1.6	0.9
opt_in_TOU_(no_drop_outs)	1017	44.4	33.9	19.8	1.4	0.6

I think the Sacramento community would be better off if everybody was on my pricing plan

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	26.3	25.1	42.4	3.4	2.7
default_CPP_TOU_(no_drop_outs)	141	17.0	25.4	51.8	2.1	3.7
default_TOU_(no_drop_outs)	417	19.5	26.5	46.9	4.3	2.8
opt_in_CPP_(no_drop_outs)	576	36.0	30.9	28.4	4.1	0.5
opt_in_TOU_(no_drop_outs)	1017	33.8	32.1	30.7	2.6	0.8

I remember receiving a Welcome Back kit in the mail this summer from SMUD

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	31.0	19.4	33.4	5.3	11.0
default_CPP_TOU_(no_drop_outs)	141	26.4	24.0	36.4	3.0	10.1
default_TOU_(no_drop_outs)	417	27.0	22.4	31.4	8.6	10.6
opt_in_CPP_(no_drop_outs)	576	58.4	21.1	14.8	3.4	2.3
opt_in_TOU_(no_drop_outs)	1017	55.0	24.2	15.4	3.1	2.2

SMUD answered all my questions about my pricing plan

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	21.7	19.1	46.2	8.3	4.6
default_CPP_TOU_(no_drop_outs)	141	16.3	22.7	49.1	4.4	7.6
default_TOU_(no_drop_outs)	417	14.8	21.0	54.3	4.6	5.2
opt_in_CPP_(no_drop_outs)	576	41.1	26.5	27.2	3.8	1.4
opt_in_TOU_(no_drop_outs)	1017	40.1	26.6	29.9	2.3	1.1

I want to stay on my pricing plan

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	27.1	27.8	39.4	3.0	2.7
default_CPP_TOU_(no_drop_outs)	141	23.4	23.7	43.3	3.7	5.9
default_TOU_(no_drop_outs)	417	23.2	28.2	40.6	5.0	3.0
opt_in_CPP_(no_drop_outs)	576	50.6	25.5	19.3	3.1	1.6
opt_in_TOU_(no_drop_outs)	1017	48.2	26.5	20.1	3.5	1.6

Q32 - Overall, how satisfied are you with your new pricing plan?

1 Very satisfied
2 Somewhat satisfied
3 Somewhat dissatisfied
4 Very dissatisfied

Category	N	1	2	3	4
default_CPP_(no_drop_outs)	163	24.0	63.0	10.6	2.3
default_CPP_TOU_(no_drop_outs)	141	23.5	59.4	12.1	5.0
default_TOU_(no_drop_outs)	417	21.1	63.1	10.8	5.0
opt_in_CPP_(no_drop_outs)	576	40.9	50.9	7.3	0.9
opt_in_TOU_(no_drop_outs)	1017	36.7	52.9	9.1	1.3

Q33 - As a result of participating in the [SSI Script] as part of SMUD's SmartPricing Options Pilot, did you have more control over your household's electricity cost?

1 Yes
2 No

Category	N	1	2
default_CPP_(no_drop_outs)	163	67.4	32.6
default_CPP_TOU_(no_drop_outs)	141	61.6	38.4
default_TOU_(no_drop_outs)	417	62.0	38.0
opt_in_CPP_(no_drop_outs)	576	81.6	18.4
opt_in_TOU_(no_drop_outs)	1017	79.1	20.9

Q34 - Please identify any actions that you or other members of your household may have taken to lower your electricity consumption between 4:00 PM and 7:00 PM?

Turned off lights not in use during the peak period

Category	N	0	1
default_CPP_(no_drop_outs)	163	26.5	73.5
default_CPP_TOU_(no_drop_outs)	141	28.4	71.6
default_TOU_(no_drop_outs)	417	26.8	73.2
opt_in_CPP_(no_drop_outs)	576	19.5	80.5
opt_in_TOU_(no_drop_outs)	1017	18.6	81.4

Turned off office equipment during the peak period

Category	N	0	1
default_CPP_(no_drop_outs)	163	68.3	31.7
default_CPP_TOU_(no_drop_outs)	141	72.1	27.9
default_TOU_(no_drop_outs)	417	68.1	31.9
opt_in_CPP_(no_drop_outs)	576	50.9	49.1
opt_in_TOU_(no_drop_outs)	1017	60.8	39.2

Turned off entertainment systems during the peak period

Category	N	0	1
default_CPP_(no_drop_outs)	163	64.2	35.8
default_CPP_TOU_(no_drop_outs)	141	78.0	22.0
default_TOU_(no_drop_outs)	417	73.3	26.7
opt_in_CPP_(no_drop_outs)	576	56.8	43.2
opt_in_TOU_(no_drop_outs)	1017	67.0	33.0

Increased the temperature of my thermostat during the peak period

Category	N	0	1
default_CPP_(no_drop_outs)	163	$56.6	$43.4
default_CPP_TOU_(no_drop_outs)	141	$64.2	$35.8
default_TOU_(no_drop_outs)	417	$62.5	$37.5
opt_in_CPP_(no_drop_outs)	576	$59.1	$40.9
opt_in_TOU_(no_drop_outs)	1017	$52.6	$47.4

Turned off air conditioning during the peak period

Category	N	0	1
default_CPP_(no_drop_outs)	163	54.2	45.8
default_CPP_TOU_(no_drop_outs)	141	47.1	52.9
default_TOU_(no_drop_outs)	417	54.9	45.1
opt_in_CPP_(no_drop_outs)	576	30.0	70.0
opt_in_TOU_(no_drop_outs)	1017	38.2	61.8

Did laundry off peak

Category	N	0	1
default_CPP_(no_drop_outs)	163	26.5	73.5
default_CPP_TOU_(no_drop_outs)	141	17.4	82.6
default_TOU_(no_drop_outs)	417	23.7	76.3
opt_in_CPP_(no_drop_outs)	576	13.9	86.1
opt_in_TOU_(no_drop_outs)	1017	11.3	88.7

Did dishes off peak

Category	N	0	1
default_CPP_(no_drop_outs)	163	37.9	62.1
default_CPP_TOU_(no_drop_outs)	141	36.4	63.6
default_TOU_(no_drop_outs)	417	41.1	58.9
opt_in_CPP_(no_drop_outs)	576	29.5	70.5
opt_in_TOU_(no_drop_outs)	1017	27.3	72.7

Cooked dinners outside

Category	N	0	1
default_CPP_(no_drop_outs)	163	63.9	36.1
default_CPP_TOU_(no_drop_outs)	141	64.8	35.2
default_TOU_(no_drop_outs)	417	70.3	29.7
opt_in_CPP_(no_drop_outs)	576	64.1	35.9
opt_in_TOU_(no_drop_outs)	1017	66.8	33.2

Changed spa and pool pumping to off-peak hours

Category	N	0	1
default_CPP_(no_drop_outs)	163	91.6	8.4
default_CPP_TOU_(no_drop_outs)	141	84.5	15.5
default_TOU_(no_drop_outs)	417	91.7	8.3
opt_in_CPP_(no_drop_outs)	576	87.3	12.7
opt_in_TOU_(no_drop_outs)	1017	86.4	13.6

None of the above

Category	N	0	1
default_CPP_(no_drop_outs)	163	89.4	10.6
default_CPP_TOU_(no_drop_outs)	141	89.9	10.1
default_TOU_(no_drop_outs)	417	90.2	9.8
opt_in_CPP_(no_drop_outs)	576	97.0	3.0
opt_in_TOU_(no_drop_outs)	1017	97.8	2.2

Q35 - How difficult were these changes to make?

1 Not difficult at all
2 Somewhat difficult
3 Very difficult

Category	N	1	2	3
default_CPP_(no_drop_outs)	149	64.6	33.2	2.1
default_CPP_TOU_(no_drop_outs)	130	59.8	35.6	4.5
default_TOU_(no_drop_outs)	380	66.6	30.9	2.4
opt_in_CPP_(no_drop_outs)	559	66.4	32.0	1.6
opt_in_TOU_(no_drop_outs)	995	63.9	33.7	2.4

Q45 - In the past week, about how often did you look at your Electricity Use Display?

1 More than once a day
2 About once a day
3 2 - 4 times
4 Once
5 Never

Category	N	1	2	3	4	5
default_(no_drop_outs)	129	24.1	17.3	12.1	15.8	30.7
opt_in_(not_deferred)_(no_drop_outs)	548	22.1	18.8	16.2	15.3	27.6

Q47 - Have you made any changes to the way you use electricity in your home based on the information provided by the Electricity Use Display?

1 Yes
2 No
3 Not sure
4 I never got the Electricity Use Display to work

Category	N	1	2	3	4
default_CPP_TOU_received_IHD	47	70.2	8.5	6.4	14.9
default_CPP_received_IHD	49	71.4	16.3	8.2	4.1
default_TOU_received_IHD	92	63.0	18.5	6.5	12.0
default_combined_received_IHD	**188**	**66.5**	**16.0**	**6.9**	**10.6**
opt_in_CPP_received_IHD	386	59.6	10.9	6.2	23.3
opt_in_TOU_received_IHD	507	60.6	12.2	5.3	21.9
opt_in_combined_received_IHD	**893**	**60.1**	**11.6**	**5.7**	**22.5**

Q48 - Based on your experience with the Electricity Use Display, would you recommend to a friend that they get one?

1 Yes
2 No
3 Not sure

Category	N	1	2	3
default_CPP_TOU_received_IHD	47	63.8	14.8	21.2
default_CPP_received_IHD	49	79.5	12.2	8.1
default_TOU_received_IHD	92	65.2	16.3	18.4
default_combined_received_IHD	**188**	**68.5**	**15.0**	**16.4**
opt_in_CPP_received_IHD	386	58.8	16.3	24.8
opt_in_TOU_received_IHD	507	61.5	15.5	22.8
opt_in_combined_received_IHD	**893**	**60.3**	**15.9**	**23.7**

Q50 - Since 2012 you have been receiving electric service under the (insert plan name) as part of SMUD's SmartPricing Options Pilot. Below are some reasons why people say they continue to stay on the (Insert pricing plan). Please tell us how important these reasons are to you in staying on the pricing plan.

1 Very important
2 Somewhat important
3 No opinion
4 Somewhat unimportant
5 Completely unimportant

I like the pricing plan

Category	N	1	2	3	4	5
opt_in_CPP_(not_deferred)_(no_drop_outs)	576	44.9	35.9	16.3	1.9	1.0
opt_in_TOU_(not_deferred)_(no_drop_outs)	1017	44.1	34.0	19.5	1.7	0.7

I didn't know I was able to drop out of the pricing plan

Category	N	1	2	3	4	5
opt_in_CPP_(not_deferred)_(no_drop_outs)	576	12.9	20.4	46.3	7.0	13.4
opt_in_TOU_(not_deferred)_(no_drop_outs)	1017	14.2	21.4	46.0	6.1	12.4

I intended to drop out of the pricing plan, but never got around to it

Category	N	1	2	3	4	5
opt_in_CPP_(not_deferred)_(no_drop_outs)	576	5.6	10.2	51.8	9.0	23.4
opt_in_TOU_(not_deferred)_(no_drop_outs)	1017	4.3	8.4	55.6	8.6	23.1

I don't think I would be any better off on the standard rate

Category	N	1	2	3	4	5
opt_in_CPP_(not_deferred)_(no_drop_outs)	576	23.1	24.8	39.2	4.2	8.7
opt_in_TOU_(not_deferred)_(no_drop_outs)	1017	17.4	24.2	44.0	5.9	8.4

The more I got used to the pricing plan, the more I liked it

Category	N	1	2	3	4	5
opt_in_CPP_(not_deferred)_(no_drop_outs)	576	32.0	31.5	32.8	2.4	1.2
opt_in_TOU_(not_deferred)_(no_drop_outs)	1017	34.5	29.9	31.6	2.1	1.9

Q51 - Since 2012 you were assigned to a new pricing plan called the (insert plan name), as part of SMUD's SmartPricing Options Pilot. Below are some reasons why people say they continue to subscribe to the (insert plan name). Please tell us how important these reasons are to you in staying on the pricing plan.

1 Very important
2 Somewhat important
3 No opinion
4 Somewhat unimportant
5 Completely unimportant

I like the pricing plan SMUD assigned me to

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	24.5	35.0	37.9	1.9	0.8
default_CPP_TOU_(no_drop_outs)	141	26.3	27.8	39.5	2.8	3.7
default_TOU_(no_drop_outs)	417	22.6	34.6	39.0	1.9	1.9

I didn't know I was assigned to the new pricing plan

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	18.2	17.1	52.2	2.3	10.3
default_CPP_TOU_(no_drop_outs)	141	16.8	22.6	50.2	2.2	8.1
default_TOU_(no_drop_outs)	417	16.4	19.4	56.5	2.7	5.1

I didn't know I was able to drop out of the new pricing plan

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	16.7	21.3	52.1	4.2	5.7
default_CPP_TOU_(no_drop_outs)	141	18.2	25.1	43.4	3.0	10.3
default_TOU_(no_drop_outs)	417	20.6	24.8	49.3	1.9	3.4

I assume the default pricing plan SMUD selected for me is best for me

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	24.7	27.8	41.8	1.9	3.8
default_CPP_TOU_(no_drop_outs)	141	21.5	27.7	44.8	1.7	4.4
default_TOU_(no_drop_outs)	417	18.6	32.4	45.0	1.9	2.1

I intended to drop out of the pricing plan, but never got around to it

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	5.3	6.8	61.2	9.5	17.1
default_CPP_TOU_(no_drop_outs)	141	8.3	9.1	64.8	2.2	15.6
default_TOU_(no_drop_outs)	417	5.3	7.9	70.1	7.7	9.0

I'm not sure I would be any better off on the standard rate

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	15.5	29.2	42.3	3.8	9.2
default_CPP_TOU_(no_drop_outs)	141	14.0	23.9	49.9	2.6	9.6
default_TOU_(no_drop_outs)	417	13.1	25.3	53.9	3.8	4.0

The more I got used to the pricing plan, the more I liked it

Category	N	1	2	3	4	5
default_CPP_(no_drop_outs)	163	19.1	26.7	50.8	2.7	0.8
default_CPP_TOU_(no_drop_outs)	141	21.5	19.7	54.4	1.7	2.8
default_TOU_(no_drop_outs)	417	16.6	22.0	56.4	2.0	2.9