Section 7 - COST ESTIMATES

This section contains conceptual and/or provisional cost estimates reflecting the best available information at the time of preparation of the Smart Grid Deployment Plan. These estimates are not intended for use in new requests for funding and are subject to change as new information becomes available.

7 COST[44] ESTIMATES

7.1 INTRODUCTION

As part of its Smart Grid Deployment Plan, SDG&E has developed cost and benefit calculation procedures to identify, quantify, and, where possible, monetize the costs and benefits of its current and planned Smart Grid investments. SDG&E has approached each of the nine program areas described throughout this document from a cost-effectiveness perspective as described in D.10-06-047 in order to determine whether each project's costs are outweighed by its benefits. This analysis is a high priority for SDG&E in developing its Smart Grid deployment roadmap and has been applied to all projects in the Smart Grid Deployment Plan whether required to meet state or federal policy requirements or to support customer choice and preferences. SDG&E will not request authorization for funding of projects not necessary to comply with policy unless the benefits exceed the associated costs or where they are required to effectively communicate with customers.

SDG&E has developed and applied a thorough and comprehensive analysis of its proposed Smart Grid technology and infrastructure investments. As explained in the following section, this analysis is intended to be as accurate as possible, given currently available information. The analysis identified which cost and performance data offer the best approach and gauged the reliability of both cost and performance estimates for each project in SDG&E's nine Smart Grid Deployment Plan program areas. However, as explained in section 7.2.3, an estimate of the cost per customer (or participating customer) has not been provided.

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[44] "Cost" in this Smart Grid Deployment Plan is defined as capital expenditures and operating and maintenance (O&M) expenses. It does not include additional elements of total costs of projects that are included in rates paid by customers.

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Due to the nascent state of much of Smart Grid technology and the fact that actual deployment will be based on future lessons and pilots, these estimates will certainly change over time as SDG&E learns more. Additionally, it is common for competing labor resources, technology complexities, new and changing requirements, and other unforeseen circumstances to increase cost and cause project delay. In order to mitigate schedule delays and cost overruns, SDG&E's project managers leverage a number of best practices, which can aid in developing accurate estimates but, at this stage in the Smart Grid's evolution and industry deployment experience, many are not available for Smart Grid Deployment Plan projects.

To develop cost estimates leveraging best practices, detailed requirements are developed, prototypes are implemented, contingency is added to cover new and unanticipated changes based on the complexity and size of the project, lessons learned from previous project implementations are accounted for, proposals are requested from experienced integrators that are asked to commit to fixed prices, project materials are forecasted based on market prices, and experienced employees are assigned or hired to resource the project. Smart Grid projects are currently unable to leverage many of these practices, but will as they mature over time.

As the CPUC noted in D.10-06-047[45], these estimates are preliminary and conceptual. SDG&E will file supporting applications when sufficiently precise estimates are available and will revise the deployment roadmap as requirements and technology capabilities evolve.

As described in the Deployment Baseline, SDG&E has been pursuing Smart Grid solutions for several years and the CPUC has already authorized a substantial portion of the costs reflected in SDG&E's Smart Grid Deployment Plan. Those costs are included for

[45] D.10-06-047 at p.69

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the 2006 – 2020 time period and do not apply the provisional range factors described in section 7.2.2.

In addition to previously authorized expenditures, this plan includes proposed investments that have been previously filed with the CPUC in SDG&E's Test Year 2012 (TY2012) General Rate Case[46] (GRC), or in separate applications (such as Smart Grid-related Demand Response[47] and Dynamic Pricing[48] programs). These estimates do not apply the provisional range factors described in section 7.2.2.

Projected costs incremental to these two groups are also estimated and summarized below according to their regulatory jurisdiction, CPUC or FERC.

The total estimated costs of Smart Grid deployments for the years 2006 – 2020 described in this plan are approximately $3.5 to $3.6 billion, broken down as follows:

[46] A.10-12-005, information available at http://www.sdge.com/regulatory/A10-12-005.shtml
[47] A.11-03-002, information available at http://www.sdge.com/regulatory/A11-03-002.shtml
[48] A.10-07-009, information available at http://www.sdge.com/regulatory/A10-07-009.shtml

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Table 7-1: Smart Grid Deployments Total Estimated Costs 2006-2020

Previously authorized investments[49] (Smart Meter, OpEx 20/20 Smart Grid projects)	$1,042 MM
2012 Test Year General Rate Case[50]	$1,424 MM
Other active applications (Demand Response[51], Dynamic Pricing[52])	$237 MM
Estimated incremental investments – CPUC	$299 MM - $364 MM
Estimated incremental investments – FERC	$466 MM - $555 MM

7.2 APPROACH

In order to determine the overall business value of its Smart Grid Deployment Plan, SDG&E embarked on an extensive initiative to forecast and compile both the projected costs and benefits for the various projects that support Smart Grid. As part of this exercise, SDG&E examined the costs of projects and programs that provide Smart Grid functionality which are already underway or expected to begin prior to 2020.

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[49] Costs for previously authorized investments have been forecast beyond the period reflected in SDG&E's TY2012 General Rate Case (A.10-12-005).
[50] Costs for projects in the TY2012 General Rate Case (A.10-12-005) have been forecast beyond the period reflected in the application.
[51] Only the Smart Grid related costs for the Demand Response (A.11-03-002) program are included and have been forecast beyond the period reflected in the application.
[52] Ongoing costs for the Dynamic Pricing Program application (A.10-07-009) have been forecast beyond the period reflected in the application.

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7.2.1 PROJECT CLASSIFICATIONS

The cost compilation exercise involved examining the costs at the individual project level to ensure that a best cost estimate was collected. As discussed in its Smart Grid Strategy, projects were grouped into one of three classifications:

- Policy[53] – projects which serve to meet a specific regulatory mandate or policy; the driver for the project solution is the solution that is the least-cost/best-fit;
- Value – projects that are expected to provide overall benefits (e.g. reliability, economic, societal) to the utility and/or customer, including effective communications with customers, that justify the project investment; or
- Pilot – projects meant to explore new technologies or serve as a proof of concept or preliminary test case prior to the full deployment of a larger program.

7.2.2 CONCEPTUAL AND PROVISIONAL ESTIMATES

While SDG&E made every effort to ensure the validity of the costs, the final compiled figures are meant strictly to be used for informational purposes, and, consistent with D.10-06-047[54], are shown using conceptual estimates for the years 2011-2015 and provisional ranges for 2016-2020.

The project costs were collected from one or more sources, where both the labor and non-labor components of each project were examined to conduct estimates of capital expenditures and operations and maintenance (O&M) expenses.

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[53] In this Smart Grid Deployment Plan, SDG&E categorizes investments as either necessary to achieve state and federal policy objectives or as warranted by the value the investment would create for customers. The term "Policy" as used in this Smart Grid Deployment Plan is distinct and distinguishable from the concept of "policy-driven" investments as used by FERC-jurisdictional transmission operators such as the CAISO; as used herein, the term "Policy" includes investments necessary to ensure reliability and safety as well as other investments necessary to comply with SDG&E's obligation to serve, regulatory compact with the state of California and ratepayers, and other federal and state-imposed utility obligations.

[54] D.10-06-047 at p.69

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- Costs for in-flight projects or those scheduled to begin in 2011 were sourced from actual costs to-date (where available) or estimated costs submitted in prior GRC or application filings.
- Costs for projects in SDG&E's TY2012 GRC filing or other active applications were sourced from those filings.

For projects expected to extend beyond the TY2012 GRC filing period; estimates were made to determine the costs through the year 2020, for the 2011-2015 'conceptual' timeframe and the 2016-2020 'provisional' timeframe.

Depending on the nature of the project scope, schedule, and technology maturity; individual projects may have a project-level contingency factor applied, consistent in the Smart Grid Deployment Plan with assumptions made by the engineers and project managers developing those initiatives.

In order to account for the increasing level of uncertainty around project costs further out in time, additional factors were applied to project a provisional range of costs for the years 2016 - 2020. Because funding for projects previously authorized and proposed through the GRC and other applications are limited to prior years, these projects do not apply the provisional range factors – they apply only to incremental projects. These provisional range factors (as a percentage of the base forecasted cost) reflect what are believed to be a reasonable range above (+) and below (-) the estimated cost projections.

SDG&E has presented provisional ranges for 2016 – 2020 where costs could be 25 percent higher than the base case or 25 percent lower. This is due to several reasons, including the following:

1. Forecasted projects costs may include technologies that have yet to be developed and/or do not have an established cost;

2. Costs are a snapshot in time based on data available at the time of estimation and are subject to change due to unpredictable external factors (e.g. rate of inflation, health of economy, rate of technology progression); and

3. The level of uncertainty around future costs increases as a function of time; therefore, the further out the cost forecast, the higher the degree of inaccuracy.

Table 7-2 summarizes the provisional range factors used to determine the cost estimates in SDG&E's Smart Grid Deployment Plan.

Table 7-2: Summary of Provisional Range Factors

Provisional Range	Provisional Range Factors Costs 2016-2020
High	+25%
Low	-25%

7.2.3 COSTS PER CUSTOMER

Note: SDG&E investigated calculating costs per customer, but ultimately determined that this metric would be misleading so did not calculate or provide this assessment. This decision is based on a few key reasons:

1. The impacted customer base for each project varies depending on project scope. For example, the impacted user base for pilots can potentially be significantly smaller than that for projects affecting SDG&E's entire customer base. This precludes consistent comparison of cost per customer across projects if actual impacted customer count is used.

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2. For certain projects, the correct customer count to be used when calculating the cost per customer is not clear. For example, in the case of pilot projects, the actual customer count involved in the project may be disproportionately small compared to that of the full program. But to use the full customer base could be misleading since the pilot cost is smaller than the full program cost.
3. The cost per customer metric for certain projects may mask the fact that there may be substantial economies of scope or scale that can be obtained if the project is either expanded to a larger customer footprint or if other project/programs can leverage the current project (e.g. subsequent projects build off infrastructure established in current project)
4. As the Smart Grid platform evolves, alternative rate structures and other price signals are expected to emerge that will more accurately reflect the costs to provide utility services and avoid cross-subsidization. Thus, the costs for some future investments may not be borne by all customers, and projecting these costs as impacting all customers may be inaccurate and potentially misleading.

7.3 COST ESTIMATES BY PROGRAM

Provided below is a summary of the Smart Grid Deployment Plan program costs, within each project classification. As a reminder, all cost estimates are nominal, reflect the best information available at this time and are not intended for use in new requests for funding. Please note subtotals in tables in section 7.3 may differ due to rounding.

All estimates are subject to change as new information becomes available.

7.3.1 CUSTOMER EMPOWERMENT

As discussed in the Roadmap, SDG&E's Customer Empowerment program will insure customers have the information and capabilities that they need in order to make energy management decisions that meet their values, needs and desires.

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The primary drivers of costs in the Customer Empowerment program, grouped by their classification are:

- Policy: The infrastructure required to deliver energy information and dynamic pricing signals to customers via HAN and other customer premise technologies; the technology needed to provide access to energy usage data via third-party information service providers; and customer outreach and education programs that will enable customers to maximize the value they realize from these capabilities.
- Value: Smart Meters and Smart Grid-related demand response programs.
- Pilot: Research, development and demonstration of customer end-use technologies; integration of distributed energy resources in a new residential community.

Customer Empowerment projects have significant state policy drivers, including SDG&E's AMI Settlement (D.07-04-043), D.09-12-046, SB 17, the *California Long Term Energy Efficiency Strategic Plan* and achievement of the energy efficiency and demand response goals per §454.5 and §454.55 of the California Public Utilities Code.

The conceptual and provisional cost estimates for SDG&E's Customer Empowerment program are as follows:

Table 7-3: Customer Empowerment Program Conceptual and Provisional Cost Estimates

	Capital				O&M				Total Estimated Capital + O&M	
	Historical	Conceptual Estimates	Provisional Ranges 2016-2020		Historical	Conceptual Estimates	Provisional Ranges 2016-2020			
Project Class	**2006-2010**	**2011-2015**	**Low**	**High**	**2006-2010**	**2011-2015**	**Low**	**High**	**Low Range**	**High Range**
Policy	($2,676)	($83,836)	($10,481)	($10,481)	($1,700)	($100,215)	($131,912)	($131,912)	($330,819)	($330,819)
Value	($320,368)	($184,775)	($55,493)	($55,493)	($48,202)	($156,265)	($132,303)	($132,303)	($897,407)	($897,407)
Pilot	$0	($24,254)	$0	$0	$0	($8,169)	($6,789)	($11,315)	($39,212)	($43,739)
Subtotal	($323,044)	($292,865)	($65,974)	($65,974)	($49,902)	($264,650)	($271,004)	($275,530)	($1,267,439)	($1,271,965)

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For the corresponding benefits of the Customer Empowerment program, please see the Benefits Estimates section.

7.3.2 RENEWABLE GROWTH

SDG&E customers continue to install significant numbers of photovoltaic electric generation installations at residential and non-residential premises. To support distribution-level renewable generation, SDG&E plans investments that increase measurement, control and management capabilities.

Renewable Growth projects are largely driven by state policy requirements, particularly the California Solar Initiative, Self Generation Incentive Program (SGIP), Feed-in Tariffs[55], and Net Energy Metering[56].

The primary drivers of costs in the Renewable Growth program, grouped by their classification are:

- Policy: Installation of phasor measurement units in substations and on distribution lines, sensors on distribution lines to develop dynamic conductor ratings, advanced energy storage, and expansion of SDG&E's SCADA system to include all distribution circuits and to install SCADA controls of distribution line capacitors.
- Pilot: Provide customers the opportunity to participate in a community solar program.

Renewable Growth projects have significant state policy drivers, including SB 17, the *Global Warming Solutions Act of 2006* (AB 32), the *California Long Term Energy*

[55] Summary available at http://www.cpuc.ca.gov/PUC/energy/Renewables/feedintariffssum.htm
[56] http://www.cpuc.ca.gov/PUC/energy/DistGen/netmetering.htm

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Efficiency Strategic Plan and full solar photovoltaic deployment under the California Solar Initiative.

The conceptual and provisional cost estimates for SDG&E's Renewable Growth program are as follows:

Table 7-4: Renewable Growth Program Conceptual and Provisional Cost Estimates

	Capital				O&M				Total Estimated Capital + O&M	
	Historical	Conceptual Estimates	Provisional Ranges 2016-2020		Historical	Conceptual Estimates	Provisional Ranges 2016-2020			
Project Class	**2006-2010**	**2011-2015**	**Low**	**High**	**2006-2010**	**2011-2015**	**Low**	**High**	**Low Range**	**High Range**
Policy	$0	($350,440)	($244,877)	($244,877)	$0	($31,878)	($33,101)	($33,101)	($660,297)	($660,297)
Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Pilot	$0	$0	$0	$0	$0	($3,036)	($2,094)	($3,489)	($5,130)	($6,525)
Subtotal	$0	($350,440)	($244,877)	($244,877)	$0	($34,914)	($35,195)	($36,591)	($665,426)	($666,822)

While the Renewable Growth projects are primarily driven by state policy requirements, there are significant benefits associated with the successful integration of renewable resources. Please refer to the Benefits Estimates section for a discussion on the societal and environmental benefits of renewable resources and details on the economic and reliability benefits associated with the Renewable Growth program.

7.3.3 ELECTRIC VEHICLE GROWTH

As discussed in the Roadmap, SDG&E is preparing for the growth in public adoption of Plug-in Electric Vehicles. In anticipation of this growth, SDG&E plans investments that will help promote the adoption of electric vehicles, educate the public on their usage with regard to the electric grid, and assist third parties involved with the electric vehicle ecosystem to ensure successful integrate of electric vehicles within the grid.

The policy drivers of the Electric Vehicle Growth program are the *Global Warming Solutions Act of 2006* (AB 32), California's Low Carbon Fuel Standard, and SB 17.

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The primary drivers of costs in the Electric Vehicle Growth program, grouped by their classification are:

- Policy: Installation of utility-owned public access charging facilities, installation of sensors and communication technology on distribution transformers and upgrades to the electric distribution system (i.e.: to primary distribution feeders) to accommodate PEVs.
- Pilot: Test the integration of stationary batteries with PEV charging as a step toward vehicle to grid (V2G) capabilities.

The conceptual and provisional cost estimates for SDG&E's Electric Vehicle Growth program are as follows:

Table 7-5: Electric Vehicle Growth Program Conceptual and Provisional Cost Estimates

	Capital				O&M					
	Historical	Conceptual Estimates	Provisional Ranges 2016-2020		Historical	Conceptual Estimates	Provisional Ranges 2016-2020		Total Estimated Capital + O&M	
Project Class	**2006-2010**	**2011-2015**	**Low**	**High**	**2006-2010**	**2011-2015**	**Low**	**High**	**Low Range**	**High Range**
Policy	$0	($84,260)	($35,675)	($35,675)	$0	($19,293)	($32,419)	($32,419)	($171,646)	($171,646)
Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Pilot	$0	($6,740)	($3,744)	($6,241)	$0	($936)	($1,191)	($1,985)	($12,611)	($15,901)
Subtotal	$0	($91,000)	($39,419)	($41,916)	$0	($20,228)	($33,610)	($34,404)	($184,257)	($187,547)

While the Electric Vehicle Growth projects are primarily driven by state policy requirements, there are significant benefits associated with the successful integration of PEVs. Please refer to the Benefits Estimates section for a discussion on the societal and environmental benefits of PEVs, and details on the economic and reliability benefits associated with the Electric Vehicle Growth program.

7.3.4 RELIABILITY AND SAFETY

As discussed in the Roadmap, SDG&E's goal is to maintain and/or improve reliability in the face of intermittent resources and electric vehicles through improving its

measurement, control, protection, recording, and management and optimization abilities. Investments into the aforementioned abilities will supplement the existing technology investments made to improve the accuracy and speed of fault isolation and system restoration time.

Reliability and safety projects have significant state policy drivers, including SB 17, the *California Long Term Energy Efficiency Strategic Plan*, achievement of the energy efficiency and demand response goals per §454.5 and §454.55 of the *California Public Utilities Code*, achievement of the renewable portfolio standard and full solar photovoltaic deployment under the California Solar Initiative.

The primary drivers of costs in the Reliability and Safety program, grouped by their classification are:

- Policy: Implement advanced ground fault detection capabilities and advanced system planning tools, install pulse closing at additional points on the system as well as dynamic volt and VAR control capabilities, advanced energy storage to improve the localized reliability of the transmission system, conduct a renewable transmission planning study and convert manual line switches to remote SCADA operations.
- Value: Optimize advanced weather monitoring capabilities, implement wireless faulted circuit indicators, expand condition based maintenance (CBM) capabilities to selected 4 kV substation transformer banks, develop automated fault location for transmission events, implement a real-time voltage stability program and develop a plan for the deployment of synchrophasor units integrating with Western Electricity Coordinating Council (WECC).
- Pilot: Develop a capability for arc detection in 230 kV underground vaults and overhead facilities and demonstrate composite core conductor installations.

The conceptual and provisional cost estimates for SDG&E's Reliability and Safety program are as follows:

Table 7-6: Reliability and Safety Program Conceptual and Provisional Cost Estimates

	Capital				O&M				Total Estimated Capital + O&M	
	Historical	Conceptual Estimates	Provisional Ranges 2016-2020		Historical	Conceptual Estimates	Provisional Ranges 2016-2020			
Project Class	**2006-2010**	**2011-2015**	**Low**	**High**	**2006-2010**	**2011-2015**	**Low**	**High**	**Low Range**	**High Range**
Policy	($3)	($315,878)	($129,411)	($215,684)	$0	($1,071)	$0	$0	($446,363)	($532,637)
Value	($625)	($51,608)	($9,275)	($15,039)	$0	($7,591)	($11,296)	($11,296)	($80,395)	($86,158)
Pilot	$0	($7,235)	$0	$0	$0	$0	$0	$0	($7,235)	($7,235)
Subtotal	($628)	($374,722)	($138,686)	($230,723)	$0	($8,662)	($11,296)	($11,296)	($533,994)	($626,031)

For the corresponding benefits of the Reliability and Safety program, please see the Benefits Estimates section.

7.3.5 SECURITY

As discussed in the Roadmap, the core tenets of SDG&E's security strategy are: adhere to security principles, broaden awareness, converge security governance and distribute security controls. SDG&E plans to support these tenets by investing into a portfolio of security projects.

The policy drivers of the Security program include SB 17 and the NERC Critical Infrastructure Protection (CIP) standards.

The primary drivers of costs in the Security program, grouped by their classification are:

- Policy: Select and implement a replacement to the current security incident and event management environment, improve the physical access controls and network monitoring of alarm systems at substations, improve internal and external security awareness collaboration and training, improve reporting of compliance metrics and risk reporting, improve the compliance control framework, improve security threat and vulnerability management, implement

hardware and software solutions for improved vulnerability assessment and management, and develop SDG&E standards and guidelines for improving the security of SCADA technology.

The conceptual and provisional cost estimates for SDG&E's Security program are as follows:

Table 7-7: Security Program Conceptual and Provisional Cost Estimates

	Capital				O&M				Total Estimated Capital + O&M	
	Historical	Conceptual Estimates	Provisional Ranges 2016-2020		Historical	Conceptual Estimates	Provisional Ranges 2016-2020			
Project Class	**2006-2010**	**2011-2015**	**Low**	**High**	**2006-2010**	**2011-2015**	**Low**	**High**	**Low Range**	**High Range**
Policy	($1,789)	($118,179)	($10,518)	($10,518)	$0	($15,005)	($35,853)	($35,853)	($181,344)	($181,344)
Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Pilot	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	($1,789)	($118,179)	($10,518)	($10,518)	$0	($15,005)	($35,853)	($35,853)	($181,344)	($181,344)

For the corresponding benefits of the Security program, please see the Benefits Estimates section.

7.3.6 OPERATIONAL EFFICIENCY

As discussed in the Roadmap, SDG&E has designed an Operational Efficiency program to improve its ability to monitor, operate and optimize its system. To advance the overall efficiency of its grid operations, SDG&E will invest in numerous projects in its Operational Efficiency program.

The Operational Efficiency program is driven by customer value, rather than policy.

The primary drivers of costs in the Operational Efficiency program, grouped by their classification are:

- Value: Implement micropile technology, 3D modeling using state-of-the-art technology (PLS CADD/LIDAR), a distributed energy resource management

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system (DERMS), condition based maintenance (CBM), infrared inspection technology at the distribution level, an enterprise geographic information system (GIS), outage management system / distribution management system (OMS/DMS), and implement an automated facilities rating system.

- Pilot: Evaluate 'Fire Scout' arc detection capabilities in back-country areas, develop criteria for appropriate applications of dynamic line ratings on the transmission system and begin a pilot program with the CAISO to use dynamic transmission line ratings in dispatch.

The conceptual and provisional cost estimates for SDG&E's Operational Efficiency program are as follows:

Table 7-8: Operational Efficiency Conceptual and Provisional Cost Estimates

	Capital				O&M				Total Estimated Capital + O&M	
	Historical	Conceptual Estimates	Provisional Ranges 2016-2020		Historical	Conceptual Estimates	Provisional Ranges 2016-2020			
Project Class	**2006-2010**	**2011-2015**	**Low**	**High**	**2006-2010**	**2011-2015**	**Low**	**High**	**Low Range**	**High Range**
Policy	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Value	($84,313)	($183,156)	($24,337)	($39,635)	($20,076)	($38,835)	($28,874)	($33,648)	($379,592)	($399,664)
Pilot	$0	($653)	$0	$0	$0	($0)	$0	$0	($653)	($653)
Subtotal	($84,313)	($183,809)	($24,337)	($39,635)	($20,076)	($38,835)	($28,874)	($33,648)	($380,245)	($400,317)

For the corresponding benefits of the Operational Efficiency program, please see the Benefits Estimates section.

7.3.7 SMART GRID RESEARCH, DEVELOPMENT, AND DEMONSTRATION

As discussed in the Roadmap, many of the Smart Grid technologies are still the nascent stages of development, or are only concepts. SDG&E plans to promote the development and realization of such technologies by investing in projects to research and pilot these technologies.

This section contains conceptual and/or provisional cost estimates reflecting the best available information at the time of preparation of the Smart Grid Deployment Plan. These estimates are not intended for use in new requests for funding and are subject to change as new information becomes available.

The primary drivers of costs in the Smart Grid Research, Development, and Demonstration program, grouped by their classification are:

- Pilot: Install a demonstration microgrid project, construct facility upgrades, purchase and install equipment to create a Smart Grid integrated test facility, work with the CAISO to aggregate battery technology in a flexible demand pilot and conduct other Smart Grid related RD&D projects.

The conceptual and provisional cost estimates for SDG&E's Research, Development, and Demonstration program are as follows:

Table 7-9: Research, Development and Demonstration Program Conceptual and Provisional Cost Estimates

	Capital				O&M				Total Estimated Capital + O&M	
	Historical	Conceptual Estimates	Provisional Ranges 2016-2020		Historical	Conceptual Estimates	Provisional Ranges 2016-2020			
Project Class	**2006-2010**	**2011-2015**	**Low**	**High**	**2006-2010**	**2011-2015**	**Low**	**High**	**Low Range**	**High Range**
Policy	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Pilot	($2,749)	($62,631)	$0	$0	($1,680)	($20,145)	($30,691)	($30,691)	($117,896)	($117,896)
Subtotal	($2,749)	($62,631)	$0	$0	($1,680)	($20,145)	($30,691)	($30,691)	($117,896)	($117,896)

For the corresponding benefits of the Smart Grid Research, Development, and Demonstration program, please see the Benefits section.

7.3.8 INTEGRATED AND CROSS-CUTTING SYSTEMS

As discussed in the Roadmap, SDG&E recognizes the need to develop a robust enterprise-wide application platform to support its Smart Grid applications. This platform will enable new systems to co-exist with legacy systems as well as support the adoption and integration of increasingly complex data management and analytics as

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well as grid communications. To create this application platform, SDG&E will invest in numerous projects to advance its application and communications infrastructure.

The Integrated and Cross-cutting Systems program includes projects required to support a variety of policy-driven projects. Projects in this program area will provide infrastructure and application services to other systems that are required to implement policies such as the Renewable Portfolio Standard, and the California Solar Initiative.

The primary drivers of costs in the Integrated and Cross-cutting Systems program, grouped by their classification are:

- Policy: Deploy a precision time system and a next-generation application platform.
- Value: Build out a low-power wireless communication network, implement an improved data management and analytics capability commensurate with Smart Grid applications and deploy a next generation wireless communication network.

The conceptual and provisional cost estimates for SDG&E's Integrated and Cross-cutting Systems program are as follows:

Table 7-10: Integrated and Cross-cutting Systems Program Conceptual and Provisional Cost Estimates

	Capital				O&M				Total Estimated Capital + O&M	
	Historical	Conceptual Estimates	Provisional Ranges 2016-2020		Historical	Conceptual Estimates	Provisional Ranges 2016-2020			
Project Class	**2006-2010**	**2011-2015**	**Low**	**High**	**2006-2010**	**2011-2015**	**Low**	**High**	**Low Range**	**High Range**
Policy	$0	($9,521)	($14,076)	($23,460)	$0	$0	($855)	($1,424)	($24,452)	($34,405)
Value	($7,874)	($48,990)	($20,201)	($33,668)	$0	($8,193)	($15,451)	($20,848)	($100,707)	($119,572)
Pilot	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	($7,874)	($58,511)	($34,276)	($57,127)	$0	($8,193)	($16,305)	($22,273)	($125,159)	($153,977)

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Costs shown in the Integrated and Cross-cutting Systems program are net of a $28.1 million Smart Grid Investment Grant from the DOE[57] , and a $1 million PIER grant from the CEC[58] . For the corresponding benefits of the Integrated and Cross-cutting Systems program, please see the Benefits Estimates section.

7.3.9 WORKFORCE DEVELOPMENT

As discussed in the Roadmap, a key element in the success of the SDG&E Smart Grid Deployment Plan resides in the education and adoption of the program within its current and future workforce. SDG&E plans on investing in numerous human resource projects that will help deploy organizational structures as well as tools that maximize the utility's ability to manage and support the overall Smart Grid program.

State energy policies do not require utilities to have a Smart Grid Workforce Development program. However, to achieve state policy goals requires the implementation and maintenance of a complex integration of information and energy technologies, requiring a workforce with skills in these evolving areas. As Workforce Development projects are designed to meet that requirement, SDG&E has therefore classified them as "Policy."

The primary drivers of costs in the Workforce Development program, grouped by their classification are:

- Policy: Implement Smart Grid workforce management and improved organizational change management programs.

The conceptual and provisional cost estimates for SDG&E's Workforce Development program are as follows:

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[57] http://www.oe.energy.gov/recovery/1249.htm
[58] http://www.energy.ca.gov/contracts/PON-08-011_FOA_NOPA.PDF

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Table 7-11: Workforce Development Program Conceptual and Provisional Cost Estimates

	Capital				O&M				Total Estimated Capital + O&M	
	Historical	Conceptual Estimates	Provisional Ranges 2016-2020		Historical	Conceptual Estimates	Provisional Ranges 2016-2020			
Project Class	**2006-2010**	**2011-2015**	**Low**	**High**	**2006-2010**	**2011-2015**	**Low**	**High**	**Low Range**	**High Range**
Policy	$0	$0	$0	$0	$0	($5,991)	($5,755)	($9,591)	($11,746)	($15,582)
Value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Pilot	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$0	$0	$0	$0	$0	($5,991)	($5,755)	($9,591)	($11,746)	($15,582)

For the corresponding benefits of the Workforce Development program, please see the Benefits Estimates section.

7.4 CONCLUSION

SDG&E's Smart Grid Deployment Plan Cost Estimates are based on an assessment of historical, conceptual and provisional estimates and broken out by policy, customer value and/or pilot driven expenses for all of the planned projects in each deployment program area. The project costs include estimates of capital expenditures and operations and maintenance (O&M) expenses for the periods from 2011-2015 and 2016-2020 with a total estimated cost of approximately $3.5 - $3.6 billion. Corresponding benefits were also calculated and are presented in the Benefits Estimates section of the deployment plan.

This section contains conceptual and/or provisional cost estimates reflecting the best available information at the time of preparation of the Smart Grid Deployment Plan. These estimates are not intended for use in new requests for funding and are subject to change as new information becomes available.