Company: San Diego Gas & Electric Company (U 902 M)
Proceeding: 2019 General Rate Case
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Exhibit: SDG&E-14-R

REVISED

SDG&E

DIRECT TESTIMONY OF ALAN F. COLTON

(ELECTRIC DISTRIBUTION CAPITAL)

DECEMBER 2017

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

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APPENDICES

SUMMARY

Capital	2017 ($000)	2018 ($000)	2019 ($000)
	445,116	589,811	702,749

SUMMARY OF REQUESTS

San Diego Gas & Electric Company (SDG&E) is requesting the California Public Utilities Commission (CPUC or Commission) adopt our Test Year 2019 (TY 2019) general rate case (GRC) forecast of $702,590 for Electric Distribution Capital. SDG&E is also requesting the Commission adopt our forecast for capital expenditures in 2017 and 2018 of $445,116 and $589,811, respectively.

My testimony also breaks out the costs associated with Risk Assessment Mitigation Phase (RAMP) Driven Projects that increase safety by reducing risk exposure. While risk mitigation has long been ingrained in SDG&E's core business activities, this GRC is the first in which SDG&E has broken out its costs in support of mitigation activities addressing SDG&E's top safety risks. My testimony also describes SDG&E's deep-rooted safety culture and commitment to reduce risk exposure through capital upgrades.

In addition, my testimony identifies work requirements necessary to maintain clean, safe, and reliable operation of the electric distribution system. Funding requirements for these new or more extensive work elements are forecasted based on historical spending plus incremental expense requirements as appropriate. Roughly 75% of the forecasts for Electric Distribution Capital are derived from a zero-based methodology, and 25% are based on averages (predominantly a five-year average). Zero-based cost estimates or forecasts were used for a large portion of the capital electric distribution projects since they are specific projects that are non-recurring in nature.

SDG&E DIRECT TESTIMONY OF ALAN COLTON
(ELECTRIC DISTRIBUTION CAPITAL)

I. INTRODUCTION

A. Organization of Testimony

My testimony describes estimated 2017-2019 capital expenditures for SDG&E's Electric Distribution capital utility plant and demonstrates why these expenditures are necessary and reasonable. Section I of my testimony provides a brief introduction and summarizes the overall capital electric distribution forecast. Section II describes the risk assessment mitigation phase and safety culture. Section III explains SDG&E's project evaluation and prioritization process. Section IV describes the details of plant additions, shows a summary of the requested costs by category, describes the details of the major capital budget categories for electric distribution, provides an explanation of changes affecting each category of work, and then further details the requested costs by category and individual budget code. Section V describes IT projects sponsored by Electric Distribution, Section VI concludes my testimony, and Section VII describes my witness qualifications.

Appendix A and Appendix B contain tables listing the capital budget codes described in the following sections by sequential budget number overall, as well as by sequential budget number within each category respectively. For reference purposes, Appendix C contains a list of individual capital projects corresponding to RAMP risks identified in Table AFC-3 later in this testimony, Appendix D contains a Glossary of Acronyms, Appendix E contains a construction unit forecast, and Appendix F contains a fire and weather zone map.

B. Summary of Electric Distribution Capital Costs and Activities

My testimony supports SDG&E's TY 2019 forecasts of Electric Distribution Capital costs for the forecast years 2017, 2018, and 2019, and demonstrates why these expenditures are necessary and reasonable. Table AFC-1 summarizes my sponsored costs.

TABLE AFC-1
TY 2019 Summary of Total Costs

Capital	2017 ($000)	2018 ($000)	2019 ($000)
	445,116	589,811	702,749

Electric Distribution Capital projects described in my testimony are intended to maintain the delivery of safe and reliable service to our customers. SDG&E prioritizes our work to

comply with applicable laws and regulations, and to provide system integrity and reliability in accordance with our commitment to safety. SDG&E's longstanding commitment to safety focuses on three primary areas – public safety, customer safety, and employee safety. This safety-first culture is embedded in the manner in which we carry out our work and build our systems – from initial employee training to the installation, operation, and maintenance of our utility infrastructure, and to our commitment to provide safe and reliable service to our customers.

My testimony demonstrates SDG&E's need for this portfolio of projects through individual descriptions and analysis of each project's business justification, need and support related to the safety and reliability for our customers, employees and communities. My testimony addresses the forecasted costs associated with the capital electric distribution work SDG&E deems necessary to provide safe, reliable, and high-quality service to our customers. The capital electric distribution costs are broken down into 11 primary cost categories:

- Capacity/Expansion
- Equipment/Tools/Miscellaneous
- Franchise
- Mandated
- Materials
- New Business
- Overhead Pools
- Reliability/Improvements
- Safety & Risk Management
- Distributed Energy Resource Integration
- Transmission/Federal Energy Regulatory Commission (FERC) Driven Projects

Of the 11 capital project categories, there are four categories that make up the majority (69%) of the overall forecast. The four major categories are Safety & Risk Management (22%), OH Pools (21%), Reliability (16%) and New Business (10%). Figure 1 shows each category by the percentage of the overall forecast. Each specific work category is described in greater detail in my testimony under headings corresponding to these categories.

Figure 1
2017 - 2019 Capital Forecast by Percentage of Overall Forecast

Category	3 Year Total
Safety/Risk	22%
OH Pools	21%
Reliability	16%
New Business	10%
FERC Driven	8%
Franchise	6%
Mandated	6%
Materials	5%
Capacity	3%
DER	2%
Tools	1%

In preparing our projections for TY 2019 requirements, SDG&E analyzed historical 2011 to 2016 spending levels, considered underlying cost drivers and developed an assessment of future requirements. Forecast methodologies were selected based on future expectations for the underlying cost drivers, and include:

- Forecasts based on historical averages;
- Forecasts based on the BY 2016 adjusted recorded spending; and
- Forecasts based on zero-based cost estimates for specific projects.

In addition, my testimony identifies work requirements incremental to levels of historical spending and necessary to maintain the safe and reliable operation of the distribution system. Funding requirements for these new or more extensive work elements are forecasted based on historical spending plus incremental expense requirements. Roughly 75% of the forecasts for Electric Distribution Capital are zero-based and 25% are based on averages (predominantly a five-year average). Since a large portion of the capital electric distribution projects are specific projects that are non-recurring in nature, zero-based cost estimates or forecasts were used. My testimony is then summarized in a brief conclusion.

II. RISK ASSESSMENT MITIGATION PHASE AND SAFETY CULTURE

A. Risk Assessment Mitigation Phase

SDG&E has identified risk-mitigation projects to prioritize key safety risk projects, in its November 30, 2016, RAMP Report. Identifying risks and mitigation efforts and assigning roles and responsibilities to address those issues are key characteristics of SDG&E's safety culture. Within my funding request are costs associated with risk-mitigation efforts identified in the utility-submitted RAMP Report.[1] The Risk Management testimony chapters of Diana Day and Jamie York (Exhibit SCG-02/SDG&E-02, Chapters 1 and 3, respectively), describe how SDG&E translated the costs of risk-mitigation projects and programs from the RAMP Report into the individual witness areas.

The specific risks which my requested funds address are summarized in Table AFC-2:

TABLE AFC-2

RAMP Risk	Description
SDG&E-1 Wildfires Caused by SDG&E Equipment	This is the risk of wildfires caused by SDG&E equipment, including third-party pole attachments.
SDG&E-3 Employee, Contractor and Public Safety	This is the risk of non-adherence to safety programs, policies and procedures, which may result in severe harm to employees, contractors and the general public.
SDG&E-4 Distributed Energy Resources (DERs)	This is the risk of safety and reliability events due to the high penetration of distributed energy resources (DERs) on SDG&E's system
SDG&E-8 Aviation Incident	This is risk of an aviation event by SDG&E contractors, subcontractors or other third parties who may enter SDG&E's service territory that results in damages to electric transmission, distribution and/or gas transmission facilities.
SDG&E-12 Electric Infrastructure Integrity	This risk addresses the occurrence of a safety, environmental, or reliability incident due to electric equipment failure.

These risks are addressed by the capital investments requested for electrical distribution. By way of example, many projects are focused on increasing safety by reducing wildfire risk via

[1] I.16-10-015/I.16-10-016 Risk Assessment and Mitigation Phase Report of San Diego Gas & Electric Company and Southern California Gas Company, November 30, 2016. Please also refer to the Risk Management testimony chapters of Diana Day and Jamie York (Exhibit SCG-02/SDG&E-02, Chapters 1 and 3, respectively) for more details regarding the utilities' RAMP Report.

capital upgrades of equipment. This in turn addresses employee, contractor and public safety, as well as electric infrastructure integrity as equipment is upgraded.

In preparing SDG&E's GRC forecasts for Electric Distribution Capital, we continued to evaluate the scope, schedule, resource requirements, and synergies of RAMP-related projects and programs. Therefore, the final representation of RAMP costs may differ from the ranges shown in the original RAMP Report.

My testimony describes projects and programs that help to mitigate risks identified in the RAMP Report, which show as adjustments to forecasted costs. This adjustment process was used to identify both RAMP mitigation costs embedded as part of traditional and historic activities, as well as RAMP-incremental costs, which are also associated with mitigation strategies and correspond to historic or new activities. These can be found in my workpapers, Exhibit SDG&E-14-CWP, as described below. The general treatment of RAMP forecasting is described in the testimony of RAMP to GRC Integration witness Jamie York (Exhibit SCG-02/SDG&E-02, Chapter 3). Table AFC-3 provides the summary of the RAMP related costs supported by my testimony by RAMP risk:

Table AFC-3
RAMP Risk Chapters Represented in Electric Distribution Capital

ELECTRIC DISTRIBUTION (In 2016 $)			
RAMP Risk Chapter	**2017 Estimated RAMP Total (000s)**	**2018 Estimated RAMP Total (000s)**	**2019 Estimated RAMP Total (000s)**
SDG&E-1 Wildfires Caused by SDG&E Equipment	90,648	115,920	148,608
SDG&E-3 Employee, Contractor and Public Safety	6,672	8,192	10,169
SDG&E-4 Distributed Energy Resources (DERs)	507	459	0
SDG&E-8 Aviation Incident	10,000	0	0
SDG&E-12 Electric Infrastructure Integrity	72,739	144,507	182,661
Total Capital	**180,566**	**269,078**	**341,438**

Appendix C contains a list of capital projects found in my testimony supporting each of these RAMP risks in Table AFC-3 above.

As Table AFC-3 and Appendix C demonstrate, those risk mitigation efforts are associated with specific programs or projects. For each of these mitigation efforts, an evaluation was made to determine what portion, if any, was already being performed in our historical activities. A determination was also made of the portion that may be accommodated within a particular forecasting methodology, such as averaging or trending, as well as the portion, if any, that represents a true incremental cost increase or decrease from that forecasting methodology.

While the starting point for consideration of the risk mitigation effort and cost was the RAMP Report submitted in November of 2016, we did not cease our evaluation of those efforts for the preparation of this GRC request. Changes in scope, schedule, availability of resources, overlaps or synergies of mitigation efforts, and shared costs or benefits were also considered. Therefore, the incremental costs of risk mitigation sponsored in my testimony may differ from those first identified in the RAMP Report. Significant changes to those original cost estimates are discussed further in my testimony or workpapers related to that mitigation effort.

As noted earlier, I have considered alternatives to the RAMP risk mitigations discussed below. For example, for the Wildfire Risk Mitigations SDG&E considered alternatives to the proposed mitigations as it developed the proposed mitigation plan for the Wildfires risk. Typically, alternatives analysis occurs during vendor selection and when implementing activities, to obtain the best result or product for the cost. The alternatives analysis for this risk plan also took into account modifications to the proposed plan and constraints, such as budget and resources.

Alternative 1 – Extensive Use of Falling Conductor Protection (FCP)

Currently, SDG&E uses a programmatic approach to fire prevention (as noted in its Fire Prevention Plan). For this alternative, SDG&E has considered replacing its programmatic program with the exclusive use of FCP. Depending on the physical configuration of the circuit, FCP may be faster to deploy; however, FCP is a new technology and has not yet been in place long enough to fully evaluate its effectiveness. In addition, long circuits with branches near or at the end of circuits are problematic due to their physical location in relation to monitors. Currently, Engineering estimates the methods to be 70% effective when an FCP operates. Also, the dependency on circuit configuration, where a switch must be in communication with a reactive monitor device downstream in order for the coordination and algorithm to function, essentially would negate the use of FCP, especially on smaller, end of circuit branches. Further,

the intent of FCP is to stop or decrease the likelihood of an ignition occurring due to a wire down event. Nonetheless, it does not address the issue of a wire coming down. System hardening would still need to be deployed. Accordingly, SDG&E dismissed this alternative in favor of its proposed plan to test FCP monitoring along with system hardening measures.

Alternative 2 – Undergrounding the Fire Threat Zone (FTZ)

Consideration to underground the overhead electric system in the FTZ was considered as an alternative. If this alternative were pursued, the likelihood of the system serving as a source of ignition would be reduced. But, moving equipment underground does not fully remove the risk of fire due to some of the components being pad mounted (such as switches) that are a factor in events such as vehicular incidents. In addition, the cost of undergrounding electrical equipment would be very expensive (estimated in the billions of dollars) due to difficult terrain, unknown land and environmental issues, as well as the added cost of the facilities. Undergrounding also can increase restoration times due to underground fault location.

Each of the other mitigations have alternatives that are discussed in the RAMP filing.

B. Safety Culture

SDG&E's established safety-first culture focuses on in three primary areas – public, customer, and employee and contractor safety – by integrating employee training, system operations and maintenance, and safe and reliable service. Electric distribution capital investments are designed to meet SDG&E safety, reliability, and customer service objectives by developing and implementing capital investment mitigation efforts that aggressively address identified risks.

SDG&E's safety culture includes a formal process that identifies, prioritizes, analyzes, and approves capital investment projects designed to meet our safety-first culture objectives. This process includes several review committees of peers and executives. Each committee has a charter with one or several of the objectives to assess the value of these investments to customers, prioritize the spend based on several criteria (including safety and risk management), evaluate mitigation proposals and alternatives, analyze the rate impact, and review the risk mitigation effectiveness. It is through this formal process that our safety culture is developed; as all stakeholder considerations are integrated, safety is specifically prioritized, new risks are identified, and continuous improvement takes place. Additional details regarding SDG&E's safety culture can be found in Tashonda Taylor's testimony (Exhibit SDG&E – 30).

III. ELECTRIC DISTRIBUTION CAPITAL PROJECT EVALUATION AND PRIORITIZATION

A. Capital Management Governance

Several departments within the electric operations areas at SDG&E generate electric distribution capital projects, which are all reviewed, approved, and prioritized by multiple cross-functional committees. These committees, or teams, are described in more detail below.

1. Reliability Assessment Team

The Reliability Assessment Team (RAT) comprises technical leaders from various departments in the company, including: Distribution Operations, Electric Reliability, Distribution Planning, System Protection, Electric Regional Operations, and Distribution Engineering. The team also consults with Substation Engineering and Design, Transmission Engineering & Design, and Kearny Maintenance and Operations. The RAT focuses primarily on providing strategy and guidance for continuously improving system reliability performance, providing integrated planning support, and managing budgets for approved reliability improvement projects.

Proposals for reliability improvement projects are presented to the RAT in the form of a circuit analysis. The circuit analysis considers the reliability risks for the individual circuit, alternatives for reliability enhancements, reliability benefits for each mitigation alternative, and a recommended approach to enhancing reliability on the circuit. After the circuit analysis presentation, the RAT either requests that further analysis of the circuit be done, or it approves the alternative that it deems to provide the most cost-effective reliability benefit. Approved projects are prioritized by the team. Approved projects that meet a high dollar threshold require a second presentation and approval by the Technical Review Committee (TRC), in order to proceed.

2. Substation Equipment Assessment (SEA) Team

The SEA Team consists of individuals from the Substation Engineering and Design group, the Kearny Maintenance and Operations group, and Distribution and Transmission Planning groups. The SEA Team examines transmission and distribution substations and equipment for potential risks and potential failures. The team has developed a methodology for assessing risk related to substation equipment and criteria for evaluating and prioritizing the

equipment for repairs and/or replacement. In some cases, larger scale projects are created to address the issues identified by the SEA Team and needs identified by the planning groups.

In support of daily operations, the SEA Team maintains a database to track and process key operating information. The team analyzes this data to support condition-based equipment replacement. It also supports the online monitoring and diagnostics for key equipment. The SEA Team analyzes historical data, monitors how substation equipment impacts reliability indices, reviews trends related to equipment failure rates, and evaluates the amount of spare equipment in inventory. These factors are included in the methodology that the SEA Team uses to assess risk.

3. Technical Review Committee

All capacity and reliability capital projects that meet a high dollar threshold (including projects submitted through the CAISO review process) are reviewed by the Technical Review Committee (TRC). The TRC serves as an independent council of technical experts that assesses the prudence and value to customers of transmission and distribution capacity and reliability projects. The TRC is made up of representatives from Transmission and Distribution Planning and Engineering, Real Estate, Substation Construction & Maintenance and Engineering, System Protection, Major Projects, Environmental Services, Customer Services, and Electric Grid Operations. The TRC reviews all projects within a ten-year planning horizon and meets monthly to approve projects. The purpose of the TRC is to perform the following tasks:

- Analyze project alignment with company strategies for the Generation, Transmission and Distribution areas;
- Determine whether alternatives have been thoroughly described, assessed and evaluated (*e.g.*, Transmission vs. Distribution upgrades, energy efficiency measures, distributed generation planning, or do nothing);
- Determine whether project risks are reasonable, and whether mitigation plans have been developed to minimize project risks;
- Assess whether customer and company issues have been addressed early in the planning process; and
- Assist in prioritizing projects for the Electric Transmission & Distribution Capital Committee.

All proposed projects are scrutinized by the TRC using the guidance noted above. Proposed projects that do not satisfy the criteria are either eliminated from further consideration, or the department is directed to explore changes or additional alternatives and then bring the project back to the TRC for further consideration. Once projects have been approved by the TRC, they are then sent to the Electric Transmission & Distribution Capital Committee for consideration.

4. Fire Directors Steering Team

Fire risk reduction efforts have become a core tenet for all operational activities at SDG&E. Cross-functional teams have been established with the responsibility of managing and prioritizing fire risk reduction activities, and reporting on status updates. One of these teams is currently called the Fire Directors Steering Team. The Fire Directors Steering Team meets monthly to discuss overall fire preparedness strategy, review the status of risk reduction activities in fire areas, provide direction to the project managers involved in the fire risk reduction activities and provide a sounding board on new and innovative policies and programs related to fire preparedness and fire risk reduction.

Another team that focuses on fire risk reduction work is the Fire Risk Management (FiRM) project team. The wildfires in 2003 and 2007 had devastating impacts on San Diego County. Since 2007, SDG&E has devoted a tremendous amount of effort focused on reducing fire risk. In 2013, SDG&E combined the fire hardening efforts with a program designed to address pole loading issues, FiRM, a program that has evolved over time. The intent of FiRM is to aggressively address fire risk in critical areas by hardening and/or replacing antiquated line elements, utilizing advanced technology, and safeguarding facilities from known local weather conditions. Identification and prioritization of high-risk assets for hardening is a multi-faceted process that incorporates meteorological data, environmental data, historical failure data, and other sophisticated modeling tools to define the scope of work for the project. A prioritization method was established to assist with analyzing one of the highest fire risk events, known as wire-downs. To quantify the vast number of conductors and establish a prioritization method, a model was developed called Wildfire Risk Reduction Model (WRRM).

WRRM is a probabilistic computer model that can perform nearly 70 million fire behavior simulations. It conducts a risk assessment at every pole and span, using that asset's

characteristics, and geographic meteorological and environmental conditions to calculate risk metrics. WRRM utilizes the following as a quantitative approach to risk management:

- Failure rates (before in comparison to after hardening);
- Probability of ignition;
- Environmental conditions;
- Fire behavior;
- Consequence; and
- Cost of hardening project.

FiRM employs WRRM and historical wire-down data to help inform its risk-related decision-making and prioritize projects, and these ranking processes will continue to evolve and be refined by updating failure rate parameters and other risk attributes. All of the fire hardening performed within FiRM shall be within the Fire Threat Zone (FTZ) and mostly focused within the High Risk Fire Area (HRFA). *See* Appendix F for a map of these areas. Additional details pertaining to the FiRM budget are located within Section IV.K.2.

5. Electric Transmission & Distribution Capital Committee

All projects approved by teams identified above are reviewed, approved and prioritized by the Electric Transmission & Distribution Capital Committee (ET&D Committee). The ET&D Committee comprises Directors from the following functional areas: Electric System Planning & Grid Modernization, Electric Transmission & Distribution Engineering, Construction Services, Major Projects, Electric Regional Operations, Kearny Maintenance & Operations, Electric Grid Operations, Electric Distribution Operations, Real Estate & Facilities, and Public Affairs. Non-voting members include Directors from Gas Engineering and Gas Operations Services.

The primary role of the ET&D Committee is to establish priorities among the funding requests within their areas of expertise to complete the highest priority work. Electric distribution projects are prioritized for spending using the following priorities:

- Safety and Risk Management:
  - Fire risk reduction projects, like fire-hardening and aerial marking projects.
- Mandated/Compliance:
  - Projects required in compliance with programs mandated by the CPUC or other regulatory agencies.

- Corrective Maintenance Program, pole replacements, underground (UG) switch replacements, and spill prevention.

- Restoration and Maintenance of Service:
  - Reactive cable replacement, restoration of service, and management of service (*e.g.*, voltage correction).
- New Business:
  - Connection of new residential and non-residential customers.
    - Customer service extensions performed under Rule 16.
    - New distribution line extensions and upgrades required to serve new customers, performed under Rule 15.
- Franchise:
  - Requested conversion projects.
  - Relocations required due to municipal improvements.
  - Conversions performed under Rule 20A or the City of San Diego Surcharge.
- Capacity:
  - Capacity projects required to correct equipment loadings above 100%, due to area load growth.
  - Capacity projects required to increase system capacity where highly loaded equipment (above 90%) will adversely impact operations and reliability.
  - Percent equipment loading is used to sub-prioritize projects within this category.
- Reliability:
  - Proactive infrastructure replacement projects in avoidance of reactive repair or replacement.
  - Projects required to maintain or to improve reliability.
  - Capacity projects required to correct deviations from system design criteria (*e.g.*, loading between sectionalizing devices) or reduce equipment loading above 85% that may impact operations and reliability.
  - Capacity projects required to reduce area substation tie deficiencies that exceed 15MW.
  - Power quality projects to promote monitoring and level of service.
- Construction:

- Projects already in construction or significant commitments made.

The ET&D Committee evaluates electric distribution capital requests based upon four categories (*i.e.*, mandatory, base, in-flight, and elective).

- Mandatory projects and programs are those that are required by law or regulatory decision. For example, programs mandated by the CPUC are included in this category.
- Base projects are related to routine work that is required to maintain system operations and provide service. This is "must do," unavoidable operational work.
- In-flight projects are related to approved projects that have broken ground and incurred spend or have a contractual obligation that places the project past a go/no-go decision point.
- Elective projects are those where the utility has flexibility over if and when the project is completed. There is no specific law, regulatory directive, or operational requirement that requires the project to be completed at a specific time, or at all. However, there can be significant benefits from these projects that would provide sufficient justification for their implementation.

Mandatory, base, and in-flight electric distribution projects are funded using project budget historical spend as well as future year forecasts. For elective capital projects, SDG&E currently uses a software application called REVEAL to document each project's business purpose, description, scope, schedule, justification, and estimated cost. REVEAL assists with the prioritization of elective projects submitted by project managers, based upon the approved metrics associated with the project driver. This prioritization is further scrutinized by the ET&D Committee to further refine the elective projects to be funded. The ET&D Committee tracks the monthly status of its portfolio of approval projects. Priorities are adjusted, depending on whether risks are adequately being addressed, if new risks materialize based on new data, and on overall budget status.

A project manager is assigned to each project and is responsible for the documentation submitted through the review processes of the planning committees. Information from REVEAL and associated Capital Budget Documentation (CBD) is used to complete the Capital Project

Workpapers that appear in the accompanying workpapers (Exhibit SDG&E-14-CWP) to this testimony.

Each project is assigned a unique project number that usually indicates the year in which the project was initiated (as in 13247, project number 247 of year 2013). While many projects are "individual" or "specific" projects, there are also "blanket" projects that continue from year to year and encompass programs associated with many related or identical, capital items. The wood-pole replacement project (budget code 87232) is an example of one such blanket project. Many of these blanket projects have legacy numbering, usually of three digits, such as the 230 budget for underground cable replacement projects.

IV. ELECTRIC DISTRIBUTION CAPITAL FORECASTS BY CATEGORY

A. Electric Distribution Plant Additions

Electric distribution plant additions include capital projects to construct or modify facilities for the distribution of electricity at 15,000 volts (15 kV) and below, projects to construct or modify facilities that transform energy from transmission voltage levels to distribution voltage levels, and projects to improve system reliability. Protective relaying, circuit breakers, substation switchgear, and associated equipment for distribution substations and equipment on the 15 kV and below systems are also included in the electric distribution plant additions. For an overall description of the electric distribution system, please see the Electric Distribution O&M testimony of William Speer (Exhibit SDG&E-15).

Electric distribution capital projects are driven by safety and risk management, reliability, capacity needs, and customer requests or system needs, such as new customer requests for service, Rule 20 conversions, public street or highway relocations, compliance and system growth. As customer requests are received or needs are identified, resource requirements are estimated and those jobs are reviewed. If approved, these jobs are included in a category of similar types of jobs, characterized by the principal priority (*e.g.*, new business). Likewise, capital work driven by the need for existing system replacement, reinforcement and reliability issues is grouped into general project designations with other like projects (*e.g.*, cable replacement). Other capital work projects that are generally driven by the need for additional capacity (such as new circuits and transformer banks, with estimated costs exceeding $500,000) are identified by their own specific capital project designations.

Project CBDs may include more than one category of capital expenditures in their authorization for expenditures, including transmission-related expenses. The CBD may identify transmission-related costs for each project, but those costs are not included in SDG&E's GRC request. The total costs presented reflect the sum of all forecasted costs authorized on the CBDs, with an adjustment to exclude transmission-related (FERC-jurisdictional) costs. For example, in project 9137, the distribution work accounts for less than 10% of the total project cost. This request excludes the other approximately 90% of costs that are covered by FERC transmission rates.

Similarly, current projects planned for SDG&E's transmission system and substations contain components of work on the distribution network. In these cases, my testimony supports a request for the portion of the project expenditures associated with the distribution network.

B. Summary of Costs by Category

Table AFC-4 summarizes the total capital forecasts for 2017, 2018, and 2019.

TABLE AFC-4
Capital Expenditures Summary of Costs by Category
By Category - $'s in Thousands

ELECTRIC DISTRIBUTION				
Figures Shown in Thousands of 2016 Dollars				
CATEGORIES OF MANAGEMENT		**Estimated 2017**	**Estimated 2018**	**Estimated 2019**
C	CAPACITY/EXPANSION	13,269	11,002	25,176
D	EQUIPMENT/TOOLS/MISCELLANEOUS	4,833	2,531	3,029
E	FRANCHISE	34,463	40,180	35,190
F	MANDATED	33,169	34,377	32,662
G	MATERIALS	24,871	26,315	27,694
H	NEW BUSINESS	55,317	57,186	60,592
I	OH POOLS	85,103	120,386	162,491
J	RELIABILITY/IMPROVEMENTS	74,863	108,418	103,448
K	SAFETY AND RISK MANAGEMENT	83,747	113,497	184,333
L	DISTRIBUTED ENERGY RESOURCE (DER) INT.	3,298	18,343	18,016
M	TRANSMISSION/FERC DRIVEN PROJECTS	32,183	57,576	50,118
Totals[2]		445,116	589,811	702,749

In the sections that follow which describe the various capital budgets and projects within each category, forecast amounts are expressed in thousands of dollars ($1000s).

[2] *See* footnote 1.

C. Capacity/Expansion

1. Introduction

SDG&E's system peak load in 2016 was 4,343 megawatts. SDG&E must construct the distribution system to accommodate the peak load, in order to safely and reliably meet all capacity needs. The weather-normalized coincident system peak was 4,448 megawatts, while the 1-in-10 adverse weather coincident peak was approximately 4,862 megawatts, or roughly a 9% increase from the coincident system peak. The primary cost drivers for capacity projects are growth, reliability, safety, power quality and regulatory compliance.

Actual capacity expenditures are linked to customer and load growth, but are not always proportional. Variations are due to the location of the development with respect to available capacity. As San Diego expands and urban land utilization is maximized or priced at a premium, increased greenfield commercial and residential construction in rural areas occurs, potentially leading to customer increases and load growth. To accommodate load increases, SDG&E must add circuits and substations to augment the outlying infrastructure.

As shown in the construction unit forecast in Appendix F, customer growth forecasts, new customer requests, forecasted demand, and distribution substation assessments generate the best estimates of future capital requirements for capacity. Both of these influxes have either staggered growth in the area or shifted the peak. SDG&E's Electric Customer Forecast projects a growth rate of 0.9%, based upon a compound annual growth rate from 2016 to 2019.[3] Within the California Energy Commission's "California Energy Demand 2016 Update Mid Demand Case" for SDG&E forecasts a 1-in-10 weather demand growth rate of 0.05% per year for the annual growth from 2016 to 2019.[4]

An essential element of the planning process is evaluating peak loads. Peak load evaluation considers weather conditions, generation, and operational changes that may have taken place during peak conditions. Typically, this evaluation is done on several peak days to fully assess the peak load for which capacity relief projects will be needed. After the peak load is established, and weather factors along with growth is applied, the capacity of substations and

[3] Direct testimony of Kenneth E. Schiermeyer (Customer Forecast Electric), Exhibit SDG&E-38.

[4] California Energy Commission. "Corrected CEDU 2016 SDGE Mid Demand Case." http://www.energy.ca.gov/2016_energypolicy/documents/2016-12-08_workshop/mid_demand_case.php. 27 Feb. 17: SDGE Form 1.5-Mid.

field equipment is then evaluated against the forecasted loading and the existing system configuration.

SDG&E forecasts projected loads on each circuit and substation within the system on an annual basis, utilizing real-time data and crediting Net Energy Metering (NEM) customers, which results in potentially reducing or shifting the peak. Planning forecasts consider historical growth rates, adjusted recorded loads, identification of large project developments, new load additions submitted, and local economic conditions. Forecasts rely on information obtained from local cities, developers, and large customers. Forecasts for both substations and circuits are established for a ten-year planning window. For short-term planning forecasts (roughly one to two years), specific customer (site-specific) load additions are considered.

SDG&E evaluates load forecasts against system capabilities to determine whether system modifications are required. Planning studies are performed on radial circuits to meet this obligation. This analysis often includes computer simulations or power flow analysis to model both peak and contingency situations. Once a piece of equipment is projected to exceed allowable loading limits, SDG&E reviews and considers alternative system modifications. Various project alternatives would be considered, including reconfiguring the system, installing new facilities, and modifying existing facilities, as appropriate. Substations are evaluated to minimize risk, such that thermal loading limits for transformer, breaker, conductor capacities, and other equipment are not exceeded.

SDG&E evaluates every piece of equipment during the forecasting process, from the transmission system through every line section, substation transformer, substation equipment, and distribution line. SDG&E evaluates equipment not only to determine adequate capacity, but also to maintain appropriate voltages established in SDG&E's Rule 2 Tariff (Description of Service) during steady state and contingency situations. This evaluation takes into account operating criteria for transformers and other equipment that prevent equipment damage due to thermal overload, established criteria for normal load and for emergency conditions (if applicable for the associated equipment flagged), and equipment limits established by the manufacturer of the equipment (including ratings related to maximum load current, voltage, and fault current). Since substation transformer designs vary by manufacturer, the criteria for substation capacity are substation-and transformer-specific.

To finalize the planning process, SDG&E considers customers with large distribution generation dispatched during peak to be considered off-line. Large distribution generation is considered any generation larger than 500 kW on the distribution system. This approach is necessary because the generation on the distribution system does not contain any physical assurance, or a guarantee of performance by the customer. Applying this method allows SDG&E to evaluate a worst-case condition for large units, which could potentially cause problems for the distribution system when taken off-line for scheduled maintenance or for internal issues outside of SDG&E's control. This G-1 method assists with determining whether the generation could possibly affect the reliability, safety, and power quality of the system.

Capacity/Expansion projects typically consist of load transfers, re-conductors, circuit extensions, new circuits, and substations to mitigate the capacity deficiency. The Distribution for Substation category of projects includes distribution projects that are required to support the expansion of existing substations (*e.g.*, substation bank additions) or to support the construction of new substations. Since the mix of optimum solutions to projected deficiencies can vary annually, distribution capacity expenditures for circuits and substations are managed and forecasted collectively. This allows for efficient allocation of capital as required to meet forecasted load growth needs.

As previously discussed, SDG&E evaluates and prioritizes various factors during project selection via SDG&E's Capital Management Governance process. In addition to projects cost, other factors SDG&E considers include system safety, reliability, and power quality. Project selection is based not only on the least cost alternatives, but also on factors that may have an influence on reliability. SDG&E does not select a project based on the economics of a single project alone, but instead must consider the requirements of all the proposed projects in an area required to serve the load.

One driver in increasing the cost of capacity projects pertains to measures to promote safety and regulatory compliance. Regulations continue to be implemented that add to the cost of capital projects. One example is the environmental monitors with specific skill sets, education, and expertise to be present during construction activities and to oversee and provide direction for work that may affect environmental resources, including archaeological resources, Native American artifacts and burial sites, biological nesting, hydro-modification requirements, and hauling construction waste to special material sites. These monitors require compliance and

construction modifications to designs. Because of increasing regulations, SDG&E expects these expenses to continue and increase. Storm Water Pollution Prevention Plans (SWPPP) requirements by Federal, State and Municipal jurisdictions also affect costs and time spent on the job. These SWPPP expenses can increase significantly due to the new State regulations. Training of crews is now required, and ongoing costs are expected to increase, as contractors must comply with new and evolving requirements.

SDG&E assesses compliance with Public Utilities Code §353.5, which requires SDG&E to consider Distributed Energy Resource (DER) alternatives as part of delivering safe and reliable service at the lowest possible cost. After this review, the Electric Transmission and Distribution Capital Committee also reviews the specific capital projects and prioritizes the capital expenditures.

Additional details including description, forecast method, and cost drivers for each capacity/expansion project can be found in each budget code below.

TABLE AFC-5
Summary of Capacity/Expansion Budgets ($'s in Thousands)

Budget Code	Description	ESTIMATED 2017	ESTIMATED 2018	ESTIMATED 2019
209	FIELD SHUNT CAPACITORS	587	587	587
228	REACTIVE SMALL CAPITAL PROJECTS	1,831	1,831	1,831
2258	SALT CREEK NEW SUBSTATION & NEW CIRCUITS	3,336	-	-
5253	OCEAN RANCH 69/12 kV SUBSTATION	170	3,859	14,558
8253	SUBSTATION CAPACITOR BANK UPGRADES	923	923	923
8260	CIRCUIT 1047, CHOLLAS WEST-NEW CIRCUIT	1,840	-	-
11256	C1023, LI: NEW 12 kV CIR & RECOND C354	2,459	-	-
16142	C584 PAR, EXTEND C584 TO OFFLOAD C783	-	406	-
16267	C1447 MTO: EXTENSION & OFFLOAD FROM C958	390	-	-
16268	C1450, MTO:NEW 12 kV CIRCUIT	-	1,219	-
16269	JAMACHA NEW BANK & NEW 12 kV CIRCUIT	-	444	5,178
16272	DOHENY DESALINATION 15MW PROJECT	-	-	366
97248	DISTRIBUTION SYSTEM CAPACITY IMPROVEMENT	1,733	1,733	1,733

	TOTALS	13,269	11,002	25,176

2. 209 – Field Shunt Capacitors

The forecasts for Field Shunt Capacitors for 2017, 2018, and 2019 are $587, $587, and $587, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

Shunt capacitors installed on electric distribution circuits improve power factor and reduce the ampere loading on distribution circuits, substation transformers, transmission lines, and generating stations. Capacitors installed on distribution circuits also improve system voltage and voltage control on both distribution circuits and transmission lines. This project is required to achieve the present design standard in each substation and to maintain this standard in the future years using shunt capacitors. This project will also provide funding for relocating capacitors from downstream of fuses to upstream of fuses to meet SDG&E current standards.

This project provides for the installation of overhead and underground shunt capacitors on 4 kV and 12 kV distribution circuits. Reactive power requirements increase with load growth. Capacitors are needed to efficiently supply reactive power to meet the growth while maintaining a system power factor of at least 0.995 lag measured at the transmission bus. This power factor satisfies current SDG&E design standards. This project is also required to provide funding for relocating existing capacitors that do not comply with SDG&E current standards in capacitor placement.

Information regarding Field Shunt Capacitors is found in the capital workpapers. *See* SDG&E-14-CWP at section 00209 – Field Shunt Capacitors.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver associated with this budget is voltage support and control on the electrical system.

3. 228 - Reactive Small Capital Projects

The forecasts for Reactive Small Capital Projects for 2017, 2018, and 2019 are $1,831, $1,831, and $1,831, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This project is required to address primary distribution system overload and voltage related issues with individual capital jobs requiring quick modifications to the system. It is intended for the capacity projects that are not covered under the specific capital budget process. This type of project often requires a short turnaround time to address the overload and cannot be handled through the specific capital budget process. For example, an overload condition may occur when customers have a significant increase in load without notifying SDG&E in advance. The project is also required to meet the SDG&E Design Standards.

This project provides for the reconstruction and extension of overhead and underground distribution facilities to replace overloaded conductors, to correct primary voltage problems, and to transfer load to balance circuits and substations. Other minor modifications that may be required to delay larger specific projects are also included in this budget. Additionally, this project installs remote metering equipment to monitor questionable circuit loading. A cost-benefit analysis will be performed for various alternatives. The project with the lowest overall cost will be proposed.

Information regarding Reactive Small Capital Projects is found in the capital workpapers. *See* SDG&E-14-CWP at section 00228 – Reactive Small Capital Projects.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost drivers associated with this budget are to replace overloaded equipment to correct primary voltage problems and to transfer load to balance circuits and substations.

4. 2258 - Salt Creek Substation and New Circuits

The forecasts for Salt Creek Substation & New Circuits for 2017, 2018, and 2019 are $3,336, $0 and $0 respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the construction of a new low-profile substation in the Otay Ranch-Chula Vista Area. SDG&E will install a 69/12 kV substation with an ultimate capacity of 120 MVA that provides future required capacity to the rapidly developing area and increases the substation and circuit reliability. The substation will initially be built out with two transformer banks, with the potential for four transformers. Four new distribution circuits will be installed and will intercept existing circuits in the area.

Information regarding Salt Creek Substation & New Circuits is found in the capital workpapers. *See* SDG&E-14-CWP at section 02258 – Salt Creek Substation & New Circuits.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates, based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this capital project is to eliminate overloads and heavily loaded equipment by constructing a new substation and new circuits in the Southeastern Chula Vista area.

5. 5253 – Ocean Ranch 69/12 kV Substation

The forecasts for the Ocean Ranch 69/12 kV Substation project for 2017, 2018, and 2019 are $170, $3,859, and $14,558, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the construction of a new low-profile substation in the Ocean Ranch-Rancho Del Oro Area. SDG&E has purchased land and will install an ultimate capacity of 120 MVA Substation in Ocean Ranch-Rancho Del Oro area. Ocean Ranch and Rancho Del Oro are new industrial park developments located approximately 3.5 miles east of the San Luis Rey substation and approximately four miles west of the Melrose substation.

This project will reduce the capacity deficiency for the area. In addition, added tie capacity will be brought to the area, operation flexibility will be improved, and reliability increased.

Information regarding the Ocean Ranch 69/12 kV Substation & associated New Circuits is found in the capital workpapers. *See* SDG&E-14-CWP at section 05253 – Ocean Ranch 69/12 kV Substation.

b. Forecast Method

The forecast method is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates, based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this capital project is to eliminate overloads and heavily loaded equipment by constructing a new substation and new circuits in the Ocean Ranch-Rancho Del Oro area.

6. 8253 - Substation Capacitor Bank Upgrades

The forecasts for the Substation Capacitor Bank Upgrades for 2017, 2018, and 2019 are $923, $923, and $923, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for the replacement of existing single-step capacitor banks at selected substations with banks of increased capacity and multiple steps. This initiative will add capacitor banks where the power factor is below minimum requirements.

Information regarding the Substation Capacitor Bank Upgrades is found in the capital workpapers. *See* SDG&E-14-CWP at section 8253 – Substation Capacitor Bank Upgrades.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this capital project is to maintain voltage stability and improve power factor by replacing substation single-step capacitor banks where the power factor is below minimum requirements.

7. 8260 – Circuit 1047, Chollas West – New Circuit

The forecasts for the new Circuit 1047 out of Chollas West for 2017, 2018, and 2019 are $1,840, $0 and $0 respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to install conduit, new underground cable, PME3 switch, and four-Way SCADA Trayer switch to facilitate the addition of new circuit 1047 out of Chollas West Substation. Retagging of electric distribution equipment is also required after load is transferred along with a new hook stick switch.

Information regarding Circuit 1047, Chollas West – NEW CIRCUIT is found in the capital workpapers. *See* SDG&E-14-CWP at section 08260 – Circuit 1047, Chollas West – NEW CIRCUIT.

b. Forecast Method

The forecast method is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this capital project is to mitigate a forecasted 95% heavily loaded circuit 166, a forecasted 17% overload on circuit 160 and reduces a forecasted 9% overload of the 3031 bus at Streamview substation.

8. 11256 - C1023, LI: New 12 kV Cir & Recond C354

The forecasts for C1023, LI: New 12 kV CIR & RECOND C354 for 2017, 2018, and 2019 are $2,459, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to install an overhead conductor for new circuit 1023, creating a double circuit pole line with the forecasted overloaded circuit 354. Existing circuit 354 will be reconductored as part of the new double circuit pole line. This project also includes the relocation of existing capacitors and retagging of all electric distribution equipment being cutover to the new circuit.

Information regarding C1023, LI: New 12 kV CIR & RECOND C354 is found in the capital workpapers. *See* SDG&E-14-CWP at section 11256 – C1023, LI: New 12 kV CIR & RECOND C354.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances

between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this capital project is reducing a forecasted 4% overload on circuit 354 and accommodating additional customer growth. The project will also assist with voltage issues and improve reliability in the area.

9. 16142 – C584 PAR: Extend C584 to Offload C783

The forecasts for C584 PAR: Extend C584 to Offload C783 for 2017, 2018, and 2019 are $0, $406, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to extend existing circuit 584 in order to offload circuit 783 fed out of Cannon Substation. The project will install conduit, underground cable, and a new PME 10 switch. After the installation, a portion of circuit 783 will be reconfigured and equipment retagged. Funding also includes the retagging of all electric distribution equipment being cut over to the new circuit.

Information regarding C584 PAR: Extend C584 to Offload C783 is found in the capital workpapers. *See* SDG&E-14-CWP at section 16142 – C584 PAR: Extend C584 to Offload C783.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers of this budget are to improve reliability and to eliminate a forecasted 14% overload on circuit 783.

10. 16267 - C1447 MTO: Extension and Offload from C958

The forecasts for C1447 MTO: Extension & Offload from C958 for 2017, 2018, and 2019 are $390, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to extend circuit 1447, enhancing the reliability in the area and increasing the capacity on circuit 958. The project requires installation of a 4-Way SCADA Trayer switch and a padmount SCADA capacitor. The project will also include trenching and installing new conduit as well as underground cable. Funding also includes the retagging of all electric distribution equipment being cut over to the new circuit.

Information regarding C1447 MTO: Extension & Offload from C958 is found in the capital workpapers. *See* SDG&E-14-CWP at section 16267 – C1447 MTO: Extension & Offload from C958.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this capital project is to mitigate a forecasted 100% loading on circuit 958 and a forecasted 93% heavily loaded bus BK3233 at the Mesa Rim substation.

11. 16268 – C1450, MTO: New 12 kV Circuit

The forecasts for C1450, MTO: New 12 kV Circuit for 2017, 2018, and 2019 are $0, $1,219, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to install new circuit 1450, which will enhance the reliability in the area and increase the available capacity. The project requires the installation of two new SCADA switches, a pad-mount SCADA capacitor, trenching and installation of new conduit and underground cable. The project also includes the reconfiguration of existing overhead poles from a single circuit to a double circuit and the installation of two new hook sticks. Retagging of electric distribution equipment after load is transferred and a new circuit breaker is also required.

Information regarding MTO: New 12 kV Circuit is found in the capital workpapers. *See* SDG&E-14-CWP at section 16268 – C1450, MTO: New 12 kV Circuit.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this capital project is to mitigate a forecasted 17% overload on circuit 961 and increase tie capacity with the Mesa Rim and Mira Sorrento substations.

12. 16269 - Jamacha New Bank and New 12 kV Circuit

The forecasts for Jamacha New Bank & New 12 kV Circuit for 2017, 2018, and 2019 are $0, $444, and $5,178, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the installation of a new circuit out of Jamacha Substation to balance the load and a new transformer to reduce the loading on the heavily loaded existing transformer. The project will require installation of underground cable utilizing existing conduit in the area, a new four wire pole, SCADA switch, and a gang operated switch.

Retagging of electric distribution equipment is also required after load is transferred. A new 69/12 kV transformer will be installed paralleling transformer BK30 as well as a new circuit breaker.

Information regarding Jamacha New Bank & New 12 kV Circuit is found in the capital workpapers. *See* SDG&E-14-CWP at section 16269 – Jamacha New Bank & New 12 kV Circuit.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this capital project is to mitigate for a forecasted 98% heavily loaded BK30 bus at Jamacha substation and increase the reliability in the area.

13. 16272 – Doheny Desalination 15MW Project

The forecasts for Doheny Desalination 15 MW Project for 2017, 2018, and 2019 are $0, $0, and $366, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to extend circuit 792 by installation of a trench and conduit, as well as underground cable along with a four-Way SCADA switch. Two gang operated switches and retagging of electric distribution equipment is planned for this project. The customer is requesting additional load which will require a reconfiguration and modifications to existing circuits in the area to serve the new load.

Information regarding Doheny Desalination 15MW Project is found in the capital workpapers. *See* SDG&E-14-CWP at section 16272 – Doheny Desalination 15MW Project.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this capital project is to mitigate a forecasted capacity limitation due to alternate service request.

14. 97248 - Distribution System Capacity Improvement

The forecasts for Distribution System Capacity Improvement for 2017, 2018, and 2019 are $1,733, $1,733, and $1,733, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to add capacity on the distribution system in heavily loaded areas. These areas have highly loaded circuits (>95% loaded) with limited tie capacity and sectionalizing devices. This budget reduces circuit loading and increases tie capacity and sectionalizing capability and is intended to provide additional capacity and reliability on the distribution system as required by SDG&E Design Standards. Projects identified within this budget can be minor modifications needed to reduce the heavily loaded equipment.

Construction may include, feeder and branch reconductoring, installation of appropriate switching, and other equipment as necessary to increase the capacity of the distribution system for reliability and operating concerns. This project may also be used to install infrastructure for future circuit projects in conjunction with road improvements, transmission system upgrades or other upgrade activities.

Information regarding Distribution System Capacity Improvement is found in the capital workpapers. *See* SDG&E-14-CWP at section 97248 – Distribution System Capacity Improvement.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this capital project is to increase reliability by mitigating capacity limitations due to customer load growth.

D. Equipment/Tools/Miscellaneous

1. Introduction

This budget category is required to purchase new electric distribution tools and equipment required by field personnel to safely and efficiently inspect, operate and maintain the electric distribution system. The result is increased safety, reliability, and regulatory compliance.

Additional details including description, forecast method and cost drivers for each equipment/tools/miscellaneous project can be found in each budget code below.

TABLE AFC-6
Summary of Equipment/Tools/Miscellaneous Budget ($'s in Thousands)

Budget Code	Description	ESTIMATED 2017	ESTIMATED 2018	ESTIMATED 2019
206	Electric Distribution Tools/Equipment	4,833	2,531	3,029
	Total	4,833	2,531	3,029

2. 206 – Electric Distribution Tools/Equipment

The forecasts for Electric Distribution Tools/Equipment for 2017, 2018, and 2019 are $4,833, $2,531, and $3,029, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to purchase new electric distribution tools and equipment required by field personnel to inspect, operate and maintain the electric distribution system. Acquisition of standard tools will be conducted to maintain compliance with safety regulations and promote optimal performance. In addition, tools will be purchased for evaluating the latest technological advancements. All purchases will be conducted in accordance with individual user needs. SDG&E crews require tools to perform various aspects of their jobs. These tools in some instances require repair and maintenance or may be damaged during use. This project allows new tools to be procured in a timely fashion.

Information regarding Electric Distribution Tools/Equipment is found in the capital workpapers. *See* SDG&E-14-CWP at section 00206 – Electric Distribution Tools/Equipment.

b. Forecast Method

The forecast method used is a three-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The three-year

average forecast method more closely trends to the actual spend on the budget, and levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.[5]

c. Cost Drivers

The underlying cost driver for this capital project is to purchase new electric distribution tools and equipment required by field personnel to inspect, operate and maintain the electric distribution system.

[5] The forecast for capital budget code 206, appearing in workpapers as 002060 - Electric Distribution Tools/Equipment, was inadvertently calculated as a 3-year trend instead of the intended 3-year average. Correcting this error will result in a reduction over the three-year GRC cycle of approximately $4.475 million. This error will be corrected at the next opportunity.

E. Franchise

1. Introduction

The franchise category of projects is required to perform municipal overhead to underground conversion work or work in accordance with SDG&E's franchise agreements. The two categories of projects in the franchise category are those devoted to conversion of overhead distribution systems to underground and street or highway relocations due to improvements by governmental agencies.

Rule 20A projects are funded by allocations set in negotiations with the cities and counties through franchise agreements and are implemented in coordination with those cities and counties. Street and highway relocations are also included in this category and performed at SDG&E's expense in accordance with Franchise Agreements.

SDG&E also has a Franchise Agreement with the City of San Diego, which imposes a surcharge on ratepayers within the City. The proceeds from this surcharge are used by the City to fund overhead-to-underground conversion projects within the city limits through SDG&E's Budget Code 213. This surcharge program is revenue and rate base neutral, since all surcharge funds collected are turned over to the City, and all related SDG&E construction expenses are reimbursed by the City. While there are timing differences that result in an initial cost to the conversion, the cost is completely reconciled by the city at no expense to ratepayers.

New Business and Franchise budgets have a "collectible" component, where some funds are received from customers prior to construction. An example is Contributions in Aid of Construction(CIAC). The total project cost to do the work, independent from any collectible portion is included in each individual budget. Rate base modeling performed on these values still credits the collectible portion so that ratepayer impact is unchanged from the way SDG&E has demonstrated the cost of collectible projects.[6]

Additional details including description, forecast method and cost drivers for each franchise project can be found in each budget code below.

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[6] The forecast estimates for New Business inadvertently did not exclude a component of CIAC (Contributions In Aid of Construction) from historical data. CIAC is a credit posting for customer deposits for construction, and reduces the total cost of the project. By not excluding the CIAC component, those credits were in effect applied twice, thereby understating the revenue requirement by approximately $400,000, distributed primarily across New Business budgets. Although SDG&E has become aware of this understatement of expense, SDG&E does not seek increased revenue requirement related to it.

TABLE AFC-7
Summary of Franchise Budgets ($'s in Thousands)

Budget Code	Description	ESTIMATED 2017	ESTIMATED 2018	ESTIMATED 2019
105	ELECTRIC TRANS. STREET/HWY RELOCATIONS	154	154	154
205	ELECTRIC DIST. STREET/HWY RELOCATIONS	5,241	5,241	5,241
210	CONVERSION FROM OH TO UG RULE 20A	10,929	10,929	10,929
213	CITY OF SAN DIEGO SURCHARGE PROG (20SD)	18,139	18,499	18,866
17250	PACIFIC AVE 20B CONVERSION PHASE 2	-	2,226	-
17251	ESPOLA RD 20B CONVERSION	-	2,121	-
17252	SOUTH SANTA FE DR 20B CONVERSION PH2	-	1,010	-
	Totals	34,463	40,180	35,190

2. 105 - Electric Trans. Street/Hwy Relocations

The forecasts for Electric Trans. Street/Hwy Relocations for 2017, 2018, and 2019 are $154, $154, and $154, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget project provides funding to relocate SDG&E's electric transmission facilities when requested by various governmental agencies (*i.e.*, cities, counties, or the state). The projects requested by government agencies are partially or completely billable. The work scope, schedule, cash flow, and total cost of each relocation project completed under this budget are substantially controlled by the government agency requesting the relocation and are subject to frequent revisions. As such, the balances of project budgets and the overall capital project budget may not be zero at the end of a particular month or year. Given sufficient time, however, the project budgets and the capital budget should reach a zero balance.

Information regarding Electric Transmission Street/Hwy Relocations is found in the capital workpapers. *See* SDG&E-14-CWP at section 00105 – Electric Transmission Street/Hwy Relocations.

b. Forecast Method

The forecast method used is a three-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The three-year average forecast method more closely trends to the actual spend on the budget, and levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for the various capital projects as a part of this initiative is dictated by various governmental agencies (*i.e.*, cities, counties, or the state). The projects requested are dependent on the governmental agencies.

3. 205 - Electric Dist. Street/Hwy Relocations

The forecasts for Electric Dist. Street/Hwy Relocations for 2017, 2018, and 2019 are $5,241, $5,241, and $5,241, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for the relocation of existing electric distribution facilities for public improvements under the terms of franchise agreements with municipalities, and the provisions of the street and highway codes with respect to state highways. It also funds relocations for MTDB, NCTD, CCDC, and the Port of San Diego. This budget covers relocations of electric distribution facilities, including both overhead and underground, that conflict with public street and highway improvements and other infrastructure improvement projects having rights superior to those of SDG&E.

Information regarding Electric Distribution Street/Hwy Relocations is found in the capital workpapers. *See* SDG&E-14-CWP at section 00205 – Electric Distribution Street/Hwy Relocations.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for the various capital projects as a part of this initiative is dictated by various governmental agencies (*i.e.*, Cities, Counties, or the State). The projects requested are dependent on the governmental agencies.

4. 210 - Conversion from OH to UG Rule 20A

The forecasts for Conversion from OH to UG Rule 20A for 2017, 2018, and 2019 are $10,929, $10,929, and $10,929, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to convert overhead facilities to underground based on requirements of our Rule 20A conversion program; a CPUC mandated program defined in case 8209 dated 09-27-67, and effective 01-01-68, and franchise agreements with the cities of San Diego and Chula Vista. Additional customers that participate in the program are the cities of: Carlsbad, Coronado, Dana Point, Del Mar, El Cajon, Encinitas, Escondido, Imperial Beach, Laguna Beach, Laguna Hills, Laguna Niguel, La Mesa, Lemon Grove, Mission Viejo, National City, Oceanside, Poway, Solana Beach, San Clemente, San Juan Capistrano, San Marcos, Santee and the Counties of Orange and San Diego.

This budget provides for, at the utility's expense, replacement of existing overhead electric facilities with new comparable underground electric facilities. Replacement is effected at the request of the governing body in the city or county in which such electric facilities are located. This is if the conversion area selected by the governing body meets the criteria as set forth in Rule 20A. This is a CPUC mandated program and is also incorporated into the SDG&E Franchises with the cities of San Diego and Chula Vista. Total program allocations are based on the San Diego Agreement, with each other city/county receiving an amount proportional to their electric meter count in accordance with the methodology specified in Rule 20A. Expenditures in San Diego are also mandated by the MOU.

Information regarding Conversion from OH to UG Rule 20A is found in the capital workpapers. *See* SDG&E-14-CWP at section 00210 – Conversion from OH to UG Rule 20A.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average

levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver of this budget is the request to underground existing overhead facilities as mandated by CPUC Rule 20A.

5. 213 - City of San Diego Surcharge Prog (20SD)

The forecasts for City of San Diego Surcharge Program (20SD) for 2017, 2018, and 2019 are $18,139, $18,499, and $18,866 respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding, at the City of San Diego's expense, to replace existing overhead electric facilities with comparable new underground electric facilities (transmission and distribution – only distribution costs are included in these forecasts). Replacement is effected at the request of San Diego. This is a separate and distinct program from and unrelated to the Rule 20A Undergrounding Program, budget 210 – Conversion from OH to UG Rule 20A. This program is associated with SDG&E Franchise Agreement with the City of San Diego and is required by that Agreement. All expenses associated with this program will be reimbursed to SDG&E by the City from the proceeds of a surcharge collected from each electric meter account in the City of San Diego. No net capital or O&M expenditures are anticipated.

Information regarding City of San Diego Surcharge Program (20SD) is found in the capital workpapers. *See* SDG&E-14-CWP at section 00213 – City of San Diego Surcharge Program (20SD).

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Costs Drivers

The underlying cost driver for this budget is the City of San Diego's schedule for requesting conversion work be performed to underground existing electric distribution and transmission facilities within the bounds of their territory.

6. 17250 - Pacific Ave 20b Conversion Phase 2

The forecasts for Pacific Ave 20B Conversion Phase 2 for 2017, 2018, and 2019 are $0, $2,226, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for SDG&E's portion of expenses associated with this project consisting of the replacement of existing overhead electric facilities with new comparable underground electric facilities as stipulated by the requirements of Rule 20B; the criteria for Rule 20B are typically applied when a project is not eligible for Rule 20A. Replacement is effected at the request of the governing body in the city or county in which such electric facilities are located. The conversion area selected by the governing body meets the criteria as set forth in Rule 20B.

Rule 20B projects that are municipally-driven are intended to be individual projects as opposed to widespread systemic applications; funding by a local government is typically supported by community involvement and are thus less common. This budget funds the utility's portion of individually designed and planned conversion projects using established SDG&E standards and processes so that the resulting infrastructure is reliable and completed for the lowest reasonable cost. SDG&E coordinates closely with local municipalities in scheduling and prioritizing projects according to available funds, community support, and a variety of other factors affecting scope and schedule.

Information regarding Pacific Ave 20B Conversion Phase 2 is found in the capital workpapers. *See* SDG&E-14-CWP at section 17250 – Pacific Ave 20B Conversion Phase 2.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is dictated by the governing body of the city or county of which the electric facilities are located and proposed to be undergrounded under Rule 20B.

7. 17251 – Espola Road 20B Conversion

The forecasts for Espola Rd 20B Conversion for 2017, 2018, and 2019 are $0, $2,121, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for SDG&E's portion of expenses associated with this project consisting of the replacement of existing overhead electric facilities with new comparable underground electric facilities as stipulated by the requirements of Rule 20B; the criteria for Rule 20B are typically applied when a project is not eligible for Rule 20A. Replacement is effected at the request of the governing body in the city or county in which such electric facilities are located. The conversion area selected by the governing body meets the criteria as set forth in Rule 20B.

Rule 20B projects that are municipally-driven are intended to be individual projects as opposed to widespread systemic applications; funding by a local government is typically supported by community involvement and are thus less common. This budget funds the utility's portion of individually designed and planned conversion projects using established SDG&E standards and processes so that the resulting infrastructure is reliable and completed for the lowest reasonable cost. SDG&E coordinates closely with local municipalities in scheduling and prioritizing projects according to available funds, community support, and a variety of other factors affecting scope and schedule.

Information regarding Pacific Avenue 20B Conversion Phase 2 is found in the capital workpapers. *See* SDG&E-14-CWP at section 17251 – Espola Road 20B Conversion.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances

between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is dictated by the governing body of the city or county of which the electric facilities are located and proposed to be undergrounded under Rule 20B.

8. 17252 - South Santa Fe Dr 20B Conversion Phase 2

The forecasts for South Santa Fe Drive 20B Conversion Phase 2 for 2017, 2018, and 2019 are $0, $1,010, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for SDG&E's portion of expenses associated with this project consisting of the replacement of existing overhead electric facilities with new comparable underground electric facilities as stipulated by the requirements of Rule 20B; the criteria for Rule 20B are typically applied when a project is not eligible for Rule 20A. Replacement is implemented at the request of the governing body in the city or county in which such electric facilities are located. The conversion area selected by the governing body meets the criteria as set forth in Rule 20B.

Rule 20B projects that are municipally-driven are intended to be individual projects as opposed to widespread systemic applications; funding by a local government is typically supported by community involvement and are thus less common. This budget funds the utility's portion of individually designed and planned conversion projects using established SDG&E standards and processes so that the resulting infrastructure is reliable and completed for the lowest reasonable cost. SDG&E coordinates closely with local municipalities in scheduling and prioritizing projects according to available funds, community support, and a variety of other factors affecting scope and schedule.

Information regarding Pacific Avenue 20B Conversion Phase 2 is found in the capital workpapers. *See* SDG&E-14-CWP at section 17252 – South Santa Fe Drive 20B Conversion Phase 2.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is dictated by the governing body of the city or county in which the electric facilities are located and proposed to be undergrounded under Rule 20B.

F. Mandated

1. Introduction

Mandated projects are those required by the CPUC and other regulatory agencies. Mandated programs help promote public and employee safety. In addition, these programs protect SDG&E's capital investments of overhead and underground distribution facilities, maintain quality of service to SDG&E's customers, and avoid degradation of reliability due to aging electric systems.

This category of projects includes, among others, the replacement of equipment from SDG&E's Corrective Maintenance Program (CMP) (229), the replacement/reinforcement of wood distribution poles (87232), distribution switch replacement/removal (289), and manhole repair (289). Three of these budgets (229, 289, and 87232) are driven by CPUC General Order (G.O.) 165, which governs the inspection and maintenance program for a utility distribution system in furtherance of overhead and underground construction's compliance with G.O. 95 (Rules for Overhead Line Construction) and G.O. 128 (Rules for Construction of Underground Electric Supply and Communications Systems). SDG&E's CMP compliance plan was submitted to the CPUC on July 1, 1997. G.O. 165 became effective on January 1, 1998. G.O. 165 and SDG&E's submitted plan require the routine inspection of electric distribution facilities and the correction of infractions found from those inspections. The infractions identified during the inspections represent deviations from the rules outlined in G.O. 95 and G.O. 128 and must be cleared within twelve months of the initial inspection. Imminent safety hazards found on the inspections are immediately addressed. The programs included in this category represent the capital expenditures necessary to correct those infractions.

Additionally, SDG&E has identified risk-mitigation projects in an effort to prioritize key mandated projects. As a result, SDG&E submitted the RAMP Report on November 30, 2016. Identifying risks and mitigation efforts and assigning roles and responsibilities to address those issues are key characteristics of SDG&E's culture. Within my funding request are costs associated with risk-mitigation efforts identified in the utility-submitted RAMP Report. As discussed in the Risk Management testimony chapters of Diana Day and Jamie York (Exhibit SCG-02/SDG&E-02, Chapters 1 and 3, respectively), the costs of risk-mitigation projects and programs were translated from that RAMP Report into the Mandated capital budgets below.

Further details regarding RAMP-specific Mandated capital budgets can be found under Table AFC-3 in Section II.

Additional details including description, forecast method and cost drivers for each mandated project can be found in each budget code below.

TABLE AFC-8
Summary of Mandated Budgets ($'s in Thousands)

Budget Code	Description	ESTIMATED 2017	ESTIMATED 2018	ESTIMATED 2019
102	ELEC TRANS LINE RELOCATION PROJECTS	39	39	39
229	CORRECTIVE MAINTENANCE PROGRAM	10,803	10,803	10,803
289	SWITCH REPLACEMENT & MANHOLE REPAIR	5,438	5,438	5,438
6247	REPLACEMENT OF LIVE FRONT EQUIPMENT	685	685	685
10265	AVIAN PROTECTION PROGRAM	1,635	1,635	1,635
11144	ON-RAMP AERIAL LIGHTING	-	1,256	-
13264	DISTRIBUTED GENERATION INTERCONNECT. PRO	507	459	-
13266	DISTRIBUTION AERIAL MARKING & LIGHTING	119	119	119
87232	POLE REPLACEMENT AND REINFORCEMENT	13,943	13,943	13,943
	Totals	33,169	34,377	32,662

2. 102 – Elec Trans Line Relocation Projects

The forecasts for the Electric Transmission Line Relocation projects for 2017, 2018, and 2019 are $39, $39, and $39, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Project Description

This budget provides funding for the distribution/CPUC forecasted spend as a component of transmission/FERC driven projects. Transmission/FERC projects are funded though the FERC formula ratemaking process. The distribution/CPUC cost component of transmission/FERC projects is funded through the GRC process. This budget provides a holding account for payments received from developers and government agencies for developer/agency requested relocation of SDG&E electric transmission facilities. While this budget is intended to

be a zero-balance budget, there are times where incremental work is necessary due to unforeseen circumstances or to account for future electric system projects.

Information regarding the Electric Transmission Line Relocation initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 00102 – Electric Transmission Line Relocation.

b. Forecast Method

The forecast method used is a three-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The three-year average forecast method more closely trends to the actual spend on the budget, and levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Driver(s)

The underlying cost driver for this budget is based on the number of requests SDG&E receives to relocate its transmission infrastructure by developers or local agencies.

3. 229 - Corrective Maintenance Program (CMP)

The forecasts for CMP for 2017, 2018, and 2019 are $10,803, $10,803, and $10,803, respectively. This is an ongoing program that is expected to continue through the test year.

a. Description

This budget provides funding for the inspection and maintenance of overhead and underground electric distribution facilities. This program is mandated under CPUC G.O. 165 to promote safe, high-quality electrical service and compliance with SDG&E and CPUC construction standards found in G.O. 95 and 128. Inspections are performed on a cyclical basis and conditions found during inspections are repaired in compliance with SDG&E's CMP plan. This program has been ongoing since January 1998. All electric distribution facilities are visually patrolled on an annual basis in urban and rural areas and inspected in detail every three, five, or ten years depending on equipment type. Conditions found during the inspections may require only labor to repair equipment or may require replacement of equipment that is no longer serviceable. Inspections and some repair work are captured under O&M budgets included in witness William Speer's testimony (Exhibit SDG&E-15). This program is mandated by the CPUC and is designed to provide reliable service and a safe environment for SDG&E's employees, contractors and the public.

Information regarding the CMP is found in the capital workpapers. *See* SDG&E-14-CWP at section 00229 – Corrective Maintenance Program (CMP).

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this budget is the CMP inspections. This budget is used to fund work resulting from those inspections.

4. 289 - Switch Replacement and Manhole Repair

The forecasts for CMP UG Switch Replacement and Manhole Repair for 2017, 2018, and 2019 are $5,438, $5,438, and $5,438, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to replace or remove underground and overhead switches and to repair underground structures, all of which impact system integrity and employee and public safety. This will allow SDG&E to continue to operate distribution equipment and facilities for the safety and well-being of both employees and the general public and to comply with G.O. 95, 128 and 165. Failure to implement this program would reduce reliability and limit operational flexibility, while increasing the risk of injury to field personnel and the public. Without implementing such a program, SDG&E may increase the risk of equipment failure and prolonged outages.

Information regarding CMP UG Switch Replacement & Manhole Repair is found in the capital workpapers. *See* SDG&E-14-CWP at section 00289 – CMP UG Switch Replacement & Manhole Repair.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because the workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a longer period of time and provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this budget is based on the number of substructures requiring structural repair and the number of switches that need to be removed or replaced due to being Mechanically Inoperable (MIO). Inoperable switches severely hamper SDG&E's ability to restore service in an outage and limit operating flexibility, so it is very important that MIO switches are removed or replaced.

5. 6247 - Replacement of Live Front Equipment

The forecasts for Replacement of Live Front Equipment for 2017, 2018, and 2019 are $685, $685, and $685, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to replace live-front pad-mounted distribution equipment with dead-front pad-mounted distribution equipment, when it is encountered during normal SDG&E work. Live-front equipment contains electrical components enclosed in a protective (usually steel) cabinet that does not have additional protective barriers; live electric connections are exposed when live-front equipment cabinets are opened, an action that is supposed to only be performed by qualified electric personnel. Replacing live-front equipment with dead-front equipment that has additional safety barriers such as removable fiberglass or composite plates, protective covers or additional compartmentalization will improve operational flexibility, reliability, and safety for SDG&E field personnel and the general public.

Information regarding Replacement of Live-Front Equipment is found in the capital workpapers. *See* SDG&E-14-CWP at section 06247 – Replacement of Live-Front Equipment.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget relates to the forecasted number of replacements of live-front pad-mounted distribution equipment with dead-front pad-mounted distribution equipment from year to year.

6. 10265 – Avian Protection Program

The forecasts for Avian Protection program for 2017, 2018, and 2019 are $1,635, $1,635, and $1,635, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for identifying and retro-fitting, rearranging, or building-to-standard distribution poles in SDG&E's service territory to prevent electrocution of birds and to facilitate compliance with Federal and State Laws: 1) Migratory Bird Treaty Act (16 U.S.C. §§ 703-712), 2) Bald and Golden Eagle Protection Act (16 U.S.C. §§ 668-668d), and 3) the California Fish and Game Code (Cal. Fish and Game Code §§ 3503, 3503.5, 3511, 3513). The project will also harden the system and reduce fire risk associated with avian electrocutions, improve SDG&E reliability and customer service, and align with Avian Power Line Interaction Committee (APLIC) Guidelines. The plan will systematically inspect all distribution lines and poles in the overhead distribution system that either: 1) lie within the Avian Protection Zone, or 2) have associated known bird contacts, in which case we will identify and resolve potential avian risks.

Information regarding the Avian Protection Program is found in the capital workpapers. *See* SDG&E-14-CWP at section 10265 – Avian Protection Program.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this capital project are the need to reduce the potential for bird electrocutions, and to facilitate compliance with Federal and State laws.

7. 11144 – On-Ramp Aerial Lighting

The forecasts for On-Ramp Aerial Lighting program for 2017, 2018, and 2019 are $0, $1,256, and $0, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to establish wireless communication aerial lighting to meet the state and federal requirements and increase public and employee safety. The Federal Aviation Administration establishes the standards and notification criteria for the construction or alteration of objects affecting navigable airspace. SDG&E must meet those requirements as well as California State Aeronautics Code Title 21 and local Airport Land Use Commissions.

Information regarding the On-Ramp Aerial Lighting program is found in the capital workpapers. *See* SDG&E-14-CWP at section 11144 – On-Ramp Aerial Lighting.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is the number of required installations of on-ramp wireless aerial lighting SDG&E places in service. The number of installations performed is determined by line assessments which specify the required locations for these aerial lights.

8. 13264 - Distributed Generation Interconnect Project

The forecasts for Distributed Generation Interconnect Project for 2017, 2018, and 2019 are $507, $459, and $0, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to facilitate the interconnection of customer- or developer-owned generation to SDG&E's electric distribution system. The projects consist of performing engineering, design, and construction of interconnection facilities from generator switchgear to the point of interconnection on SDG&E's distribution system. Most generators interconnected under this budget are 0.5 to 10 MW in size.

Information regarding the Distributed Generation Interconnect Project is found in the capital workpapers. *See* SDG&E-14-CWP at section 13264 – Distributed Generation Interconnect Project.

b. Forecast Method

The forecast method used is zero-based. It is based on interconnection projects in the SDG&E WDAT and Rule 21 queue and in-service dates. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is the number of customers or developers that request an interconnection onto SDG&E's distribution system, according to mandates by Electric Rule 21 and the Wholesale Distribution Open Access Tariff.

9. 13266 - Distribution Aerial Marking and Lighting

The forecasts for Distribution Aerial Marking and Lighting for 2017, 2018, and 2019 are $119, $119, and $119, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to install aerial lighting and marking on SDG&E-owned distribution facilities as required by the Federal Aviation Administration (FAA). The FAA, U.S. Department of Transportation, has authority to regulate and oversee all aspects of American civil aviation. Federal Regulation Title 14 CFR Part 77 establishes the standards and notification

criteria for the construction or alteration of objects affecting navigable airspace. SDG&E is subject to this regulation and must notify the FAA when proposing the construction or alteration of facilities that exceed notice criteria under Part 77.9(b). When determined by the FAA, SDG&E will install aviation hazard marking and lighting consistent with FAA recommendations and advisories. In addition to complying with FAA regulations, SDG&E is also subject to California State Aeronautics Code Title 21, and local Airport Land Use Commissions. This budget is a sister budget to the Transmission Aerial Marking and Lighting Budget. The primary objective of this budget is to comply with FAA requirements, California State Aeronautics Code Title 21, and local Airport Land Use Commissions, in addition to increasing public and employee safety by installing aerial marking and lighting.

Information regarding Distribution Aerial Marking and Lighting is found in the capital workpapers. *See* SDG&E-14-CWP at section 13266 – Distribution Aerial Marking and Lighting.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is to comply with FAA and other state & local agency requirements through the installation of aerial marking and lighting.

10. 87232 - Pole Replacement and Reinforcement

The forecasts for Pole Replacement and Reinforcement for 2017, 2018, and 2019 are $13,943, $13,943, and $13,943, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for the pole restoration and replacement program for in-service distribution poles utilizing steel and fiberglass poles. These replacements are incorporated into routine CMP pole replacements. Wood pole damage is attributed to numerous

factors including, but not limited to, the loss of original preservative treatment experienced with Penta-Cellon poles (Pentachlorophenol, a pesticide, and Cellon, a preservative treatment for wood poles used by the DOW Chemical Company to inject pentachlorophenol using a liquid petroleum gas such as propane), the presence of fungi decay, and bird and/or termite damage. All electric distribution poles and associated equipment are visually patrolled on an annual basis in urban and rural areas, inspected in detail every five years, and receive a wood pole intrusive inspection on average every ten years. Inspections and some repair work are captured under O&M budgets included in the Electric Distribution O&M testimony of William Speer (Exhibit SDG&E-15).

The pole inspection/restoration/replacement program is designed to comply with G.O. 165 and SDG&E's compliance plan submitted on July 1, 1997. In addition, this budget protects SDG&E's capital investments of overhead distribution facilities by maintaining G.O. 95 mandated safety factors for the applicable grades of construction. This program promotes SDG&E's compliance with G.O. 95 and 165 and is expected to improve the life expectancy of the overhead distribution system, minimize customer safety risks, and mitigates the need for extensive capital replacements. Pole replacement candidates are identified through the CMP Overhead Visual Program and contracted wood pole intrusive inspections. Candidate poles are confirmed for replacement and enter the job queue for replacement.

Information regarding Pole Replacement and Reinforcement is found in the capital workpapers. *See* SDG&E-14-CWP at section 87232 – Pole Replacement and Reinforcement.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this budget is related to compliance with G.O. requirements and an increased emphasis on pole loading analysis.

G. Materials

1. Introduction

The Materials category is required to provide distribution transformers necessary to operate and maintain the electric distribution system. This blanket project is required to purchase transformers, supplying new and replacement equipment and maintaining inventory at each electric distribution service center. The expenditures in this category are closely related to work being done in New Business, Mandated, Capacity, Reliability, Safety and Risk Management, as well as all other categories where transformers are installed.

Additional details including description, forecast method and cost drivers for each capacity/expansion project can be found in each budget code below.

TABLE AFC-9
Summary of Materials Budgets ($'s in Thousands)

Budget Code	Description	ESTIMATED 2017	ESTIMATED 2018	ESTIMATED 2019
202	ELECTRIC METERS & REGULATORS	4,156	5,106	5,974
214	TRANSFORMERS	20,715	21,209	21,720
	Totals	24,871	26,315	27,694

2. 202 - Electric Meters and Regulators

The forecasts for the Electric Meters and Regulators project for 2017, 2018, and 2019 are $4,156, $5,106, and $5,974, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to install distribution meters and regulators necessary to operate and maintain SDG&E's electric distribution system. The budget is an ongoing blanket project to purchase new watt-hour meters and regulators used to service the electric distribution customers. The meters and regulators are required to maintain inventory levels at each of the electric distribution service centers. The meters could be used for new business installations and can also be installed as replacements for meters that are damaged or not properly functioning.

Information regarding Electric Meters and Regulators is found in the capital workpapers. *See* SDG&E-14-CWP at section 00202 – Electric Meters & Regulators.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify that the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is new business that requires the installation of meters and regulators.

3. 214 – Transformers

The forecasts for the Transformers for 2017, 2018, and 2019 are $20,715, $21,209, and $21,720, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to install distribution transformers necessary to operate and maintain the electric distribution system. SDG&E purchases the new transformers, supplies new and replacement equipment, and maintains inventory at each electric distribution service center.

Information regarding the Transformers project is found in the capital workpapers. *See* SDG&E-14-CWP at section 00214 – Transformers.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is directly related to the required need of transformers related to the various work being performed.

H. New Business

1. Introduction

Most of the expenditures associated with the New Business budgets are a direct result of customer requests. Those requests can be for new services, upgraded services, new distribution systems for commercial and residential developments, system modifications to accommodate new customer load, customer requested relocations, rearrangements, removals and the conversion of existing overhead lines to underground. All work and cost responsibilities are governed by applicable tariffs, which typically place the bulk of the cost on the utility. This category of work also has some budgets with collectible components.

New Business work is subject to a quick turnaround, as it is in direct response to customer requests. New customers seeking service from SDG&E submit requests with time frames based on their own needs and for which urgency of need will vary. Therefore, all projected budget requirements are based on economic indicators suggesting the anticipated level of construction activity.

The New Business budgeting process is based on the construction unit forecast, an in-depth assessment that combines data on permit activity and the most current outlook on housing and land development, presented by a variety of economic forecasting entities. SDG&E typically updates its construction unit forecast twice a year. Construction units are a concept unique to SDG&E. A residential unit represents the work performed by SDG&E construction crews to bring energy to new construction. A construction unit is not the same as a "meter set," because a meter can be connected or disconnected to a residence many times over the life of the structure and is counted as one "set" each time the task is performed. A construction unit is counted only once, when the company extends its system to serve a new residence. One residential construction unit usually maps to one new dwelling unit. One new single-family residence or one new apartment unit equals one residential construction unit. Nonresidential construction units, on the other hand, do not match one-to-one to each related business. Rather, one nonresidential construction unit maps to one business structure (point of service). For example, one newly constructed office building may represent one nonresidential construction unit, even though there may be many tenant businesses occupying the same office building.

There are electric construction units and gas construction units. A residence may have both electric service and gas service. If so, two construction units are counted: one electric unit

and one gas unit. A construction unit forecast with an electric component and a gas component is also produced. Forecasting residential electric construction units is the primary forecasting effort. Gas units are derived by applying a set of historical ratios of completed gas units to completed electric units, to a forecast of residential electric units. The forecast of residential electric units is driven by a forecast of San Diego county residential building permits. The forecast of residential permits is usually permit information gathered locally, combined with permit information provided by a nationally recognized data service provider, such as Global Insight, Inc. The information gathered locally is used to develop a current-year and one-year-out forecast of permits. The permit series provided by the national data service provider is merged with the front end of the permit forecast to create a five-year set of residential permits to use as a model driver. The forecasting tool is based on a relationship between a long history of San Diego county residential permits and SDG&E residential electric construction units. Once the forecast of residential electric construction units is prepared, it is then shared down to electric sub-categories such as single-family/multi-family and overhead/underground electric. Gas units are generated by applying the above-mentioned ratios. Appendix E provides a chart of the latest construction unit forecast prepared by SDG&E in the manner described above.

Additional details including description, forecast method and cost drivers for each capacity/expansion project can be found in each budget code below.

TABLE AFC-9
Summary of New Business Budgets ($'s in Thousands)

Budget Code	Description	ESTIMATED 2017	ESTIMATED 2018	ESTIMATED 2019
204	ELECTRIC DISTRIBUTION EASEMENTS	871	1,037	1,097
211	CONVERSION FROM OH-UG RULE 20B, 20C	2,557	2,828	3,101
215	OH RESIDENTIAL NB	747	906	961
216	OH NON-RESIDENTIAL NB	809	950	998
217	UG RESIDENTIAL NB	12,658	16,055	16,993
218	UG NON-RESIDENTIAL NB	6,251	7,502	7,877
219	NEW BUSINESS INFRASTRUCTURE	7,414	8,944	9,437
224	NEW SERVICE INSTALLATIONS	4,951	6,007	6,336
225	CUSTOMER REQUESTED UPGRADES AND SERVICES	8,637	9,387	10,288
235	TRANSFORMER & METER	3,504	3,504	3,504

	INSTALLATIONS			
15258	MIDCOAST TROLLEY EXTENSION PROJECT	6,918	66	-
	Totals	55,317	57,186	60,592

2. 204 - Electric Distribution Easements

The forecasts for the Electric Distribution Easements for 2017, 2018, and 2019 are $871, $1,037, and $1,097, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to obtain new electric distribution easements necessary to provide service to new customers, accommodate street and highway relocations, underground conversions and other capital improvement projects to improve electrical service. SDG&E performs necessary surveys and mapping functions, document research, document preparation, and negotiations with private and governmental property owners for the acquisition of real property rights to allow the installation of new electrical distribution facilities on private property or public lands. The budget also allows for the acquisition of real property easement rights to install new business electric facilities on private property to provide service for new customer loads. There is no reasonable alternative to this project if the company must install or maintain electric facilities on, under, or over private property or public lands.

Information regarding the Electric Distribution Easements project is found in the capital workpapers. *See* SDG&E-14-CWP at section 00204 – Electric Distribution Easements.

b. Forecast Method

The forecast method used is zero-based and utilizes historical costs and growth factors derived from the construction unit forecast. The forecast also considers existing easements that have expired or are expected to expire within this GRC forecast period. Appraisals are performed to determine the actual cost of new easements.

c. Cost Drivers

The underlying cost driver for this budget is related to the requirement to operate and maintain the electric distribution system in a safe and reliable manner.

3. 211 - Conversion from OH-UG Rule 20B, 20C

The forecasts for the Conversion from OH-UG Rule 20B, 20C for 2017, 2018, and 2019 are $2,557, $2,828, and $3,101, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to convert existing electric overhead distribution lines to underground distribution lines upon customer request. This project reflects SDG&E's portion of the costs for installing new underground facilities to replace existing overhead facilities for projects meeting the criteria for Rule 20B and 20C. SDG&E is responsible for a portion of the costs associated with converting overhead distribution lines to underground distribution lines to comply with the "Rules for the Sale of Electric Energy."

Information regarding the Conversion from OH-UG Rule 20B, 20C project is found in the capital workpapers. *See* SDG&E-14-CWP at section 00211 – Conversion from OH-UG Rule 20B, 20C.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a longer period and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this budget is based on the amount of conversion work currently awaiting construction, changing trends toward the use of 20B conversions by municipalities and the forecasted level of new customer growth.

4. 215 - OH Residential New Business

The forecasts for the OH Residential New Business for 2017, 2018, and 2019 are $747, $906, and $961, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for the extension of new overhead electric distribution systems to new residential electric customers requesting service from SDG&E. This project includes third wire bring ups and transmission under builds, to serve new residential customers.

This project is in accordance with the "Rules for the Sale of Electric Energy," filed with and approved by the CPUC, as electric facilities must be provided to qualified applicants.

Information regarding the OH Residential New Business project is found in the capital workpapers. *See* SDG&E-14-CWP at section 00215 – OH Residential New Business.

b. Forecast Method

The forecast method used is a five-year average based on historical data incorporating growth factors derived from the construction unit forecast. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a longer period and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this capital project is residential customer growth.

5. 216 - OH Non-Residential New Business

The forecasts for the OH Non-Residential New Business for 2017, 2018, and 2019 are $809, $950, and $998, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for the extension of new overhead electric distribution systems to new non-residential electric customers requesting service from SDG&E. This project provides for the extension of the overhead distribution system, including third wire bring ups and transmission under builds, that serve new non-residential customers. This project is in accordance with the "Rules for the Sale of Electric Energy," filed with and approved by the CPUC, as electric facilities must be provided to qualified applicants.

Information regarding the OH Non-Residential New Business project is found in the capital workpapers. *See* SDG&E-14-CWP at section 00216 – OH Non-Residential New Business.

b. Forecast Method

The forecast method used is a five-year average based on historical data incorporating growth factors derived from the construction unit forecast. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the

peaks and valleys in this blanket budget over a longer period and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this capital project is non-residential customer growth.

6. 217 - UG Residential New Business

The forecasts for the UG Residential New Business for 2017, 2018, and 2019 are $12,658, $16,055, and $16,993, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to extend new underground electric distribution systems to new residential electric customers requesting service from SDG&E. This project provides for the extension of the underground electric distribution system to serve new residential customers. This project is in accordance with the "Rules for the Sale of Electric Energy," filed with and approved by the CPUC, as electric facilities must be provided to qualified applicants.

Information regarding the OH Non-Residential New Business project is found in the capital workpapers. *See* SDG&E-14-CWP at section 00217 – UG Residential New Business.

b. Forecast Method

The forecast for this pool is derived from the recorded BY 2016 expenditures with a net upward adjustment based on applying growth factors derived from the construction unit forecast. The requirement for underground residential line extension work has continued to increase year after year. Unlike the sporadic nature of overhead line extension requirements, underground line extension requirements are easier to predict, as virtually all new residential developments are required to be served by underground electric systems. As such, the year-end net expenditure for 2016 represents just how much this category has grown in recent years.

c. Cost Drivers

The underlying cost driver for this capital project is residential customer growth.

7. 218 - UG Non-Residential New Business

The forecasts for the UG Non-Residential New Business for 2017, 2018, and 2019 are $6,251, $7,502, and $7,877, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to extend new underground electric distribution systems to new non-residential electric customers requesting service from SDG&E. This project provides for the extension of the underground electric distribution system to serve new non-residential customers. This project is in accordance with the "Rules for the Sale of Electric Energy," filed with and approved by the CPUC, as electric facilities must be provided to qualified applicants.

Information regarding the OH Non-Residential New Business project is found in the capital workpapers. *See* SDG&E-14-CWP at section 00218 – UG Non-Residential New Business.

b. Forecast Method

The forecast for this pool is derived from the recorded BY 2016 expenditures with a net upward adjustment based on applying growth factors derived from the construction unit forecast. The requirement for underground non-residential line extension work has increased. Unlike the sporadic nature of overhead line extension requirements, underground line extension requirements are somewhat easier to predict, as virtually all new non-residential development are required to be served by underground electric systems. As such, the year-end net expenditure for 2016 is a good indication of the requirements of this category.

c. Cost Drivers

The underlying cost driver for this capital project is non-residential customer growth.

8. 219 - New Business Infrastructure

The forecasts for the New Business Infrastructure for 2017, 2018, and 2019 are $7,414, $8,944, and $9,437, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to install facilities for new electric customers to be served from both the overhead and underground distribution system and facilitates various future development needs. This project is in accordance with the "Rules for the Sale of Electric Energy," filed with and approved by the CPUC, as electric facilities must be provided to qualified applicants.

Information regarding the New Business Infrastructure project is found in the capital workpapers. *See* SDG&E-14-CWP at section 00219 – New Business Infrastructure.

b. Forecast Method

The forecast method used is a five-year average based on historical data incorporating growth factors derived from the construction unit forecast. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a longer period and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this capital project is new business customer growth.

9. 224 - New Service Installations

The forecasts for the New Service Installations for 2017, 2018, and 2019 are $4,951, $6,007, and $6,336, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to deliver electric service to new customers from new or existing electric distribution systems and facilitates the installation of new overhead and underground electric services for new customers. The installation of distribution facilities is to be installed on Budgets 215, 216, 217, 218, or 219. This project is in accordance with the "Rules for the Sale of Electric Energy," filed with and approved by the CPUC, as electric facilities must be provided to qualified applicants.

Information regarding the New Service Installations project is found in the capital workpapers. *See* SDG&E-14-CWP at section 00224 – New Service Installations.

b. Forecast Method

The forecast for this pool is derived from the BY 2016 expenditures with a net upward adjustment based on applying growth factors derived from the construction unit forecast. The volume of electric service work (services only, no distribution) has been increasing steadily over the past few years. The year-end net expenditure for 2016 is a good indication of current requirements to support this category.

c. Cost Drivers

The underlying cost driver for this capital project is customer growth.

10. 225 - Customer Requested Upgrades and Services

The forecasts for the Customer Requested Upgrades and Services for 2017, 2018, and 2019 are $8,637, $9,387, and $10,288, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to replace, relocate, rearrange or remove existing electric distribution and service facilities as requested by customers. This project is in accordance with the rules for the sale of electric energy, filed with and approved by the CPUC as modifications to existing electric facilities may be required due to customer requests and in conjunction with new business projects.

Information regarding the New Service Installations project is found in the capital workpapers. *See* SDG&E-14-CWP at section 00225 – Customer Requested Upgrades and Services.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a longer period and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this capital project is customer growth.

11. 235 - Transformer and Meter Installations

The forecasts for Transformer and Meter Installations for 2017, 2018, and 2019 are $3,504, $3,504, and $3,504, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for specific work related to new or existing customer installations and the handling and salvage of scrapped distribution line equipment, specifically involving the installation and/or removal of transformers and meters. SDG&E Electric Rule 16 provides that modification to existing electric facilities may be required in conjunction with new business projects, and due to customer request.

Information regarding the Transformers and Meter Installations project is found in the capital workpapers. *See* SDG&E-14-CWP at section 00235 – Transformers and Meter Installations.

b. Forecast Method

The forecast method used is a four-year average based on historical data. Four years was chosen because the 2012 spend was unusually high and inconsistent with the ensuing years. This is the most appropriate methodology, because workload can vary from year to year. The four-year average levels out the peaks and valleys in this blanket budget over a longer period and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this capital project is customer growth.

12. 15258 - Midcoast Trolley Extension Project

The forecasts for the Midcoast Trolley Extension Project for 2017, 2018, and 2019 are $6,918, $66, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the relocation of multiple SDG&E facilities to accommodate the extension of the light and heavy rail lines in the City of San Diego. The San Diego Association of Governments (SANDAG) will be responsible for the extension of the rail lines. Said facilities include electric transmission, electric distribution, and high and medium pressure distribution gas infrastructure.

Information regarding the Midcoast Trolley Extension project is found in the capital workpapers. See SDG&E-14-CWP at section 15258 – Midcoast Trolley Extension Project.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this budget is to accommodate the extension of the SANDAG Light and Heavy Rail Extension Project.

I. Overhead Pools

1. Introduction

Capital projects incur certain costs that originate from central activities, which are subsequently distributed to those capital projects based on one or more factors, such as project direct labor, contracted invoice amounts, or total project direct costs. Examples of costs included in this category are engineering capacity studies, reliability analysis and preliminary design work. Many of these costs cannot be attributed to a single capital project and are thus spread to those projects that are ultimately constructed and placed into service. These central activity costs are also called 'pooled' or 'indirect' costs. My Electric Distribution capital project testimony presents capital project forecasts as direct labor and non-labor costs. SDG&E has shown pool costs as separate components starting in the TY 2008 GRC. The mechanics of the distribution of indirect costs onto these project direct costs, resulting in total project costs, is performed in the rate base model. The source of Contract Administration and Department Overhead indirect costs originating in the Electric Distribution functions at SDG&E are presented in my testimony and address those pooled costs that are ultimately distributed over capital projects, including both electric and gas distribution. I also present the source of capital indirect costs related to Local Engineering - Electric Distribution (ED) Pool and the distribution portion of the Local Engineering - Substation Pool. Indirect capital costs are applied consistently and uniformly to work done within a given category, such as Electric Distribution, for both collectible and non-collectible jobs.

Internally at SDG&E, more detailed engineering is being done for new facilities and for rebuilding electric infrastructure. Historically, distribution has been a standards-based business. With regulation changes and an increased focus on risk reduction, the need has arisen to perform more engineering than in the past. The forecasts in the labor and non-labor areas of these local engineering pools are based on historical information with a trend applied to synchronize the pool forecasts with the overall increases in projected work for the entire Electric Distribution area and the distribution portion of the Electric Substation projects and related activities, respectively. The forecasted increases in the three other major categories described above will have a significant impact on the Local Engineering - Distribution Pool.

Additional details including description, forecast method and cost drivers for each capacity/expansion project can be found in each budget code below.

TABLE AFC-10
Summary of Overhead Pools Budgets ($'s in Thousands)

Budget Code	Description	ESTIMATED 2017	ESTIMATED 2018	ESTIMATED 2019
901	LOCAL ENGINEERING - ELECTRIC DISTRIBUTION POOL	60,788	81,200	97,618
904	LOCAL ENGINEERING - SUBSTATION POOL	13,948	25,924	48,346
905	DEPARTMENT OVERHEAD POOL	4,495	5,870	7,157
906	CONTRACT ADMINISTRATION POOL	5,872	7,392	9,370
	Totals	85,103	120,386	162,491

2. 901 - Local Engineering –ED Pool

The forecasts for the Local Engineering – Electric Distribution (ED) Pool for 2017, 2018, and 2019 are $60,788, $81,200, and $97,618, respectively.

a. Description

This budget provides funding for the Local Engineering - ED Pool. This pool consists of planners, designers, and engineers, and support personnel who research, analyze, and design the facilities needed to serve customers. These persons address the engineering needs for new services, facilities relocations, overhead-to-underground conversions, capacity, and reliability projects. These persons also address the interaction with internal and external customers in preparing a work order package for construction. This pool includes the costs that will be allocated to electric distribution capital activities. Typical activities included in this account are:

- Communicating with internal and external customers to collect information necessary to prepare a work order package for construction;
- Performing load and sizing studies to determine the design characteristics to apply to a construction project;
- Developing a design for the construction project that meets the customer needs for service and the overall system design requirements. This design identifies the material, labor and equipment requirements necessary to complete the construction project;
- Coordination of the permitting and rights of way requirements;

- Preparing cost estimates per the line extension rules and presenting these estimates to the internal or external customer for their approval;
- Preparing contracts and processing fees for new business construction projects; and
- Preparing work order packages and transmitting them to the internal and external groups.

Local Engineering activities are required to see a project from inception to completion. Due to the volume of capital work that takes place on the distribution system, the most effective and efficient way to allocate the planning and engineering activities is using the overhead pools. It is not feasible to charge directly for each electric distribution job due to the tremendous volume of work orders. These capital overhead pool forecast values are referenced in the Rate Base testimony of Craig Gentes in Exhibit SDG&E-33, under budget code 901.

Information regarding the Local Engineering - ED Pool budget is found in the capital workpapers. *See* SDG&E-14-CWP at section 00901 – Local Engineering - ED Pool.

b. Forecast Method

The forecast for this pool is derived from the base year expenditures with a net upward adjustment based on a historical relationship of Local Engineering – electric distribution capital overhead to capital expenditures. Local Engineering – electric distribution support tracks the historical relationship between the engineering and support requirements and the related capital of Capacity/Expansion, Mandated, Reliability/Improvements, and Transmission/FERC Driven Projects (Expenditures for Meters & Regulators, Capital Tools, and the Smart Meter Program are excluded).

c. Cost Drivers

The underlying cost driver in the growth of expenditures for this Pool is due to industry trends increasing the use of detailed engineering studies or designs, instead of relying solely on standards. New advanced tools, like LiDAR and PLS-CADD, are also changing the way engineering and design work is done for electric distribution facilities.

3. 904 - Local Engineering -Substation Pool

The forecasts for the Local Engineering – Substation Pool for 2017, 2018, and 2019 are $13,948, $25,924, and $48,346, respectively.

a. Description

This budget provides funding for the Local Engineering – Substation Pool. This pool consists of planners, designers, engineers and support personnel who research, analyze, and design the facilities needed to serve customers. These persons address the engineering needs for substation projects. These persons also address the interaction with internal and external customers in preparing a work order package for construction. This pool includes the costs that will be allocated to electric distribution and transmission substation capital activities. Typical activities included in this account are:

- Communicating with internal and external customers to collect information necessary to prepare a work order package for construction;
- Performing load and sizing studies to determine the design characteristics to apply to a construction project;
- Developing a design for the construction project that meets the customer needs for service and the overall system design requirements. This design identifies the material, labor and equipment requirements necessary to complete the construction project;
- Coordination of the permitting and rights of way requirements;
- Preparing cost estimates according to the line extension rules and presenting these estimates to the internal or external customer for their approval;
- Preparing contracts and processing fees for new business construction projects; and
- Preparing work order packages and transmitting them to the internal and external groups.

Local Engineering activities are required to see a project from inception to completion. Due to the volume of capital work that takes place on the distribution system, the most effective and efficient way to allocate the planning and engineering activities is using the overhead pools. It is not feasible to charge directly for each electric distribution/substation job due to the tremendous volume of work orders. In the case of the Local Engineering – Substation Pool, only the related substation activities are charged to this project. These capital overhead pool forecast

values are referenced in the testimony of Craig Gentes (Exhibit SDG&E-33, under budget code 904).

Information regarding the Local Engineering - Substation Pool budget is found in the capital workpapers. *See* SDG&E-14-CWP at section 00904 – Local Engineering - Substation Pool.

b. Forecast Method

The forecast for this pool is derived from the base year expenditures with a net upward adjustment based on a historical relationship of Local Engineering – substation capital overhead to capital expenditures. Local Engineering – substation support tracks the historical relationship between the engineering and support requirements and the related capital of Capacity/Expansion, Mandated, Reliability/Improvements, and Transmission/FERC Driven Projects (Expenditures for Meters & Regulators, Capital Tools, and the Smart Meter Program are excluded).

c. Cost Drivers

The underlying cost driver for this budget is capital substation work.

4. 905 - Department Overhead Pool

The forecasts for the Local Engineering – Overhead Pool for 2017, 2018, and 2019 are $4,495, $5,870, and $7,157, respectively.

a. Description

This budget provides funding for Department Overheads. Costs included in this budget are for supervision and administration of crews in the SDG&E Construction and Operation (C&O) districts. Department Overhead is charged for expenses that are not attributable to one project, but benefit many projects, or the C&O districts. C&O managers, construction managers, construction supervisors, dispatchers, operations assistants and other clerical C&O employees charge this account. Construction field employees charge this account when meeting on multiple projects. The non-labor piece consists of administrative expenses such as: office supplies, telephone expenses, mileage, employee uniforms and professional dues. This pool includes the costs that will be allocated to distribution electric capital activities. These capital overhead pool forecast values are referenced in the testimony of Craig Gentes (Exhibit SDG&E-33, under budget code 905). Typical activities included in this account are:

- Management and supervision of construction personnel; and
- Scheduling, material ordering, and dispatching for construction personnel.

Information regarding the Department Overhead Pool budget is found in the capital workpapers. *See* SDG&E-14-CWP at section 00905 – Department Overhead Pool.

b. Forecast Method

This forecast is derived by taking the base year expenditures and applying a net upward adjustment based on a historical relationship of electric and gas distribution capital overhead to capital expenditures. Department Overhead support tracks the historical relationship between the support requirements and the related capital of Capacity/Expansion, Franchise, Mandated, Materials, New Business, Reliability/Improvements, Safety and Risk Management, and Transmission/FERC Driven Projects (Expenditures for Meters & Regulators, Capital Tools, and the Smart Meter Program are excluded).

c. Cost Drivers

The underlying cost drivers in the Department Overhead Pool follow the costs in the other capital categories.

5. 906 - Contract Administration Pool

The forecasts for the Local Engineering – Contract Administration (CA) Pool for 2017, 2018, and 2019 are $5,872, $7,392, and $9,370, respectively.

a. Description

This budget provides funding for the CA Pool and consists of those expenses necessary for the administration of projects that are performed by contractors at SDG&E. The expenses to this pool consist of labor for Contract Administrators (CAs), Field Construction Advisors and support personnel, as well as the associated non-labor support costs such as office and field supplies. This pool includes the costs that will be allocated to contracted work. These capital overhead pool forecast values are referenced in the testimony of Craig Gentes (Exhibit SDG&E-33, under budget code 906). Typical activities included in this account are:

- Working with contractors to develop fixed price bids for construction projects;
- Overseeing the contractor work to remove obstacles and verify work is completed and complies with company standards;
- Approving contractor invoices for completed work; and
- Developing and administering contract units for unit priced contracts.

- The CA Pool consists of those expenses necessary for the administration of projects that are performed by contractors for SDG&E. Due to the volume of capital work that takes place on the electric distribution system, the most effective and efficient way to allocate the contract administration costs is using the CA Pool. It is not feasible to charge directly for each electric distribution job due to the tremendous volume of work orders.

Information regarding the CA Pool budget is found in the capital workpapers. *See* SDG&E-14-CWP at section 00906 – Contract Administration (CA) Pool.

b. Forecast Method

This forecast method used is zero based. CA support tracks the historical relationship between the support requirements and the related capital of Capacity/Expansion, Franchise, Mandated, New Business, Reliability/Improvements, Safety and Risk Management, and Transmission/FERC Driven Projects (Expenditures for Meters & Regulators, Capital Tools, and the Smart Meter Program are excluded).

c. Cost Drivers

The underlying cost drivers for this budget follow the cost drivers described in all other capital categories.

J. Reliability/Improvements

1. Introduction

Customers' expectations about the availability of service continue to increase. SDG&E has been proactive in trying to address this increased expectation and aging infrastructure issues.

SDG&E has been recognized for having a very reliable electric system. From 2005 through 2016, SDG&E has been ranked "Best in the West" in reliability by PA Consulting Group, earning their regional ReliabilityOne award for eleven consecutive years.[7] This is consistent with the Commission Staff's May 9, 2016, "California Electric Reliability Investor-Owned Utilities Performance Review 2006-2015" (CPUC Reliability Review)[8] finding that "reliability in the SDG&E service territory has maintained a consistently high level of reliability."[9]

Cable failures remain the biggest contributor to the System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI), and SDG&E continues to experience and forecast polymeric cable failures. The cable failure rate is primarily due to the remaining 1,639 circuit miles of high-failure rate unjacketed cable. Over the last five-years, cable failure has caused approximately 25% of all distribution outage minutes, and this continues to tax the workforce and impact customers. Additionally, SDG&E is beginning to see a rise in failures of jacketed cable, as the various types of jacketed cable approach their manufacturer recommended service life. SDG&E predicts a steady uptrend of jacketed cable failures over the next five-years.

SDG&E continues with its effort to improve reliability through the installation of additional Supervisory Control and Data Acquisition (SCADA) devices and other advanced technologies. With additional fault indicating, sectionalizing, and circuit automation devices, the ability to restore customers' service improves and outage times can be reduced.

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[7] Please see the Electric Distribution O&M testimony of William Speer (Exhibit SDG&E-15).

[8] Available at http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/PPD_Work_Products_(2014_forward)/PPD%20Reliability%20Review.pdf.

[9] *Id.* at iii.

Additionally, SDG&E has identified risk-mitigation projects in an effort to prioritize key reliability projects. As a result, SDG&E submitted the RAMP Report on November 30, 2016.[10] Identifying risks and mitigation efforts and assigning roles and responsibilities to address those issues are key characteristics of SDG&E's culture. Within my funding request are costs associated with risk-mitigation efforts identified in the utility-submitted RAMP Report. As discussed in the Risk Management testimony chapters of Diana Day and Jamie York (Exhibit SCG-02/SDG&E-02, Chapters 1 and 3, respectively), the costs of risk-mitigation projects and programs were translated from that RAMP Report into the Reliability Capital budgets below. Further details regarding RAMP specific Reliability Capital projects can be found under AFC-3 in Section II.

Additional details, including description, forecast method, and cost drivers for each capacity/expansion project can be found in each budget code below.

TABLE AFC-11
Summary of Reliability/Improvements Budgets ($'s in Thousands)

Budget Code	Description	ESTIMATED 2017	ESTIMATED 2018	ESTIMATED 2019
203	DISTRIBUTION SUBSTATION RELIABILITY	1,569	1,569	1,569
226	MANAGEMENT OF OH DIST. SERVICE	6,338	6,338	6,338
227	MANAGEMENT OF UG DIST. SERVICE	3,493	3,493	3,493
230	REPLACEMENT OF UNDERGROUND CABLES	11,800	26,257	15,564
236	CAPITAL RESTORATION OF SERVICE	10,832	11,162	11,502
1269	REBUILD POINT LOMA SUBSTATION	7,003	501	-
6254	EMERGENCY TRANSFORMER & SWITCHGEAR	50	1,000	50
6260	4 KV MODERNIZATION	-	8,954	11,393
7245	TELEGRAPH CANYON-4TH BANK & C1226	1,771	-	-
9271	MARGARITA SUB-NEW 12 kV CKT. 1259	722	-	-
11249	INSTALL SCADA ON LINE	289	5,346	5,295

[10] Previously identified in this testimony as I.16-10-015/I.16-10-016 RAMP Report of San Diego Gas & Electric Company and Southern California Gas Company, November 30, 2016. Please also refer to the Risk Management testimony chapters of Diana Day and Jamie York (Exhibit SCG-02/SDG&E-02, Chapters 1 and 3, respectively) for more details regarding the utilities' RAMP Report.

	CAPACITORS			
11253	WIRELESS FAULT INDICATORS	340	4,386	4,345
11261	SEWAGE PUMP STATION REBUILDS	1,546	331	-
11267	SCADA EXPANSION-DISTRIBUTION	-	6,976	6,976
12243	PHASOR MEASUREMENT UNITS	2,016	2,016	2,016
12246	ADVANCED GROUND FAULT DETECTION	321	321	321
12247	SMART ISOLATION & RECLOSING	1,356	1,356	1,356
12249	ADVANCED WEATHER STA. INTEGRATION & FORE	208	208	988
12266	CONDITION BASED MAINTENANCE-SMART GRID	1,546	1,546	1,546
13242	KEARNY 69/12 kV SUB REBUILD/RELOC	4,500	7,000	-
13243	NEW VINE 69/12 kV SUBSTATION	10,942	-	-
13244	STREAMVIEW 69/12 kV SUB REBUILD-PRE ENG	50	50	50
14143	POWAY SUBSTATION REBUILD	177	-	-
15243	SUBSTATION SCADA EXPANSION-DISTRIBUTION	547	554	-
16244	METEOROLOGY-OUTAGE PREDICTION MODELING	717	-	-
16245	METEOROLOGY-FIRE BEHAVIOR MODELING	272	-	-
16257	VAULT RESTORATION	-	1,000	1,000
16258	OIR WORST CIRCUITS	2,502	2,502	2,502
16260	MORRO HILL SUB REBUILD	12	1,118	3,751
17253	ELECTRIC DISTRIBUTION GRID ANALYTICS	-	3,300	3,300
93240	DISTRIBUTION CIRCUIT RELIABILITY CONSTRUCTION	2,800	2,990	4,949
99282	REPLACE OBSOLETE SUB. EQPT.	1,144	8,144	15,144
	Totals	74,863	108,418	103,448

2. 203 - Distribution Substation Reliability

The forecasts for the Distribution Substation Reliability for 2017, 2018, and 2019 are $1,569, $1,569, and $1,569, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for small changes to electrical distribution substation facilities. General project categories include safety related improvements, replacement of failed/obsolete equipment, and capital additions under $500,000. This budget is required to maintain the reliability and integrity of distribution substations. The specific work required to meet safety requirements, replace obsolete or failed equipment, and make necessary small capital additions is based on requests from Engineering, Planning, Operations, and Maintenance groups.

Information regarding the Management of Distribution Substation Reliability initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 00203 – Distribution Substation Reliability.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a longer period and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this budget is the need to replace failed equipment in SDG&E's substations.

3. 226 - Management of OH Dist. Service

The forecasts for the Management of Overhead Distribution Service for 2017, 2018, and 2019 are $6,338, $6,338, and $6,338, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to reinforce the electric overhead distribution system infrastructure by responsive action to system damages, deterioration, and unsafe conditions outside normal restoration of service. The overall objective is to maintain continuity of safe and reliable customer service.

This budget also provides for the reconstruction of existing overhead distribution facilities as necessary to correct improper voltage conditions, replace overloaded overhead facilities, make emergency repairs not normally associated with restoration of service, repair or replace deteriorated or unsafe equipment not found through the Corrective Maintenance

Program, and install fault indicators, fusing and switching equipment as necessary to maintain service reliability.

The alternatives to full funding for this budget include:

- Reduction or suspension of mitigating efforts and correction of customer voltage problems (complaints);
- Operation of existing overhead facilities under overloaded conditions beyond acceptable limits that could accelerate system failures; and
- Delay in emergency repairs of unsafe conditions.

The above alternatives will have an adverse effect on public safety, service reliability, customer satisfaction and repair costs. Delaying responsive action could ultimately result in regulatory fines, increased number of customer complaints, and higher long-term repair costs.

Information regarding the Management of OH Distribution Service initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 00226 – Management of OH Distribution Service.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a longer period and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost drivers for this budget are the need to make overhead equipment repairs and upgrades necessary to maintain continuity of safe and reliable electric service to SDG&E customers.

4. 227 - Management of UG Dist. Service

The forecasts for the Management of Underground Distribution Service for 2017, 2018, and 2019 are $3,493, $3,493, and $3,493, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to reinforce the electric underground distribution system infrastructure by responsive action to system damages, deterioration, and unsafe conditions

outside normal restoration of service. The overall objective is to maintain continuity of safe and reliable customer service.

This budget also provides for the reconstruction of existing underground distribution facilities as necessary to correct improper voltage conditions, replace overloaded underground facilities, make emergency repairs not normally associated with restoration of service, repair or replace deteriorated or unsafe equipment not found through the Corrective Maintenance Program and install fault indicators, fusing and switching equipment as necessary to maintain service reliability.

The alternatives to full funding for this budget include:

- Reduction or suspension of mitigating efforts and correction of customer voltage problems (complaints);
- Operation of existing underground facilities under overloaded conditions beyond acceptable limits that could accelerate system failures; and
- Delay in emergency repairs of unsafe conditions.

The above alternatives will have an adverse effect on public safety, service reliability, customer satisfaction and repair costs. Delaying responsive action could ultimately result in regulatory fines, increased number of customer complaints and higher long-term repair costs.

Information regarding the Management of OH Distribution Service initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 00227 – Management of UG Distribution Service.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a longer period and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost drivers for this budget are the need to make underground equipment repairs and upgrades necessary to maintain continuity of safe and reliable electric service to customers.

5. 230 - Replacement of Underground Cables

The forecasts for the Replacement of Underground Cables for 2017, 2018, and 2019 are $11,800, $26,257, and $15,564, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for the proactive replacement of underground cable that was identified to have a high probability of failure based on electric reliability circuit analysis and historical cable failure data. It is also required to provide quality customer service and reliability to existing customers by proactively replacing failed cable in the underground cable system. There are approximately 85 circuit miles of unjacketed feeder cable and 1809 circuit miles of unjacketed lateral cable remaining on the SDG&E electric distribution system.

Information regarding the Replacement of Underground Cable initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 00230 – Replacement of Underground Cable.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this budget is to provide quality customer service and reliability to existing customers by proactively replacing cable in the underground cable system.

6. 236 - Capital Restoration of Service

The forecasts for the Capital Restoration of Service for 2017, 2018, and 2019 are $10,832, $11,162, and $11,502, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for the restoration of electric service due to system interruptions caused by severe inclement weather conditions, fires, equipment failures, and damages caused by a third party. It also provides for the reconstruction of existing overhead and

underground distribution facilities as necessary to restore electric service to customers. The funds within this budget cover all costs associated with the following factors:

- Storm damage (rain/wind/fire, for example);
- Damage to electric distribution facilities by others (*e.g.*, car/equipment contacts);
- Emergency repairs of facilities that are required for service restoration (cable or equipment failures, for example).

The budget provides reactionary repairs to SDG&E distribution facilities as necessary to restore electric service to customers in a timely manner and in compliance with the CPUC General Orders.

The alternatives to full funding for this project include:

- A reduction or suspension of restoration efforts; and
- A delay in timely restoration of system interruptions.

The noted alternatives will have an adverse effect on public safety, service reliability, customer satisfaction and repair costs. Delaying responsive action could ultimately result in regulatory fines and poor customer and community relationships.

Information regarding the Replacement of Underground Cable projects is found in the capital workpapers. *See* SDG&E-14-CWP at section 00236 – Capital Restoration of Service.

b. Forecast Method

The forecast method used is a four-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The four-year average levels out the peaks and valleys in this blanket budget over a longer period and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this budget is storm activity or extreme weather events.

7. 1269 – Rebuild Point Loma Substation

The forecasts for Rebuild Point Loma Substation project for 2017, 2018, and 2019 are $7,003, $501, $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to rebuild the 69/12 kV Point Loma Substation while also accommodating the addition of a third 69/12 kV transformer. After the completion of work, the substation will have an ultimate capacity of 120 MVA. The rebuild of the substation consists of several elements including the replacement of five aging 69 kV transmission line circuit breakers and 69 kV Potential Transformers, rebuilding the 69 kV bus, and installing a new control shelter. This project will not require a Permit to Construct (PTC), thus streamlining the construction process.

Information regarding Point Loma – Install Third Bank is found in the capital workpapers. *See* SDG&E-14-CWP at section 01269 – Point Loma-Install Third Bank.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates, which were developed based on the specific scope of work for this project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to assess whether estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is to address reliability issues with the Point Loma Substation.

8. 6254 - Emergency Transformer and Switchgear

The forecasts for Emergency Transformer and Switchgear for 2017, 2018, and 2019 are $50, $1,000 and $50 respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to support the restoration of service to our distribution customers following outages caused by equipment failures by purchasing additional emergency spare and mobile equipment. The number of aging transformers and switchgear on the SDG&E system is at the level that additional failures are expected despite our efforts to replace the equipment before failure. Lead times for replacement units continue to be extended out farther

every year. This project will provide additional 69/12 kV transformers and 12 kV switchgear to maintain the level of spare equipment required to support the aging fleet of transformers and switchgear. SDG&E currently does not have any mobile 12 kV regulators or a section of 12 kV switchgear. This project will correct that with the purchase of both of those items. A failure inside of any existing metalclad switchgear could result in a lengthy outage without an available mobile unit. All mobile equipment is usually connected using portable 69 kV and 12 kV cables – this budget will allow funding to maintain the required number of portable cables required to connect all portable equipment.

Information regarding this initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 06254 – Emergency Transformer and Switchgear.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates, which were developed based on the specific scope of work for this project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to assess whether estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver associated with this budget is the safe and rapid restoration of service following an outage caused by equipment failures.

9. 6260 – 4 kV Modernization

The forecasts to remove 4 kV substations from service for 2017, 2018, and 2019 are $0, $8,954, and $11,393, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to remove from service a matured class of infrastructure that is often regarded throughout the utility industry as obsolete. Retaining 4 kV substations would exacerbate existing safety, operation and maintenance issues. Half of the substations are more than 50 years old, and replacement components for those substations are no longer available. The operation of 4 kV substations is of a major safety concern because the company is

facing a shortage of qualified crews and electricians who are familiar with and knowledgeable about design and operation of those aging and obsolete substations. The maintenance cost is unusually high and continues to increase. The 4 kV substations also present reliability risks for customers, because high failure rates and lack of replacement parts have the potential to cause more frequent and unnecessary extended outages. SDG&E's 4 kV modernization plan addresses all areas of 4 kV substation and distribution infrastructure removals and upgrades. The plan spans 27 years, prioritized by the replacement of 4 kV substation and circuits of the highest risk, as determined by various operational factors, and measured as a ratio of enterprise benefits to cost. This budget incorporates mitigation of potential safety risks identified through RAMP in the early years of the program. Construction will include but will not be limited to changing poles, cross-arms, conductors, insulators, transformers, switches, pad-mounted equipment, subsurface structures, and other equipment to accommodate modern 12 kV construction with advanced distribution automation and volt-var control (*e.g.*, conservation voltage reduction [CVR] capabilities).

Information regarding the 4 kV Modernization initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 06260 – 4 kV Modernization.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates, which were developed based on the specific scope of work for this project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to assess whether estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is to increase reliability, improve overall operational flexibility, safety risk reductions, environmental benefits, and strategic drivers including reduced long-term operational and maintenance costs, added capacity for distributed energy resources, reduced energy losses (improved energy efficiency), and opportunities to repurpose land.

10. 7245 – Telegraph Canyon-4th Bank and C1226

The forecasts for Telegraph Canyon- 138/12 kV Bank & C1226 for 2017, 2018, and 2019 are $1,771, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to mitigate heavily loaded circuits in the Otay Mesa area and increase reliability for circuits feeding the Salt Creek substation, as well as major customers in the area. The project requires trenching and installing conduit as well as new underground cable along with removing existing underground cable. Two new PME3 manual switches will be installed and the relabeling of electric distribution equipment is also required after load is transferred. This project will provide further ties to circuits being cut over to the Salt Creek substation.

Information regarding Telegraph Canyon- 138/12 kV Bank & C1226 is found in the capital workpapers. *See* SDG&E-14-CWP at section 07245 – Telegraph Canyon- 138/12 kV Bank & C1226.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is to mitigate a forecasted 94% heavily loaded circuit 942 and to increase reliability for circuits fed by Salt Creek substation as well as major customers in the area.

11. 9271 – Margarita Substation – New 12 kV Circuit 1259

The forecasts for the Margarita Substation – New 12 kV Circuit 1259 for 2017, 2018, and 2019 are $722, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to improve reliability in the South Orange County area by transferring load from other circuits to the newly constructed circuit. This is the preferred project to ensure SDG&E can provide safe and reliable service to its customers in the area. The project requires trenching and installing conduit as well as underground cable along with a four-Way Trayer SCADA switch. Retagging of electric distribution equipment is also required after load is transferred.

Information regarding the Margarita Substation – New 12 kV Circuit 1259 project is found in the capital workpapers. *See* SDG&E-14-CWP at section 09270 – Margarita Substation – New 12 kV Circuit 1259.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is to provide additional capacity for new customer developments and enhance circuit reliability in the area by enhancing the tie capacity on several circuits.

12. 11249 - Install SCADA On Line Capacitors

The forecasts for Install SCADA On Line Capacitors for 2017, 2018, and 2019 are $289, $5,346, and $5,295, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to convert existing distribution line capacitors to SCADA control, in order to provide improved VAR control and improved system efficiency and operability. SCADA controls will also alert utility personnel of capacitor failures and/or fuse

operations. This will increase capacitor bank reliability, minimize downtime, and expedite repair work.

SCADA controlled capacitor banks will provide local and remote control, failure prediction and detection, reduced operating cost, and should enhance distribution system performance through improved voltage and reactive power control. SCADA on line capacitors will improve SDG&E's ability to dynamically adjust reactive power flow, which is critical to accommodating evolving technologies, including less predictable Distributed Energy Resources. SCADA controlled capacitors will also allow early indications of problems and potential failures of line capacitors.

Information regarding the SCADA On Line Capacitors initiative is found in the capital workpapers. *See* SDG&E-14-CWP section 11249 – Install SCADA On Line Capacitors.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this capital project is to enhance system capacity and circuit reliability on the system by increasing the operating capabilities of our distribution capacitors.

13. 11253 - Wireless Fault Indicators

The forecasts for Wireless Fault Indicators for 2017, 2018, and 2019 are $340, $4,386, and $4,345, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to install wireless fault indicators on SDG&E's distribution system. Wireless fault indicators are used to continuously monitor distribution circuits to locate faults more efficiently and accurately due to rapid pinpointing of line faults. When coupled with

the On-Ramp Wireless system, the wireless fault indicator will communicate information to distribution system operators. This allows the operators to dispatch electric troubleshooters closer to the exact fault location to more quickly identify and isolate the fault and begin service restorations. Wireless fault indicators provide detection and indication of electrical faults in the electric power distribution networks of the utility. Currently, the status of the indicators (tripped or reset) must be checked by visual inspection. This method takes a considerable amount of time to drive to the field, patrol the line to locate the tripped fault circuit indicator and repair the line. In addition, there is no way to validate that the existing indicator is working properly. The new wireless fault indicator employs wireless communications technologies to remotely monitor their status.

Information regarding the Wireless Fault Indicator initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 11253 – Wireless Fault Indicators.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is to enhance system restoration times and overall system reliability by employing wireless communication technologies to remotely monitor line faults.

14. 11261 - Sewage Pump Station Rebuilds

The forecasts for Sewage Pump Station Rebuilds for 2017, 2018, and 2019 are $1,546, $331, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to rebuild three existing 12/4kV substations which feed City of San Diego owned sewage treatment and pump station facilities based on aging

infrastructure and the goal of increased reliability. Point Loma Sewage, Sewage Pump Station #1, and Sewage Pump Station #2 are the three substations associated with this budget. The three stations that are being rebuilt feed the City's operation that pumps all the sewage generated in the city and a large portion of the sewage generated in the county out to be treated before it is pumped into the Pacific Ocean. All three stations need upgrades to the breakers and transformers, as the electrical equipment has reached the end of its life.

Information regarding the Sewage Pump Station Rebuilds is found in the capital workpapers. *See* SDG&E-14-CWP at section 11261 – Sewage Pump Station Rebuilds.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver is the need to replace aging infrastructure that supports the service provided to the sewage pump stations described above.

15. 11267 - SCADA Expansion-Distribution

The forecasts for SCADA Expansion – Distribution for 2017, 2018, and 2019 are $0, $6,976, and $6,976, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for the installation and expansion of the SCADA system on distribution circuits through the addition of new automated switches. The budget targets expanding feeder isolation SCADA switches to increase sectionalizing capabilities, reducing large customer count impact. It also targets increasing SCADA tie switches between different circuits to provide quick restoration capabilities to customer load isolated from the substation source due to damage/fault.

Information regarding the SCADA Expansion – Distribution initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 11267 – SCADA Expansion – Distribution.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is to enhance system restoration times by improving the SCADA system on our distribution circuits.

16. 12243 – Phasor Measurement Units

The forecasts for Phasor Measurement Units (PMU) for 2017, 2018, and 2019 are $2,016, $2,016, and $2,016, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for PMU throughout the distribution system to employ high-speed time-synchronized measurement devices. The installation of these devices will occur at substations and at key points on the distribution system. The time stamped, and digitized waveform measurement technology introduces key insight to the distribution system. Using time stamped, digitized waveform measurements, SDG&E can analyze the output of PV systems, identify changes in PV output and enable the dispatch of energy storage devices to counteract the effects of PV output fluctuation.

Information regarding the PMU initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 12243 – Phasor Measurement Units.

b. Forecast Method

The forecast method used is a three-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The three-year average forecast method more closely trends to the actual spend on the budget, and levels out the

peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver for this budget is to improve reliability by employing high speed, time synchronized measurement devices.

17. 12246 – ADVANCED GROUND FAULT DETECTION

The forecasts for Advanced Protection for 2017, 2018, and 2019 are $321, $321, and $321, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to enhance ground fault detection schemes for distribution circuits to allow for improved detection of downed conductors. The project will also provide protective relay systems to detect high impedance faults, where the fault current may be very low and the resultant arcing fault may provide erratic current input to the protective relay. This effort will concentrate on protective relays on distribution feeder breakers in substations, and on pole-mounted service restorers on the distribution feeder. The advanced protective systems will provide faster isolation of downed conductors, promoting enhanced safety and improved service reliability. The project will install new equipment and upgrades at substations within high risk fire areas and upgrade and install new service restorers.

Additionally, the budget will improve public safety, and the reduced risk of fire ignition from downed conductors will result from the early detection and isolation of low-current intermittent ground faults. These "high impedance" faults are very difficult to detect with conventional protective relay applications. Newly enhanced equipment and algorithms are increasingly available for use on SDG&E's distribution system in both new installation and existing device upgrade applications. The scope will integrate well with other company efforts to maximize safe operation of our distribution system infrastructure. The additional SCADA data retrieved from the new algorithms will further improve the knowledge base regarding high-impedance faults specific to SDG&E's service territory.

Information regarding the Advanced Protection budget is found in the capital workpapers. *See* SDG&E-14-CWP at section 12246 – Advanced Protection.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for each project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this project are to enhance public safety and to improve reliability by reducing the risk of fire ignition from downed conductors.

18. 12247 – Smart Isolation and Reclosing

The forecasts for Smart Isolation and Reclosing for 2017, 2018, and 2019 are $1,356, $1,356, and $1,356, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for off-the-shelf technology to limit the discharge energy on the distribution system. The sensor-equipped devices reduce energy applied to the system when reclosing into a faulted section of a circuit for testing. Installation of these devices will consist of specific locations throughout the distribution system.

Information regarding the Smart Isolation and Reclosing initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 12247 - Smart Isolation and Reclosing.

b. Forecast Method

The forecast method used for is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is to enhance reliability and improve public safety.

19. 12249 – Advanced Weather Station Integration and Forecast

The forecasts for Advanced Weather Station Integration and Forecast for 2017, 2018, and 2019 are $208, $208, and $988, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to further modernize the SDG&E weather network, which is currently the largest network of its kind anywhere in the country. This weather network brings superior situational awareness for the weather conditions impacting the electric and gas system, supporting daily operations and emergency operations. The weather network also serves as a data foundation for high performance computer modeling which generates multiple analytical tools that are used across the organization.

This budget aims to replace aging sensors and equipment with the latest technology. This will include new thermometers, hygrometers, anemometers, batteries, solar panels, modems, and in some cases pyrometers. Much of this equipment has reached its life expectancy of three to five years and a proactive modification of this instrumentation will be necessary to keep the network running efficiently into the future.

The SDG&E weather network has become a critical component to the success of the Community Fire Safety Program. The weather information is used to calibrate models such as the Fire Potential Index and the SDG&E Outage Prediction Model which gives our company the ability to anticipate when critical fire weather conditions or strong storms are approaching the area, allowing proactive preparedness measures to be taken. The weather network is also one of the primary pieces of intelligence that is used when, and if, the decision is made to proactively de-energize portions of the electric infrastructure during times of critical fire weather conditions. In addition to becoming a critical component in how SDG&E keeps its employees, customers and communities safe, this information is also shared with our stakeholders. The typical lifespan of our meteorological instrumentation is close to five years, and proactive maintenance of the weather network will be an important component for future success of the Community Fire Safety Program (CFSP).

Information regarding the Advanced Weather Station Integration and Forecast budget is found in the capital workpapers. *See* SDG&E-14-CWP at section 12249 – Advanced Weather Station Integration and Forecast.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this budget is the replacement of aging meteorological instrumentation.

20. 12266 – Condition Based Maintenance – Smart Grid

The forecasts for Condition Based Maintenance – Smart Grid for 2017, 2018, and 2019 are $1,546, $1,546, and $1,546, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to implement advanced technologies to monitor the health of critical distribution substation assets. SDG&E installs Conditioned Based Maintenance (CBM) monitoring equipment on distribution facilities in SDG&E substations. The CBM project benefits are centered around better understanding the health of assets so that proper maintenance activities are identified and performed as needed to achieve greater asset utilization and longevity of use. Additionally, the CBM project has a dependency from the Outage Management System/Distribution Management System (OMS/DMS) system that will use portions of the real-time asset information generated by the CBM system to dynamically rate substation transformer load capacity, which provides operational benefits aligned with the Smart Grid Deployment plan.

Information regarding Condition Based Maintenance – Smart Grid budget is found in the capital workpapers. *See* SDG&E-14-CWP at section 12266 – Condition Based Maintenance – Smart Grid.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this budget are the need to install advanced monitoring equipment on substation equipment and to enhance safety and reliability.

21. 13242 – Kearny 69/12 kV Sub Rebuild/Relocation

The forecasts for the Kearny 69/12 kV Substation Rebuild/Relocation project for 2017, 2018, and 2019 are $4,500, $7,000, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to rebuild the existing Kearny substation. The Kearny substation ranks second in the number of outages when ranked among SDG&E's substation fleet. The capacity of the existing substation cannot be expanded to a fourth transformer bank required for reliability in 2017 to serve the new and adjacent Kaiser Hospital and to meet projected electric distribution load growth in the Kearny Mesa area. The Kearny substation consists of aging infrastructure including switchgear, transformers, transmission and distribution circuit breakers and capacitors.

Kearny substation, built in 1968, ranks in the top percentile of the SEA team's substation rebuild need rankings based on number of substation outages. It currently feeds the San Diego County Emergency Operation Center and feeds the new Kaiser Hospital built approximately half a mile from the Kearny substation. Approximately 4MW of load from this hospital is being served by this substation. With this load addition, Kearny substation is at 93% capacity which

will drive the need for a fourth transformer bank addition for reliability and future capacity. Due to the current configuration of the substation, the substation must expand to add this fourth transformer bank and associated 12 kV equipment.

Information regarding the Kearny 69/12 kV Substation Rebuild/Relocation project is found in the capital workpapers. *See* SDG&E-14-CWP at section 13242 – Kearny 69/12 kV Substation Rebuild/Relocation.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this budget is increased system reliability.

22. 13243 – New Vine 69/12 kV Substation

The forecasts for the New Vine 69/12 kV Substation for 2017, 2018, and 2019 are $10,942, $0, and $0, respectively. SDG&E plans to build and place this project in-service by the test year.

a. Description

This budget provides funding to construct a new 69/12 kV substation with an ultimate capacity of 120 MVA in the downtown San Diego area. The project is currently under construction and will serve the downtown and outlying areas in San Diego once completed. The project will also add tie capacity and increase reliability to the existing substations in the area.

Information regarding the New Vine 69/12 kV Substation is found in the capital workpapers. *See* SDG&E-14-CWP at section 13243 – New Vine 69/12 kV Substation.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates,

contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this project is to accommodate load growth in the San Diego downtown area and improve reliability of existing infrastructure.

23. 13244 – Streamview 69/12 kV Sub Rebuild – Pre Eng

The forecasts for the Streamview 69/12 kV sub rebuild – pre-engineering for 2017, 2018, and 2019 are $50, $50, and $50, respectively. SDG&E plans to complete the preliminary engineering by the test year while the remainder of the project is expected to continue beyond the test year.

a. Description

This budget provides funding for the purchase of land adjacent to the existing Streamview substation along with the pre-engineering required to rebuild the facility. This project will rebuild the Streamview substation to an ultimate capacity of 120 MVA, four transformer bank substations, and will also improve tie capacity in the College area. The project will also be necessary to increase substation capacity.

Information regarding the Streamview 69/12 kV Substation rebuild is found in the capital workpapers. *See* SDG&E-14-CWP at section 13244 – Streamview 69/12 kV Sub Rebuild.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this capital project are to increase reliability by replacing aging infrastructure and to decrease per circuit customer count exposure during potential outages.

24. 14143 – Poway Substation Rebuild

The forecasts for the Poway Substation Rebuild for 2017, 2018, and 2019 are $177, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to rebuild the existing 69/12 kV Poway Substation due to aging infrastructure and a lack of SCADA functionality within the existing facility. The project will underground three 69 kV transmission lines into the substation while also making provisions for a fourth line to accommodate future expansion. The substation will be rebuilt as a low-profile design with a new control shelter, transmission bus work, and adding space for an ultimate capacity of 120 MVA.

Information regarding the Poway Substation Rebuild project is found in the capital workpapers. *See* SDG&E-14-CWP at section 14143 – Poway Substation Rebuild.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this capital project is to improve reliability by replacing aging infrastructure and adding SCADA to the substation.

25. 15243 – Substation SCADA Expansion - Distribution

The forecasts for the Substation SCADA Expansion – Distribution for 2017, 2018, and 2019 are $547, $554, and $0, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for the installation, upgrades, and expansion of the SCADA system at SDG&E's distribution substations. Benefits of installing SCADA include faster faulted circuit identifications, faster isolation of faulted electric distribution circuits, faster load restoration when system disturbances occur and improved system performance by mitigating electric system deficiencies.

Information regarding Substation SCADA Expansion – Distribution is found in the capital workpapers. *See* SDG&E-14-CWP at section 15243 – Substation SCADA Expansion - Distribution.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Costs Drivers

The underlying cost drivers for this budget are for improved system reliability, improved system restoration, and the mitigation of the distribution system deficiencies.

26. 16244 – Meteorology – Outage Prediction Modeling

The forecasts for Meteorology – Outage Prediction Modeling for 2017, 2018, and 2019 are $717, $0, and $0, respectively. SDG&E plans to build and place the Outage Prediction Modeling project in service by the test year.

a. Description

This budget provides funding to use data analytics and historical outage data to predict the impacts from winter storms, lightning storms, or any adverse weather events. While comprehensive models have been previously built, this project will finalize model verification, information visualization and deployment. SDG&E will use the weather models built to support our CFSP and integrate these models into outage prediction algorithms. The predicted outages will then be fed into our OMS system providing decision support for storm operations.

Weather is the number one impact on the electric system. The Outage Prediction Modeling system will work to quantify the weather-related impacts that SDG&E may experience on the system 365 days a year, using state of the art computing techniques. Just as the Fire Potential Index (FPI) has been able to streamline our response to wildfire potential, this new model will streamline our ability to respond to the outage potential on the system.

Information regarding the Meteorology – Outage Prediction Modeling budget is found in the capital workpapers. *See* SDG&E-14-CWP at section 16244 – Meteorology – Outage Prediction Modeling.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this project is to increase reliability and enhance safety by predicting the impacts from winter storms, lightning storms, or any adverse weather events.

27. 16245 – Meteorology – Fire Behavior Modeling

The forecasts for Meteorology – Fire Behavior Modeling for 2017, 2018, and 2019 are $272, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to modernize and operationalize fire behavior modeling by leveraging the technology developed to run the Wildfire Risk Reduction Model (WRRM) and run that operationally using high performance computing. Each day when the SDG&E Meteorology team runs its weather forecasts and fuels analysis, the digitized output will feed directly into a devoted server that will then use that information to simulate thousands of ignitions across the service territory. Based upon the growth pattern of the fires, we can take that

intelligence to present a risk assessment to operations so that they will be able to effectively prepare.

This project will take results from predictive models of wind location/intensity and integrate them into an operational tool. This tool will yield daily assessments of fire threat, which the system operators will associate with potential system failures. Each potential failure will be analyzed together with forecasted weather and fuels information to assess fire growth potential and the impacts to the company and the community, should an ignition occur. The resulting daily risk assessment report will support the safe and reliable operation of the system, *e.g.*, the implementation of sensitive relay settings, staging crews, fire crew staging, and reclosing functions.

Meteorology has worked closely with our Fire Coordination group to enhance the fire science that is integrated into our company's operational decision-making. Meteorology has also built state-of-the-art prediction models to forecast the location and intensity of winds that can damage our electric system, through rapid and catastrophic wildfire growth across our service territory. The objective is to leverage the investment in wildfire situational awareness and integrate this into a single tool. For example, SDG&E will integrate all of the data generated by the wildfire models into the WRRM, thus calculating real-time risk on the system, to prioritize staging and assist operational decision support. In addition to being used as a daily threat assessment and decision support tool, Fire Behavior Modeling will also be used as an emergency management tool, should a large fire start in SDG&E's service territory. This tool will be able to predict fire perimeters using the latest fire science and weather technology that SDG&E has developed. We will be able to integrate the model output into a geospatial environment that will enable our Fire Coordination team to quickly determine which portions of the distribution and transmission system are threatened.

Information regarding the Meteorology – Fire Behavior Modeling project is found in the capital workpapers. *See* SDG&E-14-CWP at section 16245 – Fire Behavior Modeling.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual

costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers of this budget are to support the safe and reliable operation of the system and decision making via the daily risk assessment report.

28. 16257 – Vault Restoration

The forecasts for Vault Restoration for 2017, 2018, and 2019 are $0, $1,000, and $1,000, respectively. This is an ongoing project that is expected to continue through the test year.

a. Description

This budget provides funding for the replacement or repair of deteriorated customer-owned vaults associated with SDG&E facilities. Each vault is inspected through our CMP, and based on the results of these detailed inspections, minor equipment repairs (*e.g.*, lighting, fans) and/or major structural repairs are identified. Engineering practices and CPUC General Orders dictate the replacement or repairs of these vaults be completed to ensure employee, contractor, and public safety.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers of this project are increasing reliability and enhancing public and employee safety.

29. 16258 – Order Instituting Rulemaking (OIR) Worst Circuits

The forecasts for the OIR Worst Circuits for 2017, 2018, and 2019 are $2,502, $2,502, and $2,502, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to support projects and construction of projects that include modifications to, installation and/or replacement of equipment to improve reliability on SDG&E's 1% worst circuits as identified in the CPUC Annual Reliability Report. This budget is a result of the CPUC's recent OIR R.14-12-014 – Electric Reliability Reporting, which addresses the top 1% worst circuits at the utility. SDG&E is required to determine and complete cost-effective remediation projects on worst circuits and to improve the circuits that include any or all of the following; installation of fuses, overhead and underground manual switches, SCADA service restorers, SCADA switches, overhead fault indicators, circuit reconfiguration, and circuit reconductoring for improving electric system reliability.

Information regarding the OIR Worst Circuit initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 16258 – OIR Worst Circuits.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this budget are switch installations, reconductors, installation of fault indicators, circuit reconfiguration, installation of fuses, and other circuit modifications required to improve reliability on these worst performing circuits.

30. 16260 – Morro Hill Substation Rebuild

The forecasts for the Morro Hill Substation Rebuild for 2017, 2018, and 2019 are $12, $1,118, and $3,751, respectively. This is an ongoing project that is expected to continue through the test year.

a. Description

This budget provides funding to replace aging infrastructure at the existing Morro Hill substation. The Morro Hill substation was originally built in 1977 as a short-term substation

solution utilizing wood structures and minimal equipment. The need for the substation still exists and it needs to be completely rebuilt to eliminate the wood pole structures and replace aging equipment and infrastructure.

The objectives and benefits of the rebuild include replacing existing and obsolete infrastructure to new standards, including the addition of transmission protective circuit breakers for the transformers and the addition of bus ties – all of which increase reliability and operational effectiveness, rebuilding equipment to new seismic standards, rebuilding the facility to new security standards, improving the aesthetics of the existing substation, increasing ultimate distribution and transmission capacity, increasing available distribution tie capacity between neighboring substations which allows for more operating flexibility and shorter outage times, reducing maintenance on substation equipment, supporting the addition of monitoring specific substation equipment which results in improved maintenance and operations, and increasing safety (both public and employee) due to design spacing, fire walls, and new equipment.

Information regarding the Morro Hill Sub Rebuild project is found in the capital workpapers. *See* SDG&E-14-CWP at section 16260 – Morro Hill Sub Rebuild.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers of this project are replacing aging infrastructure and increasing reliability and safety at the existing Morro Hill substation.

31. 17253 – Electric Distribution Grid Analytics

The forecasts for Electric Distribution Grid Analytics for 2017, 2018, and 2019 are $0, $3,300, and $3,300, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to expedite decisions made for outage and storm management. This ultimately leads to a reduction in SAIDI and SAIFI impacts. The budget also enhances the reliability and safe operation of the distribution system. SDG&E will consolidate data sources from different functional areas allowing operations to create operational reports and dashboards for reliability, storm, and day-to-day management. These applications would provide data to management for decision making. The project will consolidate data from Service Now, SCADA (direct feed preferred), NMS (as switched), Customer (AMI), EDW, GIS (as built), Click (work order); SAP - financials, PM; Cascade, DERMS, and PMU. The project will build dashboards and create reports that contain real-time outages (electric and communications), alarms, trends, prediction, calculates SAIDI and SAIFI, and maintains correlation with asset history and failure.

Information regarding Electric Distribution Grid Analytics is found in the capital workpapers. *See* SDG&E-14-CWP at section 17253 – Electric Distribution Grid Analytics.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this budget is to enhance the reliability and safe operation of the distribution system as well as improve system restoration efforts.

32. 93240 – Distribution Circuit Reliability Construction

The forecasts for Distribution Circuit Reliability Construction for 2017, 2018, and 2019 are $2,800, $2,990, and $4,949, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for the addition of equipment necessary to improve service reliability of electric customers and maintain corporate reliability standards. The electric service reliability will deteriorate in the absence of comprehensive remedial solutions offered by these projects, and electric reliability performance is negatively impacted by system deficiencies and an aging infrastructure. This budget funds projects that mitigate existing electric system deficiencies and improve system performance per General Reliability, SCADA Initiatives and the Community Fire Safety Program.

Information regarding the Distribution Circuit Reliability Construction initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 93240 – Distribution Circuit Reliability Construction.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this budget are mitigating existing electric system deficiencies and projects for system performance improvements.

33. 99282 – Replace Obsolete Substation Equipment

The forecasts to Replace Substation Obsolete Substation Equipment for 2017, 2018, and 2019 are $1,144, $8,144, and $15,144, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to improve safety and reliability related to the replacement of obsolete and problematic substation equipment. SDG&E will focus primarily on distribution substation bank transformers and circuit breaker replacements. The Substation Equipment Assessment (SEA) Team will develop alternatives to replace or remove obsolete and problematic

equipment. A condition assessment process and evaluation criteria have been created using probability and risk analysis, financial impacts and present value analysis to evaluate projects. Equipment that is truly obsolete, such as equipment that cannot be maintained (no spare parts available) or that poses a safety risk will be replaced. Each year, the average age of all substation equipment increases, with the oldest transformer currently over 80 years old. The ranking of substation equipment is an ongoing process and involves identifying equipment that presents a significant risk to the system. Based on the cost and availability of raw materials from the manufacturer and global demand, lead times for major substation equipment has increased to six months for circuit breakers and to approximately one year for transformers.

Substations are essential to the operation of the electric system and must be kept in reliable condition. The sum of all distribution substations contains a total of approximately 300 transformers with an average age of approximately 13 years and 1500 circuit breakers, with an average age of 26 years. The estimated cost of replacing three percent or nine bank transformers, and five percent or 75 distribution circuit breakers is $26M, which will provide a sufficient rate of funding to replace the highest priority obsolete and problematic equipment. A cost-benefit analysis will be conducted on a project-by-project basis. Proactive planning is required for the replacement of equipment that has exhausted its useful life.

Due to safety and reliability concerns, there are no alternatives to obsolete equipment projects. However, alternative repair options are evaluated if they are proven to be a cost-effective solution and can reasonably extend the life or reduce the risk of failure of the equipment. Each project is evaluated on a case-by-case basis. The primary difference between the 99282 budget and the 203 budget is that the 99282 budget covers work that is proactive in nature, whereas the 203 budget primarily covers reactive work.

Information regarding the Replace Obsolete Substation Equipment initiative is found in the capital workpapers. *See* SDG&E-14-CWP at section 99282 – Replace Obsolete Substation Equipment.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a longer period and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost drivers for this budget are the need to replace obsolete equipment or to add new equipment to enhance substation reliability.

K. Safety and Risk Management

1. Introduction

The capital investments requested in this category address the mitigation of safety and physical system security risks. For example, a large percentage of the capital projects in this category are focused on increasing safety, by reducing wildfire risk. While wildfire risk reduction has been ingrained in SDG&E's core business activities, the sole purpose of several of the projects in this category is to reduce risk by performing capital upgrades.

SDG&E's RAMP Report identifies key safety risks and the plans to mitigate them. This section of my testimony identifies certain costs associated with these RAMP risk-mitigation efforts. The Risk Management testimony chapters of Diana Day and Jamie York (Exhibit SCG-02/SDG&E-02, Chapters 1 and 3, respectively), describe how SDG&E translated the costs of risk-mitigation projects and programs from the RAMP Report into the Safety & Risk Management capital budgets below. Section II of my testimony provides a summary of SDG&E's RAMP-specific Safety and Risk Management capital budgets and SDG&E's safety culture.

Additional details including description, forecast method, and cost drivers for each capacity/expansion project can be found in each budget code below.

TABLE AFC-12
Summary of Safety and Risk Management Budgets ($'s in Thousands)

Budget Code	Description	ESTIMATED 2017	ESTIMATED 2018	ESTIMATED 2019
13247	FIRM GRC BLANKET BUDGET	57,780	57,780	57,780
14249	SF6 SWITCH REPLACEMENT	3,509	14,088	14,088
15246	RANCHO SANTA FE SUB FIRE HARDENING	3,144	3,035	-
15257	LARGE-SCALE COMM INFRASTR PROVIDER (CIP)	-	5,020	5,020
15259	FIRE THREAT ZONE ADV PROTECT & SCADA UPG	1,337	1,337	1,337
16252	ELECTRIC INTEGRITY RAMP	788	14,858	52,406
16255	RTU MODERNIZATION	5,969	8,977	3,700
16259	TP: C261, C262, C263, & C266 RE-ROUTE	-	-	3,842
17242	TWIN ENGINE HELICOPTER	10,000	-	-
17249	12/4 KV SUBSTATION SECURITY: ALARM SYSTEM	950	3,820	5,730

17254	POLE RISK MITIGATION AND ENGINEERING (PRiME)	270	4,582	40,430
	Totals	83,747	113,497	184,333

2. 13247 – FiRM GRC Blanket Budget

The FiRM project title stands for Fire Risk Mitigation, a major effort at SDG&E to reduce the risk of distribution system-caused fire in the service territory by reducing potential ignition sources. The forecasts for the FiRM GRC Blanket Budget for 2017, 2018, and 2019 are $57,780, $57,780, and $57,780, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to mitigate fire risk in the most critical, high fire-risk areas of our system. Wildfire is a significant risk for San Diego County and South Orange County, as witnessed in 2003, 2007, and in 2014. Not only is wildfire a risk to the public, it also threatens the reliability of the electric system. This initiative will address aged conductor, aged splices, overloaded poles, and other conditions that are known to be a risk in the fire-prone areas.

Of the high fire risk events, contact of ignitable fuel with energized conductors (wire-down) comprises one of the highest fire risk events. Mitigation of an energized wire-down, or an electrified conductor contacting a non-approved surface, is paramount to the FiRM project. Based on historical wire-down data, approximately 75% of the wire-downs in SDG&E service territory occur on spans with #4 or #6 copper conductors. Furthermore, this type of conductor, relative to other common conductors utilized in SDG&E service territory, possesses a higher failure rate. As such, the FiRM project almost exclusively targets this aged, small copper conductor and wood poles for replacement with a more robust conductor and steel poles.

SDG&E employs a prioritization method to quantify and assess the relative risk of asset failure resulting in ignition and propagation of fire in its distribution system, taking into account a high percentage (approximately 50%) of small copper conductor. SDG&E's WRRM assesses the relative risk of fire for various assets in tandem with historical wire-down data, as described in Section III.B.4.

FiRM projects are scoped on a circuit-by-circuit basis, taking into account various risk factors. Risk mitigation methods include fire-hardening, by replacing antiquated conductor and poles, as well as other targeted fire risk mitigation methods on the circuit, including removal of

equipment, long span elimination, upgrading fixed capacitors for remote SCADA monitoring, and advanced technology implementation (namely, falling conductor protection).

Falling Conductor Protection (FCP) strategically places on circuits to detect instantaneous voltage differences caused from a broken conductor, and de-energizes the conductor as it falls to the ground. While this fire mitigation method does not reduce the likelihood of wire-downs, it does reduce the likelihood of an energized wire-down and subsequently reduces fire risk. This method of fire mitigation is used as a supplement to conductor and pole replacement risk mitigation.

The combination of these fire mitigation methods effectively and efficiently reduces the risk of fire initiation and propagation, while prioritizing the highest risk assets for strategic targeting by the FiRM project. Replacement poles, conductors, and other hardware are designed and constructed in accordance with current regulatory requirements as well as known local weather conditions for increased preparedness.

Information regarding the FiRM GRC Blanket Budget project is found in the capital workpapers. *See* SDG&E-14-CWP at section 12266 – FiRM GRC Blanket Budget.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this budget relate to the need to reduce fire risk by addressing aged conductor, aged splices, and overloaded poles, as well as other conditions that are known to be a risk in fire-prone areas.

3. 14249 – SF6 Switch Replacement

The forecasts of SF6 Switch Replacements for 2017, 2018, and 2019 are $3,509, $14,088, and $14,088, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget will provide funding to proactively remove or replace sulfur hexafluoride (SF6) gas insulated distribution switchgear. SF6 switches were primarily installed on SDG&E's electric distribution system during the 1980s and through the 2000s, as SF6 was the best insulation option available at that time. Since then, SF6 has been recognized by federal and state legislatures as a large contributor to elevated greenhouse gas levels, leading to the increased regulatory oversight in utility procedures involving SF6 switchgear, and alternative insulation mediums have been adopted. This project will reduce environmental risks associated with the potential for emissions.

All the switches removed or replaced as a part of this initiative are padmounted or sub-surface. With new technologies, many of the units can be replaced with similar, non-gas insulated switches; however, some switches will simply be removed, while others may require a more involved switch change-out, including a circuit reconfiguration.

The primary objective of this initiative is to reduce environmental risks associated with the potential for SF6 emissions. Sulfur hexafluoride is now known to have a global warming potential of 23,900 times that of carbon dioxide, and associated emission rate regulations are becoming more restrictive each year. Both the Environmental Protection Agency (EPA) and the CARB require utilities to track the "life" of a gas switch from "cradle-to-grave," as well as gas cylinder inventory and gas transfers in and out of switches. Removal and replacement of SF6 switches in SDG&E's distribution system will reduce the likelihood of SF6 emissions from leaking switches, thus reducing emission rates. The switch change-outs will also reduce the amount of recordkeeping required, therefore reducing errors and increasing accuracy. Other efforts at SDG&E are underway to reduce SF6 emissions risks, including leak detection and monitoring of substation gas circuit breakers.

Information regarding the SF6 Switch Replacement project is found in the capital workpapers. *See* SDG&E-14-CWP at section 14249 – SF6 Switch Replacement.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual

costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this capital project relates to reducing greenhouse gas emissions, reducing reliability risks, and staying in compliance with regulatory requirements.

4. 15246 – Rancho Santa Fe Substation Hardening

The forecasts for the Rancho Santa Fe Substation Hardening for 2017, 2018, and 2019 are $3,144, $3,035, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the distribution/CPUC forecasted spend as a component of this transmission/FERC project. Transmission/FERC projects are funded though the formula rate making process. The distribution/CPUC cost component of transmission/FERC projects is funded through the GRC process.

This budget will provide funding to upgrade the existing Rancho Santa Fe Substation. The Rancho Santa Fe Substation is over 40 years old with the 4 kv, 12 kV, and 69 kV constructed from the mid-1960s to the mid-1970s. It is the only substation that serves the Rancho Santa Fe area and is located in a fire threat zone. This substation serves several critical customers, including several communications companies, water facilities (Santa Fe Irrigation District, the Badger Plant, San Diego County Water Authority, Olivenhain Municipal Water District, and San Dieguito Water District who all have critical pumping facilities), the Rancho Santa Fe Fire Department and the North County Dispatch JPA.

The Rancho Santa Fe Substation fire hardening project will consist of removing the aging 69/4 kV substation, cutting it over to existing 12 kV circuits, replacing aging infrastructure on the 12 kV and 69kV equipment, replacing the 12 kV circuit getaways, replacing the 12.5 MVA 69/12 kV spare with a 28 MVA transformer, and installing distribution SCADA.

The substation's control shelter needs to be replaced because it is too small for the control and protection requirements of the substation and is physically deteriorating. The 12 kV switchgear is one of the oldest on the system and is not built to today's current reliability and safety standards. The substation is currently fed by a single 28 MVA 69/12 kV transformer and

a 69/4 kV transformer, with an aging spare 12.5 MVA 69/12 kV transformer on stand-by, and currently only has tie capacity to pick up approximately 38% of its load in the event of a substation outage. The substation does not have distribution SCADA and has out-of-date transmission and distribution relaying without fault locating capability.

Information regarding Rancho Santa Fe Substation Fire Hardening is found in the capital workpapers. *See* SDG&E-14-CWP at section 15246 –Rancho Santa Fe Sub Fire Hardening.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this budget are to replace aging equipment, to improve distribution reliability, and to fire-harden the substation.

5. 15257 – Large Scale Communications Infrastructure Provider (CIP)

The forecasts for Large Scale CIP for 2017, 2018, and 2019 are $0, $5,020, and $5,020, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget will provide funding for pole replacements that are initiated from large-scale CIP attachment projects. SDG&E is mandated per G.O. 95, to replace any pole that is below a certain safety factor. If the safety factor is determined to be below the acceptable value prior to a CIP attaching, then SDG&E is responsible for the pole change-out. If a large-scale project is initiated by a CIP, then it is anticipated there will be numerous pole change-outs. The process is initiated via the submittal of a joint-use application for a CIP Attachment Request. If engineering analysis reveals that the pole is below a certain safety factor, then the pole is replaced.

Information regarding the Large-Scale CIP project is found in the capital workpapers. *See* SDG&E-14-CWP at section 15257 – Large-Scale Communication Infrastructure Provider.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on a combination of detailed cost estimates that were developed based on the specific scope of work for the project and from previous large scale pole replacement projects. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this budget are the number of CIP attachment requests received and the need to maintain a safe and reliable system.

6. 15259 – Fire Threat Zone (FTZ) advanced protection and SCADA Upgrades

The forecasts for FTZ Advanced Protection and SCADA Upgrades for 2017, 2018, and 2019 are $1,337, $1,337, and $1,337, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget will provide funding to replace aging circuit breakers and/or obsolete electromechanical relays, to create a more comprehensive protection system by taking advantage of newer field technologies under installation by the FiRM project, and to create visibility in fire threat areas with installation of distribution SCADA. Some of the substations addressed by this project do not have distribution SCADA and have obsolete distribution relaying without fault-locating capability.

The FTZ Advanced Protection project will install new circuit breakers and/or relays to allow for improved protection functions and event recording for faults, create a protection system which will allow for communication of field devices with substation relays, install 12 kV Bus Differential relays to improve overall protection, and install Distribution SCADA systems where appropriate.

All substations affected by this project are within the FTZ. This project will upgrade distribution relaying and associated circuit breakers at these substation locations and improve

system visibility for operators. It will allow for implementation of new relay standards with improved coordination in locations where device coordination is difficult due to lower fault currents. Lastly, once field devices are upgraded, it will allow for communication between field devices and substation feeder relays.

Information regarding the FTZ Advanced Protection and SCADA Upgrades is found in the capital workpapers. *See* SDG&E-14-CWP at section 15259 – FTZ Advanced Protection and SCADA Upgrades.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this budget are to replace aging equipment, improve distribution reliability, and improve fire threat risk mitigation in distribution substations.

7. 16252 – Electric Integrity Ramp

The forecasts for Electric Integrity RAMP for 2017, 2018, and 2019 are $788, $14,858, and $52,406, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

Pursuant to proposed incremental capital activities described in the 2016 RAMP, this budget code represents a collection of projects implementing safety mitigation measures associated with the Electric Infrastructure Integrity (EII) RAMP risk chapter. Several programs addressing key infrastructure improvement projects across electric distribution, substation, and transmission may be implemented as part of this initiative to proactively address the potential for premature asset failure.

In coordination with the CPUC's Safety and Enforcement Division (SED), SDG&E participated in following the new GRC processes beginning in the TY 2019 rate case, including

the Safety Model Assessment Proceeding (S-MAP) and RAMP. The RAMP efforts led SDG&E to identify and quantify various areas for primarily safety-related risk mitigation with respect to infrastructure improvements that have potential to fail in a manner that may cause injuries to the public or personnel. The RAMP process provided SED and other relevant parties the opportunity to comment on SDG&E's RAMP Report. The programs as proposed in the RAMP quantified potential safety risk reductions across the enterprise, providing benefits to employees, the public, and SDG&E's contractors. These efforts are required to supplement other risk areas noted in the RAMP filing, including SDG&E-1, Wildfire Caused by SDG&E Equipment Failure.

SDG&E's 2016 RAMP Report identified key safety risks and associated mitigation plans across the entire service territory, including plans for mitigating the highest relative potential safety risks regarding electric distribution system infrastructure. The proposed EII program scope includes overhead wire safety enhancements to safeguard against potential wire-down events, corrosion mitigation programs (*e.g.*, freeway crossing structural improvements), enhanced switch inspections and high-risk replacements, and potential strategic undergrounding of distribution lines where practical for frequent or relatively high consequence outage exposure areas. These infrastructure improvement programs generally target mitigating safety risks in the non-FTZ areas. These EII programs are all designed to be implemented as short, medium, and long-term projects, in order to address various levels of safety risks. In general, shorter term projects aim to address areas believed to have higher propensities for failure coupled with greater safety, reliability, and financial impacts. Many of these efforts are expected to span a period of ten or more years and will address the top quartile of quantified safety risks. Other infrastructure improvements driven by potential safety risks continue to be assessed by SDG&E and will also be implemented in addition to or in place of the aforementioned programs. SDG&E continues to refine comprehensive risk quantification methodologies and will implement the appropriate measures to reduce risk exposure.

Information regarding Electric Integrity RAMP are found in the capital workpapers. *See* SDG&E-14-CWP at section 16252 – Electric Integrity RAMP.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops

detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is for safety risk mitigation with respect to infrastructure improvements that have potential to fail in a manner that may cause injuries to the public or personnel. These RAMP programs aim to reduce the likelihood of premature asset failure of electric infrastructure which will provide benefits across the enterprise to employees, the public, and SDG&E's contractors.

8. 16255 – RTU Modernization

The forecasts for RTU Modernization for 2017, 2018, and 2019 are $5,969, $8,977, and $3,700, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget will provide funding to resolve issues with the current SCADA system. This project will allow SDG&E to address existing issues and move away from the legacy communications protocol that is no longer supported. This project will also allow a more transparent view of our grid, which will enhance our reliability and security of the grid. The project will also proactively modernize our SCADA RTU and replace unsupported, outdated legacy equipment.

The new system will allow SDG&E to perform needed mission critical functionality of migrating over to IP-based communications, address security vulnerability issues, enhance reliability for a seamless fail-over system if needed, replace legacy systems and equipment and upgrade RTUs for enhanced visibility. The project scope will replace approximately 465 legacy RTUs (RMS900) in the field with a more modernized unit to better support operations. These RTUs are field sites only and do not include substations.

SDG&E is implementing this project to address various issues with our existing SCADA system, such as: lack of vendor support in response time, causing extensive delays, lack of SCADA vendor support for narrow-band IP communications (IP communications provide enhanced reliability, security, and scalability), antiquated user interface, inefficient development

of SCADA screens, end of life reached for SCADA communication topology, and lack of industry support for existing SCADA vendor, which has been losing market shares. Additionally, the current RMS900 RTUs are no longer supported by their vendor.

Information regarding RTU Modernization is found in the capital workpapers. *See* SDG&E-14-CWP at section 16255 – RTU Modernization.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers of this budget are to replace aging SCADA system issues to increase reliability, allow for a more transparent view of our grid and enhance the security of our grid.

9. 16259 – TP: C261, C262, C263 and C266 Re-Route

The forecasts for TP: C261, C262, C263 AND C266 RE-ROUTE for 2017, 2018, and 2019 are $0, $0, and $3,842, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget will provide funding to eliminate a safety risk within the Torrey Pines area as the location of multiple poles currently introduce safety as well as reliability risks in the area. Relocating the equipment from overhead to underground will improve the safety and the reliability risk in the area. The project requires new trench and conduit, as well as installing new underground cable. Four new cable poles are required along with four new hook sticks and the removal of overhead poles to relocate the distribution circuits from overhead to underground. There are three deteriorated poles in the Torrey Pines corridor that feed approximately 5,000 customers, including some very large industrial accounts. These poles have been drastically deteriorated and are located within a slope of a canyon that has potentially unstable soil. If an

outage were to occur from either the poles collapsing or being washed away, the location within the canyon presents limited helicopter support and the extremely sensitive environmental area where the poles are currently located further limits the ability to perform maintenance in a timely manner.

Information regarding TP: C261, C262, C263 AND C266 RE-ROUTE is found in the capital workpapers. *See* SDG&E-14-CWP at section 16259 – TP: C261, C262, C263 AND C266 RE-ROUTE.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this capital project are to eliminate safety risks and to increase reliability within the Torrey Pines area.

10. 17242 – Twin Engine Helicopter

The forecasts for the Twin Engine Helicopter for 2017, 2018, and 2019 are $10,000, $0, and $0, respectively. SDG&E plans to acquire this aircraft and place this project in service by the test year.

a. Description

This budget will provide funding to purchase a twin-engine helicopter to address safety risks associated with helicopter operations, as well as to provide a more capable aircraft. Currently, SDG&E contracts the exclusive use of a single-engine helicopter for flight operations. To address safety concerns and the need for a more capable aircraft, the decision has been made to acquire a twin-engine helicopter. Financial analysis demonstrates a lower cost to ratepayers over the life of the asset when the aircraft is purchased, as opposed to leased.

From a safety perspective, the twin-engine helicopter provides redundant engine and flight control systems, advanced avionics to allow for instrument flight, and autopilot for reduced

pilot fatigue. Regarding flight capabilities, a twin-engine helicopter provides for increased payload and power margins, integrated infrared, and high-definition camera, and an improved maintenance program.

Information regarding the Twin Engine Helicopter project is found in the capital workpapers. *See* SDG&E-14-CWP at section 17242 – Twin Engine Helicopter.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers of this budget are to address safety risks associated with helicopter operations as well as to provide a more capable aircraft for SDG&E operational needs.

11. 17249 – Tee Modernization Program

The forecasts for Tee Modernization Program for 2017, 2018, and 2019 are $950, $3,820, and $5,730, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding to improve reliability and reduce safety risk by replacing aging 600A tee connectors on circuits with multiple historical tee failures and with high fault current. A 'tee' is a type of connector on the underground electric distribution cabling system. Tee connector failures have become one of the largest contributors to customer outages in the last few years.

600A tees are located on the main feeder of radial circuits. When they fail, all or most of the customers on a circuit experience a sustained outage. The modernization of tees provides a more reliable system that has more sectionalizing capability. Additionally, when tees fail, they can fail violently, which poses a serious safety risk to our field personnel and the general public.

Information regarding the Tee Modernization Program is found in the capital workpapers. *See* SDG&E-14-CWP at section 17249 – Tee Modernization Program.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers of this project are increased reliability and sectionalizing capability of the distribution system, while reducing the risk of injury or property damage due to failure.

12. 17254 – Pole Risk Mitigation and Engineering (PRiME)

The forecasts for PRiME for 2017, 2018, and 2019 are $270, $4,582, and $40,430, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget will provide funding to a program designed to ensure poles continue to meet G.O. 95 standards and locally known conditions (wind), loading safety factors, and clearance criteria as well as other conditions that are known to be a risk.

SDG&E owns and maintains approximately 200,000 wood distribution poles, 170,000 of which are currently not included in the scope of other projects (*e.g.*, FiRM, CNF). All overhead electric facilities, including wood poles, must be designed, constructed, and maintained in accordance with G.O. 95. The aged overhead electric system was designed in accordance with the requirements in place at the time of construction. Many of SDG&E's poles are greater than 40 years old, and have been subjected to increases in load due to additional attachments that have been added over the life of the facilities (*e.g.*, fiber optic, antennas).

SDG&E has successfully utilized granular weather data and computer modeling to create a system-wide wind design map, which is based on our best possible prediction of "known local conditions." Today, SDG&E knows more about the weather conditions that the overhead

electric system is exposed to than ever before. The level of data far surpasses what was used when many of the poles in our system were originally installed.

Since the original overhead electric system was first installed, not only has more local knowledge been obtained, new tools have been developed to enhance the accuracy of pole loading calculations. Distribution designs have historically utilized standards based on conservative assumptions. Today, computer programs are available that make the design of poles more accurate and facilitate more comprehensive analysis. Computer programs available today (*e.g.*, PLS-CADD) allow engineers and designers to model structures using non-linear analysis and Finite Element Analysis. SDG&E is utilizing precise LiDAR (Light Detection and Ranging) data to develop a very accurate three-dimensional model of the overhead electric system. Not only does LiDAR provide the data necessary to analyze pole loading, it also creates an opportunity to easily check wire-to-wire clearances. LiDAR and PLS-CADD are tools that have been used for transmission lines for over 15 years, but are just now being used on a larger scale for the distribution system.

In addition to having more information about how meteorological forces impact our overhead electric system, we also now know that a contributing factor to the pole loading issue is that there have been cumulative additions/attachments to poles over their lifespan. In many cases, small pieces of electrical equipment have been added to poles, services have been added, conductors have been replaced with larger conductors, additional communications lines have been installed, over-lashing of communication lines has occurred, pole-top extensions have been used to increase clearances, and/or equipment has been upsized when it was replaced during an outage or for maintenance reasons. While many of the things described above do add additional load to poles, they may not generally be considered "material" increases in load, and therefore calculations were not performed. These cumulative additions over the life of the asset can result in poles being overloaded.

As mentioned, many of SDG&E's wood poles are 40 years old or more. Over the last 40 years, there have been changes in technology, changes in consumer communications needs, and improvements in the way overhead electric systems are configured, all of which have contributed to additional mechanical load being added to wood poles. CIPs have contributed to overloads on poles, especially in the past few decades. In some cases, CIPs may have attached without notifying SDG&E (possibly preceding the application and pole loading requirements), and some

have added additional facilities, assuming the existing agreement covered the new equipment. The CIPs also historically attached to poles without knowing if the safety factor was already reduced due to deterioration on the poles (G.O. 95 allows a one-third reduction due to pole degradation and/or additional load). The interaction of loads on the pole and the remaining strength of a pole have been a key point of discussion in the Electric Safety OIR.

Utilities across the United States have historically only looked at the amount of deterioration on wood poles during intrusive inspections. The primary factors considered in calculating the safety factor on poles are deterioration and loads, and it is rare that a utility has intrusive inspection contractors looking at deterioration and loads in combination.

Safety and reliability are very important to SDG&E. Because we have more information about "known local conditions" than we ever had before, and we have new tools available for comprehensive analysis, we are embarking on a new program to confirm that the structures supporting overhead electric lines meet the required safety factors. SDG&E's PRiME Program is yet another step into mitigating risks related to the overhead electric system, much like FiRM has done.

The initial subset of poles will be made up of approximately 1,600 poles as a pilot phase spread across SDG&E's service territory. Appropriate conclusions can be drawn geographically to determine the differences in expected outcomes and population sizes that vary across SDG&E's service territory. This occurred with FiRM. SDG&E embarked on the program with an initial strategy, but as data came in and construction progressed, SDG&E saw the need to alter the methodology and approach for that program.

The pilot phase of PRiME will occur in 2018, where 1600 poles will be analyzed. Results from the pilot phase will be used to prioritize future year projects based on risk and to further define cost. The program will ramp up in 2019 where 22,600 poles will be analyzed, with an estimated 170,000 poles analyzed over a nine-year period. The focus of the PRiME efforts will be on pole loading (clearances will be checked, but that is not the primary driver). PRiME will use a risk-based model that considers many factors to identify pole failure risk potential. Some of the risk factors that will be included in the model are locally known conditions (wind), age of pole, intrusive inspection data, un-guyed structures, conductor size/type, load of Communications Infrastructure Providers and conductor size. Once facilities are identified for replacement, SDG&E will use PLS-CADD to build a three-dimensional model

of the overhead ruling span (dead end to dead end) to consider dynamic interactions with other poles and the effect of pole replacement work on the performance of other poles within the ruling span. Other risks such as clearance risks may be identified as part of the analysis within the ruling span, which will also be mitigated as part of the pole replacement project. Upon completion of the work, a PLS-CADD model will be generated to true up the data to be stored in the asset registry. Other areas of PRiME focus include: new pole loading processes and enhancements aimed to improve data quality, a true up of as-built designs, and the development of an asset registry to house PLS-CADD files. The 3-D ruling span models will not only be used to assess existing conditions on the overhead system, it will also be used as the foundation for future capital upgrades.

PRiME is a nine-year program designed to address risks related to pole loading, specifically focused on wood poles. SDG&E will focus on the areas of highest risk first. During initial implementation years, SDG&E will aggressively analyze the poles based on a risk model where wood poles will be replaced and designed for known local wind conditions, and for all known attachments. PRiME will result in a much safer and more reliable overhead electric system.

Information regarding Pole Risk Mitigation & Engineering is found in the capital workpapers. *See* SDG&E-14-CWP at section 17254 – Accelerated Pole Loading.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this budget is to lower the potential risks that non-compliant poles can result in if a failure were to occur, such as personal injury, property damage, and fire ignition.

L. Distributed Energy Resource (DER) Integration

1. Introduction

The distribution system has evolved from limited energy producers and unidirectional, predictable power flows from the substation to customers, to a bidirectional, more complex distribution grid. This evolution within the distribution grid results in bidirectional power flows and introduces significant changes to facility design and daily grid operations. Some of these operational changes include complex maintenance schemes and outage restoration plans, which may impact the reliability of the distribution system.

These new energy producers are known as Distributed Energy Resources or DER. This term incorporates producers under the former term Distributed Generation, or DG, but also includes newer technologies, smaller installations, and things such as advanced battery storage. SDG&E has experienced a proliferation of DERs in its services territory. To help integrate DERs to the distribution grid, the grid must evolve to continue with meeting the future needs of customers and society.

The increase of DERs is primarily associated with large increases in solar PV installations that have risen approximately 40% per year since 2007. Growth is expected to continue with the costs of DER technology continuing to decline. SDG&E needs to support the influx of DERs and provide avenues to allow for continued growth, while at the same time managing the integrity of its distribution system and the safety of utility workers, communications workers, and the general public. To accomplish this task, investments are needed to change the distribution grid from its original design of point-source one-way power flows, to a grid that can accommodate multi-point two-way power flows. This affects the basic capacity specifications of overhead conductors and underground cables and the design of segmentation and safety equipment such as fuses, interrupters, switches, and other controlling devices. SDG&E also seeks to gain experience with the types of technologies that DER providers are expected to install through the acquisition of related equipment, in order to develop the instrumentation, troubleshooting, and safety procedures necessary to the modern DER-enabled grid.

The purpose of this design-based approach is to reduce adoption barriers while continuing to deliver safe and reliable service to customers. Further information on DER Integration is discussed in the testimony of Alan Dulgeroff (SDG&E-13).

Additional details including forecasted costs, project descriptions, forecast method, and cost drivers for each DER Integration project can be found in each budget code below.

TABLE AFC-13
Summary of Distributed Energy Resource Integration Budgets ($'s in Thousands)

Budget Code	Description	ESTIMATED 2017	ESTIMATED 2018	ESTIMATED 2019
11246	SMART TRANSFORMERS	258	-	-
11247	ADVANCED ENERGY STORAGE	-	5,154	10,000
14243	BORREGO SPRINGS MICROGRID ENHANCEMENTS	1,769	515	-
14259	VANADIUM FLOW BATTERY PROJECT	539	-	-
16243	MICROGRID FOR ENERGY RESILIENCE	-	5,894	7,916
17244	VOLT/VAR OPTIMIZATION TRANSFORMER	-	500	100
17245	ITF-INTEGRATED TEST FACILITY	523	1,050	-
17246	BORREGO MICROGRID 3.0	209	5,230	-
	Totals	3,298	18,343	18,016

2. 11246 – Smart Transformers

The forecasts for Smart Transformers for 2017, 2018, and 2019 are $258, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget will provide funding for the installation of monitoring devices on some transformers serving customers with charging stations for plug-in electric vehicles that are purchased between 2010 and 2020. Sensing devices attached to the transformers will be used to monitor real-time loading and establish accurate load profiles. These devices must also be capable of communicating load information to a data center in a distribution substation.

Beginning in 2010, plug-in electric vehicles began to be deployed in the SDG&E service territory. There are now almost 26,000 plug-in electric vehicles in San Diego County. The rate of deployment will increase substantially between now and 2020. Because electric vehicle charging can range from roughly 1.4 kW to roughly 19.2 kW depending on type of charge and vehicle, SDG&E is concerned about the effect that charging electric vehicles will have on distribution transformer loading and operation. To determine the effect of electric vehicle

charging on a transformer, it is necessary to perform on-line monitoring at the transformer. Smart transformers will be the method used to perform this task. Distribution transformers will be converted to smart devices by installing monitoring equipment on the secondary transformer bushings, which will be performed as part of phase one of this project.

The project will also allow for SDG&E to learn about the plug-in electric vehicle charging patterns of customers on a real-time basis. This information is important in determining the effects of electric vehicle charging on distribution transformers. The information will also be useful in determining if loading guidelines for transformers serving customers with plug-in electric vehicles need to be revised. This load data would also be used to proactively troubleshoot customer voltage problems that could occur due to an overloaded transformer.

Information regarding the Smart Transformers project is found in the capital workpapers. *See* SDG&E-14-CWP at section 11246 – Smart Transformers.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this project is to provide reliable service to our customers by analyzing the system performance on a real-time basis while plug-in vehicles are being charged.

3. 11247 – Advanced Energy Storage

The forecasts for Advanced Energy Storage for 2017, 2018, and 2019 are $0, $5,154, and $10,000, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget will provide funding to mitigate intermittency and operational problems from renewable energy sources by installing energy storage on distribution circuits that have a high

concentration of photovoltaic (PV) systems. The initiative will install energy storage in the form of electric batteries on the electric distribution system. Energy Storage coupled with advanced inverter functionality allows for 4-quadrant operational support. The 4-quadrant operation consists of the advance inverter having the capabilities to consume or provide reactive resource during exporting or importing of real power. Advanced energy storage thus enables DER implementation by way of PV smoothing, voltage control, and increasing reliability. Energy Storage and renewable generation may not share the same point of common coupling when installed on a distribution circuit. Therefore, further installation and analysis is needed to determine the effectiveness of PV smoothing and voltage control when the generation and storage are decoupled.

Advanced energy storage devices will help minimize impacts of intermittency and operational problems associated with the variable output of renewable energy resources. The solution will place distributed energy storage systems on circuits with a high penetration of distributed energy resources (*e.g.*, customer photovoltaic systems).

Information regarding the Advanced Energy Storage project is found in the capital workpapers. *See* SDG&E-14-CWP at section 11247 – Advanced Energy Storage.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this budget relate to the growing penetration of renewable energy and DER PV on the electric system.

4. 14243 – Borrego Springs Microgrid Enhancements

The forecasts for the Borrego Springs Microgrid Enhancements for 2017, 2018, and 2019 are $1,769, $515, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for improved and expanded utilization of the Borrego Springs Microgrid in responding to a variety of outage situations, demand response requests, and voltage/frequency regulation. This project will leverage various new technologies and resources, including advanced inverter functionality, automated switching, local power generation and energy storage, as well as adding, hardening, reconfiguring, and upgrading key infrastructure, so that the newly enhanced microgrid will become more flexible and automated, with remote access capabilities. The residents of Borrego Springs are fed by a single radial transmission line from Narrows to the Borrego Springs Substation.

The community of Borrego Springs is in the middle of the Anza Borrego Dessert, in a remote and isolated region, and is subject to frequent and severe weather conditions, including high temperatures above 120 degrees Fahrenheit, high winds, flash floods, and lightning. Through the Borrego Springs Microgrid Demonstration (BSMD) Project, SDG&E has learned that a microgrid can be an effective solution to mitigating outage impacts. During the first BSMD project from 2011 to 2014, the microgrid successfully demonstrated the ability to temporarily island a single circuit. Since then, the BSMD project has been expanded to include the entire load and to utilize the NRG Solar Facility to provide renewable generation during the day. In its current configuration, Borrego Springs has encountered many challenges while trying to utilize the microgrid to serve the entire community during the day with only renewable generation, while maintaining electric service to critical loads of Borrego. The current challenges will be mitigated with the following goals in mind: enhance emergency readiness, increase operational flexibility, decrease outage response time, decrease interruptions, increase grid resiliency, demonstrate new microgrid technologies, increase microgrid load capacity, and utilize increased renewable generation.

The Borrego Springs Microgrid Enhancements project consists of two phases. Phase 1 of the project involves near-term solutions to operationalizing the microgrid, specifically allowing our Electric Distribution Operators to operate the microgrid as an asset. Phase 2 of the project involves increasing the operational flexibility and capability of the current microgrid. This will include hardening key distribution infrastructure, additional SCADA devices, upgrades to the protection schemes, integration of the NRG solar facility, and the ultracapacitor.

Information regarding the Borrego Springs Microgrid Enhancements project is found in the capital workpapers. *See* SDG&E-14-CWP at section 14243 – Borrego Springs Microgrid Enhancements.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers of this budget relate to the need to provide reliable service, especially in remote areas of San Diego County.

5. 14259 – Vanadium Flow Battery Storage

The forecasts for Vanadium Flow Battery Project for 2017, 2018, and 2019 are $539, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the installation and evaluation of a Vanadium-Redox Flow (VRF) Battery system (2MW / 8 MWh) with support from The New Energy and Industrial Technology Development Organization (NEDO), Japan's DOE, to assess appropriateness for SDG&E's needs.

NEDO is targeting strategic partnerships in the US for grid technology demonstrations of energy storage. NEDO has selected Sumitomo to conduct VRF demonstrations in California. NEDO will fund up to $10M per site for Sumitomo's VRF. The VRF system will be installed for grid support and market functions demonstrations.

Flow battery technologies are appropriate for MW scale energy storage applications, however, no North American demonstrations have been conducted. This project enables a low-cost/low-risk VRF demonstration, at a relatively low cost to SDG&E. The objectives of this project include evaluating the system's size and performance (a 4 MWh VRF footprint is equal to a tennis court with a claimed infinite cycle life), evaluating flow system relevance for multi-

MWh applications (*i.e.*, substation and larger), addressing the ability of the system to perform market functions (CAISO market) in addition to grid services, and differentiating VRF system performance from lithium-ion.

Information regarding the Vanadium Flow Battery Project is found in the capital workpapers. *See* SDG&E-14-CWP at section 14259 – Vanadium Flow Battery Project.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers of this budget are to assess the appropriateness and the evaluation of a Vanadium-Redox Flow (VRF) Battery system on SDG&E's electric system.

6. 16243 – Microgrid For Energy Resilience

The forecasts for Microgrid for Energy Resilience for 2017, 2018, and 2019 are $0, $5,894, and $7,916, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget will provide funding to engineer and construct solutions utilizing microgrids and DER to enhance energy resilience for public purpose and critical applications. The project focuses on utilizing microgrids to alleviate renewable intermittency, which allows for increased renewable energy penetration levels and enhanced electric service reliability. Depending on the size of the microgrid, renewable energy may be in the form of smaller or larger sources connected to the distribution feeder.

SDG&E has demonstrated that microgrids can provide additional reliability and operational flexibility, and would allow system operators to incorporate renewable energy. To date, SDG&E has been approached and invited to propose projects for local agencies and the military, and this project will provide the funds for these solutions.

Information regarding the Microgrid for Energy Resilience project is found in the capital workpapers. *See* SDG&E-14-CWP at section 16243 – Microgrid for Energy Resilience.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers of this budget are to enhance system reliability for public purpose by using microgrids and energy storage projects.

7. 17244 – Volt/Var Optimization Transformer

The forecasts for the Volt/VAR Optimization Transformer for 2017, 2018, and 2019 are $0, $500, and $100, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget will provide funding to install Gridco secondary regulation devices to correct voltage issues (low or high) on the secondary network (240V). With an increase of photovoltaic (PV) installations, SDG&E has seen a change in voltage profiles. Through AMI analysis, we have found that several distribution circuits have violated the ANSI standard of +/- 5% of nominal. This can cause damage to customer equipment and decrease energy efficiency. By optimizing our voltage profile, we will be more energy efficient and maintain ANSI standards.

Information regarding the Volt/VAR Optimization Transformer project is found in the capital workpapers. *See* SDG&E-14-CWP at section 17244 – Volt/VAR Optimization Transformer.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates,

contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this budget is to improve energy efficiency and maintain secondary voltage compliance per ANSI standards.

8. 17245 – ITF – Integrated Test Facility Improvements

The forecasts for ITF – Integrated Test Facility Improvements for 2017, 2018, and 2019 are $523, $1,050 and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding to upgrade SDG&E's Integrated Test Facility (ITF) and test equipment to support safe and reliable deployment of advanced technologies driven by state policy and consumer adoption. The ITF has hosted projects for, but is not limited to, renewable integration, electric vehicle charging, Home Area Networks, cyber security, and telecommunication advancement. The current projects have maximized available bench space and simulation capacity requiring expansion.

The ITF serves as a testing and evaluation facility, to help ensure technologies and operational schemes, both traditional and advanced, are clean, safe, and reliable. The ITF uses a Real-Time Digital Simulator (RTDS) to test actual products such as inverters, electric vehicle (EV) chargers, and various other controllers under hardware in the loop. Many use cases, both past and present, to focus on penetration levels and to help identify the capabilities of smart inverters, power electronic devices, or other mechanical devices. Such testing allows for the development of standards based on factual results and further allows engineers to become comfortable with a rapidly evolving electric grid. This type of testing guides engineers, operators and others on how to integrate more DER devices while maintaining an efficient and reliable grid. As more DER are installed on the electric grid, dynamic modeling becomes more important. The ITF supports this type of time simulation.

To sustain collaborative efforts associated with policy and industry trends and standards, SDG&E's ITF must evolve with the electric grid. The ITF will be expanded, with new equipment purchased, and additional computing resources procured.

Information regarding the ITF – Integrated test Facility project is found in the capital workpapers. *See* SDG&E-14-CWP at section 17245 – ITF – Integrated Test Facility.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this budget are the safe and reliable deployment of advanced technologies to support state policy and consumer adoption.

9. 17246 – Borrego Microgrid 3.0

The forecasts for the Borrego Microgrid 3.0 for 2017, 2018, and 2019 are $209, $5,230 and $0, respectively. This is an ongoing project that is expected to continue through the test year.

a. Description

This budget will provide funding to allow the Borrego Microgrid to operate with 100% renewables while in island configuration. This project will also support up to 300% of renewable capacity when operating in parallel with the electric grid.

The Borrego Microgrid can operate from 100% renewable energy by increasing the amount of energy storage and photovoltaic (PV) resources. The project will install 12MW of solar and 150MWh of energy storage to support a local renewable generation portfolio of 100%, while operating in island mode. This will increase grid resiliency for the entire Borrego Springs community and demonstrate low inertia microgrid control technologies. The advanced functionality will support PV smoothing and voltage control, which help enable DERs to maintain reliability of the microgrid.

The Borrego Springs Microgrid is experiencing major improvements through the Borrego Springs Microgrid Enhancements project, which maximizes renewable energy integration through advanced control systems that allow for remote operation.

Information regarding the Borrego Microgrid 3.0 project is found in the capital workpapers. *See* SDG&E-14-CWP at section 17246 – Borrego Microgrid 3.0.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this budget is to increase grid resiliency for the entire Borrego Springs community.

M. Transmission/FERC Driven Projects

1. Introduction

This category of projects covers transmission[11] projects with a distribution component. Many transmission lines have underbuilt distribution facilities on them, such as a 69 kV transmission line with a 12 kV distribution circuit on a second level below or under the transmission infrastructure. When transmission capital work is done on a transmission line, the distribution facilities often need to be modified or replaced in conjunction with the transmission work. The same scenario applies to substations containing distribution facilities. When a new transmission substation is being built, or an existing transmission substation is being modified, there is often a distribution component in the work. The FERC costs are recovered through the formula ratemaking process. The distribution component of transmission projects is included in the overall request in this GRC. For most of the FERC projects with CPUC components, the percentage of CPUC costs is low. For example, the distribution work for project 9137 accounts for less than 10% of the total project cost. This request excludes the other 90% of costs that are covered by FERC transmission rates.

Additionally, SDG&E has identified key transmission/FERC-driven projects as part of its previously discussed RAMP Report. The CPUC jurisdictional costs of risk-mitigation projects and programs were translated from that RAMP Report into the Transmission/FERC-driven capital budgets below. Further details regarding RAMP-specific Transmission/FERC-driven capital budgets can be found under Table AFC-3 in Section II.

Additional details including description, forecast method, and cost drivers for each Transmission/FERC-driven project can be found in each budget code below.

TABLE AFC-14
Summary of Transmission/FERC Driven Projects Budgets ($'s in Thousands)

Budget Code	Description	ESTIMATED 2017	ESTIMATED 2018	ESTIMATED 2019
100	ELEC TRANS LINE RELIABILITY PROJECTS	1,000	1,000	1,000
103	TRANSMISSION SUBSTATION RELIABILITY	99	99	99
6129	SOUTH ORANGE COUNTY	932	7,645	4,345

[11] In the context of my testimony, "Transmission" shall be defined as anything 69kV and greater. Per G.O. 131-D, lines between 50kV and 200kV are considered power lines, and anything above 200kV is considered transmission.

	REL ENHANCE (SOCRE)			
7144	FIBER OPTIC FOR RELAY PROTECT & TELECOM	391	391	391
8165	CLEVELAND NATIONAL FOREST POWER LINE REPLACEMENT PROJECTS	26,155	39,209	40,035
9137	TL 649 OTAY-SAN YSIDRO-BRDR SW POLE REP	412	854	-
9153	TL676-MISSION TO MESA HEIGHTS RECONDUCTO	1,015	3,554	-
10135	LOS COCHES SUB-REBUILD 138/69 KV	1,403	-	-
10144	TL691 AVO-MON WOOD TO STEEL	68	162	-
10146	TL695/6971 RECONDUCTOR & WOOD TO STEEL	123	1,140	-
10147	TL697 SAN LUIS REY WOOD TO STEEL	196	2,324	-
10149	WOOD TO STEEL POLE REPLACE - TL6912	66	245	-
11126	TL663 MISSION TO KEARNY RECONDUCTOR	-	173	-
11133	TL664-WOOD TO STEEL	305	-	-
12137	TL6916-WOOD TO STEEL	-	-	258
12149	TL694-WOOD TO STEEL	-	-	762
13130	TL674A DEL MAR RECONFIGURE/TL666D RFS	18	18	2,466
14140	TL698 WOOD TO STEEL PROJECT	-	762	762
	Totals	32,183	57,576	50,118

2. 100 – Electric Transmission Line Reliability Projects

The forecasts for the Electric Transmission Line Reliability Projects for 2017, 2018, and 2019 are $1,000, $1,000, and $1,000, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for the forecasted distribution component of electric transmission line reliability projects. Transmission/FERC projects are funded though the formula rate making process. The distribution/CPUC cost component of transmission/FERC projects is funded through the GRC process.

The initiative complies with the safety and reliability requirements promulgated by CPUC G.O. 95, A.B. 1890, A.B. 1017, North American Electric Reliability Criteria (NERC),

and California Independent System Operator (CAISO) maintenance requirements. This initiative provides funds for several purposes, such as:

1. To restore degraded transmission facilities.
2. To repair the system in the event of disaster such as storm or fire.
3. To cover small (under $750,000) projects for restoring the system that are not identified during the annual review study process.

Information regarding the Electric Transmission Line Reliability initiative is found in the capital workpapers. *See* SDG&E-14-CWP- at section 00100 – Electric Transmission Line Reliability.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers of this budget are to comply with SDG&E's obligation to serve and to meet safety requirements set by General Orders and other regulations, as detailed above.

3. 103 – Transmission Substation Reliability

The forecasts for the Electric Transmission Substation Reliability Projects for 2017, 2018, and 2019 are $99, $99, and $99, respectively. This is an ongoing initiative that is expected to continue through the test year.

a. Description

This budget provides funding for the forecasted distribution component of transmission substation reliability projects. This initiative funds small changes to electrical transmission substation facilities. General project categories include safety-related improvements, replacement of failed equipment, and capital additions.

Information regarding the Electric Substation Reliability initiative is found in the capital workpapers. *See* SDG&E-14-CWP- at section 00103 – Electric Substation Reliability.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver is to maintain the reliability and integrity of the distribution components in transmission substations.

4. 6129 – South Orange County Reliability Enhancement (SOCRE)

The forecasts for the South Orange County Reliability Enhancement (SOCRE) for 2017, 2018, and 2019 are $932, $7,645, and $4,345, respectively. This is an ongoing project that is expected to continue through the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. The project will replace the existing 138/12 kV Capistrano Substation with a new 230/138/12 kV Gas Insulated Substation and replace an existing 138 kV transmission line with two 230 kV transmission lines.

Information regarding the South Orange County Reliability Enhancement project is found in the capital workpapers. *See* SDG&E-14-CWP- at section 06129 – South Orange County Reliability Enhancement.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this project is to increase reliability in the Orange County area.

5. 7144 – Fiber Optic for Relay Protect and Telecommunications

The forecasts for the Fiber Optic for Relay Protection and Telecommunications for 2017, 2018, and 2019 are $391, $391, and $391, respectively. This is an ongoing project that is expected to continue through the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. This budget provides funding for the installation, upgrade, and expansion of SDG&E's fiber optic communication system for control and protection of transmission and distribution lines, and for automation. Besides control and protection, secure fiber optic communication is required for transporting large amounts of data at high speeds for Condition Based Maintenance (CBM), Wide Area Measurement and Control (Synchrophasors/Phasor Measurement), Video Security and Surveillance, Smart Grid, and Telecommunication.

Currently, many substations use telephone company-leased circuits and copper wire for protective relaying, and SCADA. These circuits are antiquated, unreliable, and do not meet communication requirements for new digital protective relay systems that are being installed.

The new fiber optic routes will provide communications media diversity for protective relaying throughout the SDG&E service territory. System protection is a key function in the electrical power grid, as it guards against conditions that would severely harm the electric system infrastructure and cause extended outages. Highly reliable and available communications links are essential to functional protective relaying in the event of a system fault.

Information regarding the Fiber Optic for Relay Protection and Telecommunications project is found in the capital workpapers. *See* SDG&E-14-CWP- at section 07144 – Fiber Optic for Relay Protection and Telecommunications.

b. Forecast Method

The forecast method used is a five-year average based on historical data. This is the most appropriate methodology, because workload can vary from year to year. The five-year average levels out the peaks and valleys in this blanket budget over a large period of time and still provides for the necessary level of funding for the work that falls within this budget.

c. Cost Drivers

The underlying cost driver of this budget is to maintain and enhance reliability by installing critical communications infrastructure.

6. 8165 – Cleveland National Forest Power Line Replacement Projects

The forecasts for the Cleveland National Forest Power Line Replacement Projects for 2017, 2018, and 2019 are $26,155, $39,209, and $40,035, respectively. This is an ongoing project that is expected to continue through the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project.

Transmission line outages due to forest fires have serious impacts on electric system reliability. A resulting loss of electric service can impede emergency services and our customers' abilities to cope during a fire emergency.

This budget provides funding for the distribution components related to replacement of five existing 69 kV transmission lines and seven 12 kV distribution circuits located within and outside of the Cleveland National Forest. The project will enhance system reliability in the Fire Threat Zone and the High-Risk Fire Area of the SDG&E service territory via wood-to-steel pole conversion and other fire-hardening measures. The project also establishes a Master Special Use Permit (MSUP) to replace over 70 expired permits in the Cleveland National Forest.

Information regarding Cleveland National Forest Power Line Replacement Projects is found in the capital workpapers. *See* SDG&E-14-CWP at section 08165 – Cleveland National Forest Power Line Replacement Projects.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this project is to enhance system reliability in the Fire Threat Zone and the High-Risk Fire Area of the SDG&E service territory via wood-to-steel pole conversion and other fire hardening measures.

7. 9137 – Tl649 Otay – San Ysidro – Border SW Pole Replacement

The forecasts for the TL649 Otay - San Ysidro Border SW Pole Replacement project for 2017, 2018, and 2019 are $412, $854, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. This project will reinforce the overhead infrastructure in a high-risk fire area. This budget will provide funding to the distribution components related to the rebuilding of transmission line TL649 with steel/wood (SW) equivalent structures for approximately nine miles.

Transmission line outages due to fires can have serious impacts on electric system reliability, and the resulting loss of electric service can impede emergency services and our customers' abilities to cope during the fire emergency. In an effort to reduce future damage and enhance the line's fire resistance, wood poles on TL649 within a high-risk fire area have been targeted for replacement with equivalent steel poles.

Information regarding the TL649 Otay – San Ysidro - Border SW Pole Replacement project is found in the capital workpapers. *See* SDG&E-14-CWP at section 09137 – TL649 Otay – San Ysidro – Border SW Pole Replacement.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this project is to improve the reliability and reinforce the overhead infrastructure of TL649, which is located in a fire-prone area.

8. 9153 - TL676 Mission to Mesa Heights Reconductor

The forecasts for the TL676 Mission to Mesa Heights Reconductor project for 2017, 2018, and 2019 are $1,015, $3,554, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. This budget provides funding for the replacement or modification of distribution components related to the rebuilding of TL676, which helps mitigate NERC Category B reliability criteria overloads.

Information regarding the TL676 Mission to Mesa Heights Reconductor project is found in the capital workpapers. *See* SDG&E-14-CWP at section 09153 – TL676 Mission to Mesa Heights Reconductor.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this budget is to enhance electric system reliability by providing a long-term mitigation for the identified NERC Category B reliability criteria contingency scenario.

9. 10135 – Los Coches Substation Rebuild 138/69 kV

The forecasts for the Los Coches Subtation Rebuild 138/69 kV project for 2017, 2018, and 2019 are $1,403, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the distribution component of the rebuild of Los Coches substation, a transmission/FERC-driven project. This includes work related to new substation yard arrangements and bay positions related to the additional distribution circuits.

Information regarding the Los Coches Rebuild 138/69/12 kV Substation project is found in the capital workpapers. *See* SDG&E-14-CWP at section 10135 – Los Coches Rebuild 138/69/12 kV Substation.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this budget is to enhance electric system reliability.

10. 10144 – TL691 Avo - Mon Wood to Steel

The forecasts for the TL691 AVO-MON Wood to Steel project for 2017, 2018, and 2019 are $68, $162, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. This budget provides funding for the distribution facilities that will need to be replaced or modified as part of the wood-to-steel pole replacement work on TL691. Transmission line outages due to fires can have serious impacts on electric system reliability, and the resulting loss of electric service can impede emergency services and our customers' abilities to cope during the fire emergency. In an effort to reduce future damage and enhance the line's fire resistance, wood poles on TL691 within high-risk fire areas have been targeted for replacement with equivalent steel poles.

Information regarding TL691 AVO-MON Wood to Steel project is found in the capital workpapers. *See* SDG&E-14-CWP at section 10144 – AVO-MON Wood to Steel.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this project are to improve reliability, enhance safety and reinforce the overhead infrastructure of TL691, which is located in both fire-prone and wind-prone areas.

11. 10146 – TL695/6971 Reconductor and Wood to Steel

The forecasts for the TL695/6971 Reconductor and Wood to Steel project for 2017, 2018, and 2019 are $123, $1,140, and $0, respectively. SDG&E plans to build and place this project in service by the Test Year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. This budget provides funding for the distribution facilities that will need to be replaced or modified as part of the reconductor and wood-to-steel pole replacement work on TL695/6971.

Information regarding TL695/6971 Reconductor and Wood to Steel project is found in the capital workpapers. *See* SDG&E-14-CWP at section 10146 – TL695/6971 Reconductor and Wood to Steel.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual

costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this budget is to increase reliability by mitigating a category B NERC violation of an overload from an outage on an adjacent transmission line, TL690, during peak loading conditions and to reinforce the overhead infrastructure of TL695 and TL6971 in high fire-prone areas.

12. 10147 – TL697 San Luis Rey Wood to Steel

The forecasts for the TL697 San Luis Rey Wood to Steel project for 2017, 2018, and 2019 are $196, $2,324, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. This budget provides funding for the distribution facilities that will need to be replaced or modified as part of the reconductor and wood-to-steel pole replacement work on TL697.

The specific details regarding TL697 San Luis Rey Wood to Steel project is found in the capital workpapers. *See* SDG&E-14-CWP at section 10147– TL697 San Luis Rey Wood to Steel.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers of this budget are to increase reliability by mitigating a category B NERC violation and increase fire safety and service reliability by reinforcing the overhead infrastructure.

13. 10149 – Wood to Steel Pole – Replace – TL6912

The forecasts for the Wood to Steel Pole Replacement – TL6912 project for 2017, 2018, and 2019 are $66, $245, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. This budget provides funding for the distribution facilities that will need to be replaced or modified as part of the wood-to-steel pole replacement work on TL6912.

Information regarding Wood to Steel Pole Replacement – TL6912 project is found in the capital workpapers. *See* SDG&E-14-CWP at section 10149– Wood to Steel Pole Replacement – TL6912.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this budget is to increase fire safety and service reliability in the high fire-prone areas of TL6912.

14. 11126 – TL663 Mission to Kearny Mesa Reconductor

The forecasts for the TL663 Mission to Kearny Mesa Reconductor for 2017, 2018, and 2019 are $0, $173, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. This budget provides funding for the replacement or modification of distribution components related to the rebuilding of TL663, which helps mitigate NERC Category B reliability criteria overloads.

Information regarding TL663 Mission to Kearny Mesa Reconductor project is found in the capital workpapers. *See* SDG&E-14-CWP at section 11126– TL663 Mission to Kearny Mesa Reconductor.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver of this budget is to provide a long-term mitigation for the identified NERC Category B reliability criteria by reinforcing the overhead infrastructure.

15. 11133 – TL664 – Wood to Steel

The forecasts for the TL664 – Wood to Steel project for 2017, 2018, and 2019 are $305, $0, and $0, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. This budget provides funding for the replacement or modification of distribution components related to the rebuilding of TL664. Transmission line outages due to fires can have serious impacts on electric system reliability. A resulting loss of electric service can debilitate emergency services and our customers' abilities to cope during a fire emergency. In an effort to reduce future damage and enhance the line's fire resistance, wood poles on TL664 within the fire threat zone on the western edge of Miramar have been targeted for replacement with equivalent steel poles.

Information regarding TL664 - Wood to Steel project is found in the capital workpapers. *See* SDG&E-14-CWP- at section 11133 – TL664 - Wood to Steel.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this project are to increase reliability, reinforce the overhead infrastructure, and enhance safety within the fire threat zone of TL664.

16. 12137 – TL6916 – Wood to Steel

The forecasts for the TL6916 – Wood to Steel project for 2017, 2018, and 2019 are $0, $0, and $258, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. This budget provides funding for the replacement or modification of distribution components related to the rebuilding of TL6916. Transmission line outages due to fires can have serious impacts on electric system reliability, and a resulting loss of electric service can debilitate emergency services and our customers' abilities to cope during a fire emergency. In an effort to reduce future damage and enhance the line's fire resistance, wood poles on TL6916 have been targeted for replacement with equivalent steel poles.

Information regarding TL6916 - Wood to Steel project is found in the capital workpapers. *See* SDG&E-14-CWP- at section 12137 – TL6916 - Wood to Steel.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates,

contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this project are to increase reliability, reinforce the overhead infrastructure, and enhance safety within the high fire-prone areas of TL6916.

17. 12149 – TL694 – Wood to Steel

The forecasts for the TL694 – Wood to Steel project for 2017, 2018, and 2019 are $0, $0, and $762, respectively. This is an ongoing project that is expected to continue through the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. This budget provides funding for preliminary engineering for the distribution facilities that will need to be replaced or modified as part of the wood-to-steel rebuilding work on TL694.

Information regarding TL694 - Wood to Steel project is found in the capital workpapers. *See* SDG&E-14-CWP- at section 12149 – TL694 - Wood to Steel.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost driver for this project is to increase the safety and reliability of TL694.

18. 13130 – TL674A Del Mar Reconfigure/TL666D RFS

The forecasts for the TL674A Del Mar Reconfigure/TL666D remove from service (RFS) project for 2017, 2018, and 2019 are $18, $18, and $2,466, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. This budget provides funding for the distribution facilities that will need to be replaced or modified as part of the reconfiguration work on TL674A. This is a CAISO-approved project that also removes aging infrastructure in environmentally sensitive areas.

Information regarding the Loop TL674A into Del Mar and RFS TL666D project is found in the capital workpapers. *See* SDG&E-14-CWP at section 13130 – Loop TL674A into Del Mar and RFS TL666D.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project-specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this budget are to enhance reliability for the Del Mar Substation and to remove a segment of TL666 that runs through environmentally sensitive areas.

19. 14140 – TL698 Wood to Steel Project

The forecasts for TL698 Wood to Steel Project for 2017, 2018, and 2019 are $0, $762, and $762, respectively. SDG&E plans to build and place this project in service by the test year.

a. Description

This budget provides funding for the distribution component of this transmission/FERC-driven project. This budget provides funding for the distribution facilities that will need to be replaced or modified as part of the wood-to-steel work on TL698.

Information regarding TL698 Wood to Steel Project is found in the capital workpapers. *See* SDG&E-14-CWP at section 14140 – TL698 Wood to Steel Project.

b. Forecast Method

The forecast method used is zero-based. The forecast is based on detailed cost estimates that were developed based on the specific scope of work for the project. SDG&E develops detailed cost estimates based on current construction labor rates, material costs, overhead rates, contract pricing/quotes, and other project specific details. When projects are completed, actual costs are compared to the estimate to verify the estimates are accurate. Any significant variances between the estimated cost for a project and the actual costs are scrutinized to determine whether cost estimate inputs need to be adjusted for future projects.

c. Cost Drivers

The underlying cost drivers for this capital project are to increase reliability, to reinforce the overhead infrastructure, and to enhance safety within the high fire-prone areas of TL698.

V. IT PROJECTS SPONSORED BY ELECTRIC DISTRIBUTION

A. Introduction

In addition to installing new distribution equipment such as transformers, cables, conductors, protection devices, and switches, technology-related services are also required to enhance and support the electrical distribution system contributing to delivering safe and reliable service to customers. Some of the services can include expanding existing applications, updating hardware and software, or installing new applications. A detailed description of the IT capital projects sponsored by Electric Distribution is contained within the capital workpapers of Chris Olmsted (SDG&E-24-CWP IT). The workpapers provide further justification, purpose, description of the IT project, and the specifics around the capital expense request required to complete the project. This section provides the justification for each electric distribution sponsored IT project and provides the capital cost justified within Mr. Olmsted's testimony.

1. 00813A – CPD Enhancements Phase 3

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for CPD Enhancement Phase 3 project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

The existing CPD project was implemented with the recognition that while functional, additional enhancements should be made to further improve the efficiency of the software solution. This phase of the project will provide enhancements to the existing CPD software to increase efficiency, the ability to determine compliance issues on the distribution system, and improve avoidance of non-compliance through work processes, documentation, and data integration.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

2. 00813B – CMP SAP Enhancement

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for CMP SAP Enhancement project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

This project reduces or removes critical process steps (*e.g.*, manual steps) that are prone to error and will integrate systems which are used outside of the core SAP PM system to improve managing work along with information. The enhancement will benefit regulatory compliance, canceled work order processes, and quality management as well as tracking issues. Detailed descriptions of the improvement within these areas are as follows:

- Regulatory Compliance - Increase the integrity of the CMP through several enhancements that are interdependent with SAP PM and will reduce some of the non-compliance risk.
- Canceled Work Order – Providing a workflow for order that are administratively canceled will increase visibility and require supervisor approval to ensure the corrective work along with required inspections are completed as scheduled.
- Quality Management and Tracking Issues – Providing improved governance and program transparency by configuring the Archer software to validate when the compliance work is completed and creating an automated system to track and schedule compliance as well as maintenance work ensuring projects are not missed.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

3. 00813G – Transmission and Substation Integration

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for the Transmission & Substation Integra project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

Electric Transmission and Distribution Engineering are responsible for cost estimation, design, engineering, and project management of major electric transmission and substation projects. With the current estimation tool reaching the end of its useful life, this project will replace the existing tool with a more robust and IT supported tool that utilizes geospatial capabilities accessing GIS layers as well as transmission and substation assemblies.

The replacement will increase the credibility with interveners through enhanced forecasting, which will lead to responding to data requests within the requested timeframe. The improvements within project tracking will enhance financial reporting, as it will assist with reviewing planned costs versus actual charges during construction. Additionally, this project will increase accessibility and the sharing of essential project information for estimating projects by using a centralized data repository.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

4. 00829A – SDG&E Enhanced Mobile Command Trailer

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for SDG&E Enhanced Mobile Command Trailer project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

This project provides the required equipment to install IT supported communication and electronics inside the SDG&E Mobile Command Trailer used by the US Forest Service and during events in remote locations with limited communication. The equipment purchased for this trailer will allow for six to twenty laptop connections to directly report issues and conditions to the EOC along with other fire agencies requesting localized data during the operational event. In addition, the trailer will have the capability to support two active cellular 4G/LTE network connections thereby increasing the capability and carrier flexibility in remote areas with limited or no communication coverage. With customer privacy and cybersecurity at the forefront of all remote data connections, this trailer will also provide a user with secure access for any device connected to the Wi-Fi. All of this will assist with situational awareness and improving the operation of the system to provide safe and reliable service.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

5. 00829B – Emergency Field Communication Services

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for Emergency Field Communication Services project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

This project develops and deploys ten emergency communication trailers that are standardized with the capabilities to provide satellite and microwave broadband support at remote locations. The trailers will allow for rapid deployment of multiple emergency field operations sites simultaneously during emergency situations along with secure, reliable internet connectivity for cellular, video, data, and IP applications. The high bandwidth communication from the trailers will be used by emergency field operation and guests requiring critical information. All of this will assist with situational awareness and improving the operation of the system to provide safe and reliable service.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

6. 00833F – Incremental Powerworkz Update

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for the Incremental PowerWorkz Update project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

This project builds a new mobile application for the Vegetation Application that eliminates the daily replication of GIS data and replaces existing large as well as complicated applications with a single small application. The upgrade is designed to reduce vegetation vendor costs, eliminate issues with running an unsupported software, and improve back office performance when generating reports. By migrating to a single small application, the vegetation program will have the capability to streamline the existing process reducing possible spikes requiring vegetation mitigation, which will improve reliability of the system by performing the vegetation mitigation earlier.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

7. 00833I – Electric GIS 2017 Enhancements

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for the Electric GIS 2017 Enhancement project. SDG&E plans to build and place this project in service by the test year.

a. Justification

The Enterprise GIS requires several application enhancements as well as upgrades and data model expansions to stay on pace with escalating regulatory, reliability, safety, and growth requirements. This enhancement promotes efficient reporting of GIS, improves the accuracy of capturing GIS data, provides enhanced emergency response visualization options, and reduces as-built reconciliation. The improvements in reporting will provide additional analysis for engineers to determine route causes for reliability issues and the required system improvements necessary to mitigate the type of outage in the future.

The 2017 enhancement differs from the 2018 enhancement as it includes work-flow implementation on the mobile device, desktop business rule validation expansion, Data Model development, Web upgrade analysis, and Work Order History optimization.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

8. 00833J – CPD Enhancement Phase 4

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for the CPD Enhancement Phase 4 project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

The CPD project has been fully implemented, but enhancements are needed in addition to the CPD Enhancement Phase 3 project to improve the efficiency of the existing implemented applications, resulting in an improved end user experience to further leverage the capabilities of the implemented system. Enhancements will also streamline and improve system performance, data entry requirements and end user processing time. Creating a functionality to enable orders

to be processed on a wider variety of mobile devices designed to make the overall experience stable, portable, and simplified.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

9. 00833K – Electric GIS 2018 Enhancements

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for the Electric GIS 2018 Enhancement project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

The Enterprise GIS requires several application enhancements as well as upgrades and data model expansions to stay on pace with escalating regulatory, reliability, safety, and growth requirements. This enhancement promotes efficient reporting of GIS, improves the accuracy of capturing GIS data, provides enhanced emergency response visualization options, and reduces as-built reconciliation. The improvements in reporting will provide additional analysis for engineers to determine root causes for reliability issues and the required system improvements necessary to mitigate the type of outage in the future. The 2018 enhancement differs from the 2017 enhancement as it identifies, evaluates, prioritizes, and/or implements essential enhancements to the mobile portal, and web environment.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

10. 008341I – SDG&E Fan Voice and Dispatch

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for the SDG7E Fan Voice and Dispatch project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

The fleet of current analog voice radios needs replacement with updated digital radios to increase communication reliability for field personnel during emergencies and critical operation situations. The replacement provides supportable, reliable voice communications and dispatch for day-to-day operations as well as emergency responses. With the existing analog radios no

longer manufactured, this enhancement also increases the safety of field personnel and provides potential for increasing call capacity.

Additional detailed information regarding the CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

11. 00813F – Patrol Inspect Auto CMP

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for the Patrol Inspect Auto CMP project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

SDG&E is required to inspect electric distribution systems per CPUC G.O. 165. The SDG&E CMP is designed to provide oversight of the inspection and maintenance of electric distribution facilities to assure compliance with G.O. 165. This project builds systems and processes to automate patrol inspections and the creation of follow up repair work. This system reduces compliance risk due to missed or late patrols, improper record keeping, and lost visibility of required corrective action. In addition, it will eliminate the potential failures due to handwritten documentation and transposing of patrol results on maps as well as increase field efficiencies through the use of scheduling and dispatching processes.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

12. 00833M – ET and Substation Lifecycle

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for the Electric Transmission & Substation project lifecycle for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

This is a comprehensive program with many individual initiatives that target increasing efficiencies of the project lifecycle in Electric Transmission and Substation. The comprehensive program provides a single system of records for the initiation of projects to energize equipment, adaptable standard processes, predictive indicators, full asset lifecycle visibility for regulatory, financial, and operation as well as improve resource balancing.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

13. 03851A – BPM Automation

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for the BPM Automation project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

This project implements automated BPM, workflow, and case management tools across the enterprise. The new tool increases the efficiency and transparency of multiple business processes across the organization, enables centralized process management and control, increases labor savings from reduced development time, improves process compliance, and simplifies audit capabilities.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

14. 03851C – Engineering Project Lifecycle

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for the Engineering Project Lifecycle project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

The project focuses on the engineering project lifecycle pertaining to the people, process, priorities and integration of IT applications. The project will focus on the project lifecycle refinement while continuing to refine capabilities and accountability. The results will provide more clearly defined project criteria, processes and handoffs with appropriate use of applications.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

15. 03851E – TSPI Phase 3

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for the TSPI Phase 3 project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

The TSPI Phase 3 project continues enhancing the platform established by the first two phases of TSPI. This phase of the project improves Work Order processing, as well as improvements and enhancements to work flow.

Additional detailed information regarding the CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

16. 03852A – Unmanned Aerial System Analytics

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for the Unmanned Aerial System Analytics project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

The imagery data currently gathered from Unmanned Aerial Systems (UAS) is currently stored either on local computers or in file shares and is available only to small numbers of users. This project provides IT applications and infrastructure to manage, secure, and distribute imagery data to be used by engineers, inspectors, and emergency services. These applications will provide an increased need for UAS resulting in a reduction in helicopter flights, deployment of crews to hazardous areas, limited hiking in the backcountry, and enhanced inspection quality of SDG&E assets.

Additional detailed information regarding the CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

17. 00833D – Modernizing Outage Reporting (MOR)

The workpapers of Chris Olmsted (SDG&E-24-CWP IT) reflect the forecasts for the Modernizing Outage Reporting project for 2017, 2018, and 2019. SDG&E plans to build and place this project in service by the test year.

a. Justification

The MOR project provides a more effective outage analytics reporting system as well as improved NMS functionality to support outage analytics, distribution management functionality, and other required NMS changes. In addition, it will consolidate two legacy systems for improved user experience, streamline and develop a supported internal IT system for reliability outage reporting, and increase demand outage analysis tools to enable users to retrieve information specific to needs.

Additional detailed information regarding CPD Enhancement Phase 3 project is found in the capital workpapers of Chris Olmsted. *See* SDG&E-24-CWP IT in the Electric Distribution category.

VI. CONCLUSION

The electric distribution capital budgets represent a prudent level of funding for the critical activities and capital projects to take place in the TY 2019 GRC cycle. SDG&E continues to hold safety, reliability, and customer service as key tenets for day-to-day operations. The capital projects described above are scrutinized and prioritized by a cross-functional committee to address the most important risk concerns. Forecasts were developed by using both historical expenditures and specific project estimates, assessing upward pressures, and using all available information to develop reasonable forecasts.

Many of the core business activities remain the same as described in previous rate cases, with increases in most cases due to incremental cost drivers, but there are also areas of new and expanded focus. SDG&E's established safety-first culture focuses on three primary areas – public, customer, and employee safety – by integrating employee training, system operations and maintenance, and safe and reliable service. Electric distribution capital investments are designed to meet SDG&E safety, reliability, and customer service objectives by developing and implementing capital investment mitigation efforts that aggressively address identified risks. My testimony describes SDG&E's transparent focus on mitigation activities that address key safety risks through the RAMP process, which has led to funding requests for RAMP-related capital projects in this proceeding.

Another area of increased focus is on the integration of Distributed Energy Resources. SDG&E is obligated to maintain reliability and quality of service, regardless the level of DER saturation on the electric distribution system. SDG&E continues to look at advanced technologies that can monitor the levels of customer generation and mitigate the various problems those systems can impart on the electric distribution system.

The compilation of capital projects described in this testimony are designed to meet SDG&E's service obligation to our customers and provide the clean, safe and reliable energy service that our customers have grown to expect and depend upon. I respectfully request the Commission to authorize the funding necessary to complete the projects described in my testimony.

This concludes my prepared direct testimony.

VII. WITNESS QUALIFICATIONS

My name is Alan Colton. My business address is 8335 Century Park Court, San Diego, California, 92123. I am employed by SDG&E as Director, Major Projects. I have been employed by SDG&E since 1998. Prior to being hired at SDG&E, I worked for various Structural Engineering consulting firms. I have over 20 years of experience in the utility industry. While at SDG&E, I have held various staff and management positions in the electric transmission and distribution operations and engineering groups.

My present responsibilities include providing leadership to a team of professionals that provides project management, safety management, construction management, project controls, technical management, and quality assurance services to implement large-scale electric infrastructure projects within the SDG&E service territory. As part of these duties we coordinate with stakeholder groups to provide oversight of financial performance, environmental stewardship, regulatory compliance, legal support, and public affairs for these large-scale projects.

I earned a Bachelor of Science degree in Civil Engineering from San Diego State University. I am also a registered Professional Engineer in the state of California in the field of Civil Engineering and a registered Structural Engineer in the state of California.

I sponsor the TY 2019 General Rate Case Testimony for SDG&E's Electric Distribution capital spending plan. I have not previously testified before the Commission.

APPENDIX A
LIST OF BUDGET CODES IN NUMERICAL ORDER

Budget Code	Description	GRC Driver	2017	2018	2019
100	ELEC TRANS LINE RELIABILITY PROJECTS	TRANSMISSION/FERC DRIVEN PROJECTS	1,000	1,000	1,000
102	ELEC TRANS LINE RELOCATION PROJECTS	MANDATED	39	39	39
103	TRANSMISSION SUBSTATION RELIABILITY	TRANSMISSION/FERC DRIVEN PROJECTS	99	99	99
105	ELECTRIC TRANS. STREET/HWY RELOCATIONS	FRANCHISE	154	154	154
202	ELECTRIC METERS & REGULATORS	MATERIALS	4,156	5,106	5,974
203	DISTRIBUTION SUBSTATION RELIABILITY	RELIABILITY/IMPROVEMENTS	1,569	1,569	1,569
204	ELECTRIC DISTRIBUTION EASEMENTS	NEW BUSINESS	871	1,037	1,097
205	ELECTRIC DIST. STREET/HWY RELOCATIONS	FRANCHISE	5,241	5,241	5,241
206	ELECTRIC DISTRIBUTION TOOLS/EQUIPMENT	EQUIPMENT/TOOLS/MISCELLANEOUS	4,833	2,531	3,029
209	FIELD SHUNT CAPACITORS	CAPACITY/EXPANSION	587	587	587
210	CONVERSION FROM OH TO UG RULE 20A	FRANCHISE	10,929	10,929	10,929
211	CONVERSION FROM OH-UG RULE 20B, 20C	NEW BUSINESS	2,557	2,828	3,101
213	CITY OF SAN DIEGO SURCHARGE PROG (20SD)	FRANCHISE	18,139	18,499	18,866
214	TRANSFORMERS	MATERIALS	20,715	21,209	21,720
215	OH RESIDENTIAL NB	NEW BUSINESS	747	906	961
216	OH NON-RESIDENTIAL NB	NEW BUSINESS	809	950	998
217	UG RESIDENTIAL NB	NEW BUSINESS	12,658	16,055	16,993
218	UG NON-RESIDENTIAL NB	NEW BUSINESS	6,251	7,502	7,877

Budget Code	Description	GRC Driver	2017	2018	2019
219	NEW BUSINESS INFRASTRUCTURE	NEW BUSINESS	7,414	8,944	9,437
224	NEW SERVICE INSTALLATIONS	NEW BUSINESS	4,951	6,007	6,336
225	CUSTOMER REQUESTED UPGRADES AND SERVICES	NEW BUSINESS	8,637	9,387	10,288
226	MANAGEMENT OF OH DIST. SERVICE	RELIABILITY/IMPROVEMENTS	6,338	6,338	6,338
227	MANAGEMENT OF UG DIST. SERVICE	RELIABILITY/IMPROVEMENTS	3,493	3,493	3,493
228	REACTIVE SMALL CAPITAL PROJECTS	CAPACITY/EXPANSION	1,831	1,831	1,831
229	CORRECTIVE MAINTENANCE PROGRAM	MANDATED	10,803	10,803	10,803
230	REPLACEMENT OF UNDERGROUND CABLES	RELIABILITY/IMPROVEMENTS	11,800	26,257	15,564
235	TRANSFORMER & METER INSTALLATIONS	NEW BUSINESS	3,504	3,504	3,504
236	CAPITAL RESTORATION OF SERVICE	RELIABILITY/IMPROVEMENTS	10,832	11,162	11,502
289	SWITCH REPLACEMENT & MANHOLE REPAIR	MANDATED	5,438	5,438	5,438
901	LOCAL ENGINEERING - ELECTRIC DISTRIBUTION POOL	OH POOLS	60,788	81,200	97,618
904	LOCAL ENGINEERING - SUBSTATION POOL	OH POOLS	13,948	25,924	48,346
905	DEPARTMENT OVERHEAD POOL	OH POOLS	4,495	5,870	7,157
906	CONTRACT ADMINISTRATION POOL	OH POOLS	5,872	7,392	9,370
1269	REBUILD POINT LOMA SUBSTATION	RELIABILITY/IMPROVEMENTS	7,003	501	-
2258	SALT CREEK NEW SUBTATION & NEW CIRCUITS	CAPACITY/EXPANSION	3,336	-	-
5253	OCEAN RANCH	CAPACITY/EXPANSION	170	3,859	14,558

Budget Code	Description	GRC Driver	2017	2018	2019
	69/12 KV SUBSTATION				
6129	SOUTH ORANGE COUNTY REL ENHANCE (SOCRE)	TRANSMISSION/FERC DRIVEN PROJECTS	932	7,645	4,345
6247	REPLACEMENT OF LIVE FRONT EQUIPMENT	MANDATED	685	685	685
6254	EMERGENCY TRANSFORMER & SWITCHGEAR	RELIABILITY/IMPROVEMENTS	50	1,000	50
6260	4 KV MODERNIZATION	RELIABILITY/IMPROVEMENTS	-	8,954	11,393
7144	FIBER OPTIC FOR RELAY PROTECT & TELECOM	TRANSMISSION/FERC DRIVEN PROJECTS	391	391	391
7245	TELEGRAPH CANYON-4TH BANK & C1226	RELIABILITY/IMPROVEMENTS	1,771	-	-
8165	CLEVELAND NATIONAL FOREST POWER LINE REPLACEMENT PROJECTS	TRANSMISSION/FERC DRIVEN PROJECTS	26,155	39,209	40,035
8253	SUBSTATION CAPACITOR BANK UPGRADES	CAPACITY/EXPANSION	923	923	923
8260	C1047, CHOLLAS WEST-NEW CIRCUIT	CAPACITY/EXPANSION	1,840	-	-
9137	TL 649 OTAY-SAN YSIDRO-BRDR SW POLE REP	TRANSMISSION/FERC DRIVEN PROJECTS	412	854	-
9153	TL676-MISSION TO MESA HEIGHTS RECONDUCTO	TRANSMISSION/FERC DRIVEN PROJECTS	1,015	3,554	-
9271	MARGARITA SUB-NEW 12 KV CKT. 1259	RELIABILITY/IMPROVEMENTS	722	-	-
10135	LOS COCHES SUB-REBUILD 138/69 KV	TRANSMISSION/FERC DRIVEN PROJECTS	1,403	-	-
10144	TL691 AVO-MON WOOD TO STEEL	TRANSMISSION/FERC DRIVEN PROJECTS	68	162	-
10146	TL695/6971 RECONDUCTOR & WOOD TO STEEL	TRANSMISSION/FERC DRIVEN PROJECTS	123	1,140	-
10147	TL697 SAN LUIS REY WOOD TO STEEL	TRANSMISSION/FERC DRIVEN PROJECTS	196	2,324	-

Budget Code	Description	GRC Driver	2017	2018	2019
10149	WOOD TO STEEL POLE REPLACE. - TL6912	TRANSMISSION/FERC DRIVEN PROJECTS	66	245	-
10265	AVIAN PROTECTION PROGRAM	MANDATED	1,635	1,635	1,635
11126	TL663 MISSION TO KEARNY RECONDUCTOR	TRANSMISSION/FERC DRIVEN PROJECTS	-	173	-
11133	TL664-WOOD TO STEEL	TRANSMISSION/FERC DRIVEN PROJECTS	305	-	-
11144	ON-RAMP AERIAL LIGHTING	MANDATED	-	1,256	-
11246	SMART TRANSFORMERS	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	258	-	-
11247	ADVANCED ENERGY STORAGE	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	-	5,154	10,000
11249	INSTALL SCADA ON LINE CAPACITORS	RELIABILITY/IMPROVEMENTS	289	5,346	5,295
11253	WIRELESS FAULT INDICATORS	RELIABILITY/IMPROVEMENTS	340	4,386	4,345
11256	C1023, LI: NEW 12 KV CIR & RECOND C354	CAPACITY/EXPANSION	2,459	-	-
11261	SEWAGE PUMP STATION REBUILDS	RELIABILITY/IMPROVEMENTS	1,546	331	-
11267	SCADA EXPANSION-DISTRIBUTION	RELIABILITY/IMPROVEMENTS	-	6,976	6,976
12137	TL6916-WOOD TO STEEL	TRANSMISSION/FERC DRIVEN PROJECTS	-	-	258
12149	TL694-WOOD TO STEEL	TRANSMISSION/FERC DRIVEN PROJECTS	-	-	762
12243	PHASOR MEASUREMENT UNITS	RELIABILITY/IMPROVEMENTS	2,016	2,016	2,016
12246	ADVANCED GROUND FAULT DETECTION	RELIABILITY/IMPROVEMENTS	321	321	321
12247	SMART ISOLATION & RECLOSING	RELIABILITY/IMPROVEMENTS	1,356	1,356	1,356
12249	ADVANCED WEATHER STA. INTEGRATION & FORE	RELIABILITY/IMPROVEMENTS	208	208	988
12266	CONDITION BASED MAINTENANCE-SMART GRID	RELIABILITY/IMPROVEMENTS	1,546	1,546	1,546
13130	TL674A DEL MAR	TRANSMISSION/FERC DRIVEN	18	18	2,466

Budget Code	Description	GRC Driver	2017	2018	2019
	RECONFIGURE/TL666D RFS	PROJECTS			
13242	KEARNY 69/12 KV SUB REBUILD/RELOC	RELIABILITY/IMPROVEMENTS	4,500	7,000	-
13243	NEW VINE 69/12 KV SUBSTATION	RELIABILITY/IMPROVEMENTS	10,942	-	-
13244	STREAMVIEW 69/12 KV SUB REBUILD-PRE ENG	RELIABILITY/IMPROVEMENTS	50	50	50
13247	FIRM GRC BLANKET BUDGET	SAFETY AND RISK MANAGEMENT	57,780	57,780	57,780
13264	DISTRIBUTED GENERATION INTERCONNECT. PRO	MANDATED	507	459	-
13266	DISTRIBUTION AERIAL MARKING & LIGHTING	MANDATED	119	119	119
14140	TL698 WOOD TO STEEL PROJECT	TRANSMISSION/FERC DRIVEN PROJECTS	-	762	762
14143	POWAY SUBSTATION REBUILD	RELIABILITY/IMPROVEMENTS	177	-	-
14243	BORREGO SPRINGS MICROGRID ENHANCEMENTS	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	1,769	515	-
14249	SF6 SWITCH REPLACEMENT	SAFETY AND RISK MANAGEMENT	3,509	14,088	14,088
14259	VANADIUM FLOW BATTERY PROJECT	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	539	-	-
15243	SUBSTATION SCADA EXPANSION-DISTRIBUTION	RELIABILITY/IMPROVEMENTS	547	554	-
15246	RANCHO SANTA FE SUB HARDENING	SAFETY AND RISK MANAGEMENT	3,144	3,035	
15257	LARGE-SCALE COMM INFRASTR PROVIDER (CIP)	SAFETY AND RISK MANAGEMENT	-	5,020	5,020
15258	MIDCOAST TROLLEY EXTENSION PROJECT	NEW BUSINESS	6,918	66	-
15259	FIRE THREAT ZONE ADV PROTECT & SCADA UPG	SAFETY AND RISK MANAGEMENT	1,337	1,337	1,337
16142	C584 PAR, EXTEND C584 TO OFFLOAD	CAPACITY/EXPANSION	-	406	-

Budget Code	Description	GRC Driver	2017	2018	2019
	C783				
16243	MICROGRID FOR ENERGY RESILIENCE	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	-	5,894	7,916
16244	METEOROLOGY-OUTAGE PREDICTION MODELING	RELIABILITY/IMPROVEMENTS	717	-	-
16245	METEOROLOGY-FIRE BEHAVIOR MODELING	RELIABILITY/IMPROVEMENTS	272	-	-
16252	ELECTRIC INTEGRITY RAMP	SAFETY AND RISK MANAGEMENT	788	14,858	52,406
16255	RTU MODERNIZATION	SAFETY AND RISK MANAGEMENT	5,969	8,977	3,700
16257	VAULT RESTORATION	RELIABILITY/IMPROVEMENTS	-	1,000	1,000
16258	OIR WORST CIRCUITS	RELIABILITY/IMPROVEMENTS	2,502	2,502	2,502
16259	TP: C261, C262, C263, & C266 RE-ROUTE	SAFETY AND RISK MANAGEMENT	-	-	3,842
16260	MORRO HILL SUB REBUILD	RELIABILITY/IMPROVEMENTS	12	1,118	3,751
16267	C1447 MTO: EXTENSION & OFFLOAD FROM C958	CAPACITY/EXPANSION	390	-	-
16268	C1450, MTO:NEW 12 KV CIRCUIT	CAPACITY/EXPANSION	-	1,219	-
16269	JAMACHA NEW BANK & NEW 12 KV CIRCUIT	CAPACITY/EXPANSION	-	444	5,178
16272	DOHENY DESALINATION 15 MW PROJECT	CAPACITY/EXPANSION	-	-	366
17242	TWIN ENGINE HELICOPTER	SAFETY AND RISK MANAGEMENT	10,000	-	-
17244	VOLT/VAR OPTIMIZATION TRANSFORMER	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	-	500	100
17245	ITF-INTEGRATED TEST FACILITY	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	523	1,050	-
17246	BORREGO MICROGRID 3.0	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	209	5,230	-
17249	12/4 KV SUBSTATION SECURITY: ALARM SYSTEM	SAFETY AND RISK MANAGEMENT	950	3,820	5,730

Budget Code	Description	GRC Driver	2017	2018	2019
17250	PACIFIC AVE 20B CONVERSION PHASE 2	FRANCHISE	-	2,226	-
17251	ESPOLA RD 20B CONVERSION	FRANCHISE	-	2,121	-
17252	SOUTH SANTA FE DR 20B CONVERSION PH2	FRANCHISE	-	1,010	
17253	ELECTRIC DISTRIBUTION GRID ANALYTICS	RELIABILITY/IMPROVEMENTS	-	3,300	3,300
17254	POLE RISK MITIGATION & ENGINEERING (PRiME)	SAFETY AND RISK MANAGEMENT	270	4,582	40,430
87232	POLE REPLACEMENT AND REINFORCEMENT	MANDATED	13,943	13,943	13,943
93240	DISTRIBUTION CIRCUIT RELIABILITY CONSTRUCTION	RELIABILITY/IMPROVEMENTS	2,800	2,990	4,949
97248	DISTRIBUTION SYSTEM CAPACITY IMPROVEMENT	CAPACITY/EXPANSION	1,733	1,733	1,733
99282	REPLACE OBSOLETE SUB. EQPT	RELIABILITY/IMPROVEMENTS	1,144	8,144	15,144
TOTAL			**445,116**	**589,811**	**702,749**

APPENDIX B
LIST OF BUDGET CODES IN CATEGORY ORDER

Budget Code	Description	GRC Driver	2017	2018	2019
209	FIELD SHUNT CAPACITORS	CAPACITY/EXPANSION	587	587	587
228	REACTIVE SMALL CAPITAL PROJECTS	CAPACITY/EXPANSION	1,831	1,831	1,831
2258	SALT CREEK NEW SUBSTATION & NEW CIRCUITS	CAPACITY/EXPANSION	3,336	-	-
5253	OCEAN RANCH 69/12 kV SUBSTATION	CAPACITY/EXPANSION	170	3,859	14,558
8253	SUBSTATION CAPACITOR BANK UPGRADES	CAPACITY/EXPANSION	923	923	923
8260	CIRCUIT 1047, CHOLLAS WEST-NEW CIRCUIT	CAPACITY/EXPANSION	1,840	-	-
11256	C1023, LI: NEW 12 kV CIR & RECOND C354	CAPACITY/EXPANSION	2,459	-	-
16142	C584 PAR, EXTEND C584 TO OFFLOAD C783	CAPACITY/EXPANSION	-	406	-
16267	C1447 MTO: EXTENSION & OFFLOAD FROM C958	CAPACITY/EXPANSION	390	-	-
16268	C1450, MTO:NEW 12 kV CIRCUIT	CAPACITY/EXPANSION	-	1,219	-
16269	JAMACHA NEW BANK & NEW 12 kV CIRCUIT	CAPACITY/EXPANSION	-	444	5,178
16272	DOHENY DESALINATION 15MW PROJECT	CAPACITY/EXPANSION	-	-	366
97248	DISTRIBUTION SYSTEM CAPACITY IMPROVEMENT	CAPACITY/EXPANSION	1,733	1,733	1,733
11246	SMART TRANSFORMERS	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	258	-	-
11247	ADVANCED ENERGY STORAGE	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	-	5,154	10,000
14243	BORREGO SPRINGS MICROGRID ENHANCEMENTS	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	1,769	515	-
14259	VANADIUM FLOW BATTERY PROJECT	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	539	-	-
16243	MICROGRID FOR ENERGY RESILIENCE	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	-	5,894	7,916
17244	VOLT/VAR OPTIMIZATION TRANSFORMER	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	-	500	100
17245	ITF-INTEGRATED TEST	DISTRIBUTED ENERGY	523	1,050	-

Budget Code	Description	GRC Driver	2017	2018	2019
	FACILITY	RESOURCE (DER) INTEGRATION			
17246	BORREGO MICROGRID 3.0	DISTRIBUTED ENERGY RESOURCE (DER) INTEGRATION	209	5,230	-
206	ELECELECTRIC DISTRIBUTION TOOLS/EQUIPMENT	EQUIPMENT/TOOLS/MISCELLANEOUS	4,833	2,531	3,029
105	ELECTRIC TRANS. STREET/HWY RELOCATIONS	FRANCHISE	154	154	154
205	ELECTRIC DIST. STREET/HWY RELOCATIONS	FRANCHISE	5,241	5,241	5,241
210	CONVERSION FROM OH TO UG RULE 20A	FRANCHISE	10,929	10,929	10,929
213	CITY OF SAN DIEGO SURCHARGE PROG (20SD)	FRANCHISE	18,139	18,499	18,866
17250	PACIFIC AVE 20B CONVERSION PHASE 2	FRANCHISE	-	2,226	-
17251	ESPOLA RD 20B CONVERSION	FRANCHISE	-	2,121	-
17252	SOUTH SANTA FE DR 20B CONVERSION PH2	FRANCHISE	-	1,010	-
102	ELEC TRANS LINE RELOCATION PROJECTS	MANDATED	39	39	39
229	CORRECTIVE MAINTENANCE PROGRAM	MANDATED	10,803	10,803	10,803
289	SWITCH REPLACEMENT & MANHOLE REPAIR	MANDATED	5,438	5,438	5,438
6247	REPLACEMENT OF LIVE FRONT EQUIPMENT	MANDATED	685	685	685
10265	AVIAN PROTECTION PROGRAM	MANDATED	1,635	1,635	1,635
11144	ON-RAMP AERIAL LIGHTING	MANDATED	-	1,256	-
13264	DISTRIBUTED GENERATION INTERCONNECT. PRO	MANDATED	507	459	-
13266	DISTRIBUTION AERIAL MARKING & LIGHTING	MANDATED	119	119	119
87232	POLE REPLACEMENT AND REINFORCEMENT	MANDATED	13,943	13,943	13,943
202	ELECTRIC METERS & REGULATORS	MATERIALS	4,156	5,106	5,974
214	TRANSFORMERS	MATERIALS	20,715	21,209	21,720
204	ELECTRIC DISTRIBUTION EASEMENTS	NEW BUSINESS	871	1,037	1,097
211	CONVERSION FROM OH-UG	NEW BUSINESS	2,557	2,828	3,101

Budget Code	Description	GRC Driver	2017	2018	2019
	RULE 20B, 20C				
215	OH RESIDENTIAL NB	NEW BUSINESS	747	906	961
216	OH NON-RESIDENTIAL NB	NEW BUSINESS	809	950	998
217	UG RESIDENTIAL NB	NEW BUSINESS	12,658	16,055	16,993
218	UG NON-RESIDENTIAL NB	NEW BUSINESS	6,251	7,502	7,877
219	NEW BUSINESS INFRASTRUCTURE	NEW BUSINESS	7,414	8,944	9,437
224	NEW SERVICE INSTALLATIONS	NEW BUSINESS	4,951	6,007	6,336
225	CUSTOMER REQUESTED UPGRADES AND SERVICES	NEW BUSINESS	8,637	9,387	10,288
235	TRANSFORMER & METER INSTALLATIONS	NEW BUSINESS	3,504	3,504	3,504
15258	MIDCOAST TROLLEY EXTENSION PROJECT	NEW BUSINESS	6,918	66	-
901	LOCAL ENGINEERING - ELECTRIC DISTRIBUTION POOL	OH POOLS	60,788	81,200	97,618
904	LOCAL ENGINEERING - SUBSTATION POOL	OH POOLS	13,948	25,924	48,346
905	DEPARTMENT OVERHEAD POOL	OH POOLS	4,495	5,870	7,157
906	CONTRACT ADMINISTRATION POOL	OH POOLS	5,872	7,392	9,370
203	DISTRIBUTION SUBSTATION RELIABILITY	RELIABILITY/IMPROVEMENTS	1,569	1,569	1,569
226	MANAGEMENT OF OH DIST. SERVICE	RELIABILITY/IMPROVEMENTS	6,338	6,338	6,338
227	MANAGEMENT OF UG DIST. SERVICE	RELIABILITY/IMPROVEMENTS	3,493	3,493	3,493
230	REPLACEMENT OF UNDERGROUND CABLES	RELIABILITY/IMPROVEMENTS	11,800	26,257	15,564
236	CAPITAL RESTORATION OF SERVICE	RELIABILITY/IMPROVEMENTS	10,832	11,162	11,502
1269	REBUILD POINT LOMA SUBSTATION	RELIABILITY/IMPROVEMENTS	7,003	501	-
6254	EMERGENCY TRANSFORMER & SWITCHGEAR	RELIABILITY/IMPROVEMENTS	50	1,000	50
6260	4 kV MODERNIZATION	RELIABILITY/IMPROVEMENTS	-	8,954	11,393
7245	TELEGRAPH CANYON-4TH BANK & C1226	RELIABILITY/IMPROVEMENTS	1,771	-	-
9271	MARGARITA SUB-NEW 12 kV CKT. 1259	RELIABILITY/IMPROVEMENTS	722	-	-
11249	INSTALL SCADA ON LINE CAPACITORS	RELIABILITY/IMPROVEMENTS	289	5,346	5,295
11253	WIRELESS FAULT	RELIABILITY/IMPROVEM	340	4,386	4,345

Budget Code	Description	GRC Driver	2017	2018	2019
	INDICATORS	ENTS			
11261	SEWAGE PUMP STATION REBUILDS	RELIABILITY/IMPROVEMENTS	1,546	331	-
11267	SCADA EXPANSION-DISTRIBUTION	RELIABILITY/IMPROVEMENTS		6,976	6,976
12243	PHASOR MEASUREMENT UNITS	RELIABILITY/IMPROVEMENTS	2,016	2,016	2,016
12246	ADVANCED GROUND FAULT DETECTION	RELIABILITY/IMPROVEMENTS	321	321	321
12247	SMART ISOLATION & RECLOSING	RELIABILITY/IMPROVEMENTS	1,356	1,356	1,356
12249	ADVANCED WEATHER STA. INTEGRATION & FORE	RELIABILITY/IMPROVEMENTS	208	208	988
12266	CONDITION BASED MAINTENANCE-SMART GRID	RELIABILITY/IMPROVEMENTS	1,546	1,546	1,546
13242	KEARNY 69/12 kV SUB REBUILD/RELOC	RELIABILITY/IMPROVEMENTS	4,500	7,000	-
13243	NEW VINE 69/12 kV SUBSTATION	RELIABILITY/IMPROVEMENTS	10,942	-	-
13244	STREAMVIEW 69/12 kV SUB REBUILD-PRE ENG	RELIABILITY/IMPROVEMENTS	50	50	50
14143	POWAY SUBSTATION REBUILD	RELIABILITY/IMPROVEMENTS	177	-	-
15243	SUBSTATION SCADA EXPANSION-DISTRIBUTION	RELIABILITY/IMPROVEMENTS	547	554	-
16244	METEOROLOGY-OUTAGE PREDICTION MODELING	RELIABILITY/IMPROVEMENTS	717	-	-
16245	METEOROLOGY-FIRE BEHAVIOR MODELING	RELIABILITY/IMPROVEMENTS	272	-	-
16257	VAULT RESTORATION	RELIABILITY/IMPROVEMENTS	-	1,000	1,000
16258	OIR WORST CIRCUITS	RELIABILITY/IMPROVEMENTS	2,502	2,502	2,502
16260	MORRO HILL SUB REBUILD	RELIABILITY/IMPROVEMENTS	12	1,118	3,751
17253	ELECTRIC DISTRIBUTION GRID ANALYTICS	RELIABILITY/IMPROVEMENTS	-	3,300	3,300
93240	DISTRIBUTION CIRCUIT RELIABILITY CONSTRUCTION	RELIABILITY/IMPROVEMENTS	2,800	2,990	4,949
99282	REPLACE OBSOLETE SUB. EQPT.	RELIABILITY/IMPROVEMENTS	1,144	8,144	15,144
13247	FIRM GRC BLANKET BUDGET	SAFETY AND RISK MANAGEMENT	57,780	57,780	57,780
14249	SF6 SWITCH REPLACEMENT	SAFETY AND RISK MANAGEMENT	3,509	14,088	14,088
15246	RANCHO SANTA FE SUB	SAFETY AND RISK	3,144	3,035	-

Budget Code	Description	GRC Driver	2017	2018	2019
	HARDENING	MANAGEMENT			
15257	LARGE-SCALE COMM INFRASTR PROVIDER (CIP)	SAFETY AND RISK MANAGEMENT	-	5,020	5,020
15259	FIRE THREAT ZONE ADV PROTECT & SCADA UPG	SAFETY AND RISK MANAGEMENT	1,337	1,337	1,337
16252	ELECTRIC INTEGRITY RAMP	SAFETY AND RISK MANAGEMENT	788	14,858	52,406
16255	RTU MODERNIZATION	SAFETY AND RISK MANAGEMENT	5,969	8,977	3,700
16259	TP: C261, C262, C263, & C266 RE-ROUTE	SAFETY AND RISK MANAGEMENT	-	-	3,842
17242	TWIN ENGINE HELICOPTER	SAFETY AND RISK MANAGEMENT	10,000	-	-
17249	12/4 kV SUBSTATION SECURITY: ALARM SYSTEM	SAFETY AND RISK MANAGEMENT	950	3,820	5,730
17254	POLE RISK MITIGATION & ENGINEERING (PRiME)	SAFETY AND RISK MANAGEMENT	270	4,582	40,430
100	ELEC TRANS LINE RELIABILITY PROJECTS	TRANSMISSION/FERC DRIVEN PROJECTS	1,000	1,000	1,000
103	TRANSMISSION SUBSTATION RELIABILITY	TRANSMISSION/FERC DRIVEN PROJECTS	99	99	99
6129	SOUTH ORANGE COUNTY REL ENHANCE (SOCRE)	TRANSMISSION/FERC DRIVEN PROJECTS	932	7,645	4,345
7144	FIBER OPTIC FOR RELAY PROTECT & TELECOM	TRANSMISSION/FERC DRIVEN PROJECTS	391	391	391
8165	CLEVELAND NATIONAL FOREST POWER LINE REPLACEMENT PROJECTS	TRANSMISSION/FERC DRIVEN PROJECTS	26,155	39,209	40,035
9137	TL 649 OTAY-SAN YSIDRO-BRDR SW POLE REP	TRANSMISSION/FERC DRIVEN PROJECTS	412	854	-
9153	TL676-MISSION TO MESA HEIGHTS RECONDUCTO	TRANSMISSION/FERC DRIVEN PROJECTS	1,015	3,554	-
10135	LOS COCHES SUB-REBUILD 138/69 KV	TRANSMISSION/FERC DRIVEN PROJECTS	1,403	-	-
10144	TL691 AVO-MON WOOD TO STEEL	TRANSMISSION/FERC DRIVEN PROJECTS	68	162	-
10146	TL695/6971 RECONDUCTOR & WOOD TO STEEL	TRANSMISSION/FERC DRIVEN PROJECTS	123	1,140	-
10147	TL697 SAN LUIS REY WOOD TO STEEL	TRANSMISSION/FERC DRIVEN PROJECTS	196	2,324	-
10149	WOOD TO STEEL POLE REPLACE.-TL6912	TRANSMISSION/FERC DRIVEN PROJECTS	66	245	-
11126	TL663 MISSION TO KEARNY RECONDUCTOR	TRANSMISSION/FERC DRIVEN PROJECTS	-	173	-
11133	TL664-WOOD TO STEEL	TRANSMISSION/FERC DRIVEN PROJECTS	305	-	-
12137	TL6916-WOOD TO STEEL	TRANSMISSION/FERC DRIVEN PROJECTS	-	-	258

Budget Code	Description	GRC Driver	2017	2018	2019
12149	TL694-WOOD TO STEEL	TRANSMISSION/FERC DRIVEN PROJECTS	-	-	762
13130	TL674A DEL MAR RECONFIGURE/TL666D RFS	TRANSMISSION/FERC DRIVEN PROJECTS	18	18	2,466
14140	TL698 WOOD TO STEEL PROJECT	TRANSMISSION/FERC DRIVEN PROJECTS	-	762	762
TOTAL			**445,116**	**589,811**	**702,749**

APPENDIX C
CAPITAL PROJECTS SUPPORTING RAMP RISKS

ELECTRIC DISTRIBUTION (In 2016 $)			
RAMP Risk Chapter	**2017 Estimated RAMP Total (000s)**	**2018 Estimated RAMP Total (000s)**	**2019 Estimated RAMP Total (000s)**
SDG&E-1 Wildfires Caused by SDG&E Equipment	90,648	115,920	148,608
SDG&E-3 Employee, Contractor and Public Safety	6,672	8,192	10,169
SDG&E-4 Distributed Energy Resources (DERs)	507	459	0
SDG&E-8 Aviation Incident	10,000	0	0
SDG&E-12 Electric Infrastructure Integrity	72,739	144,507	182,661
Total Capital	**180,566**	**269,078**	**341,438**

ELECTRIC DISTRIBUTION (In 2016 $)			
SDG&E-1 Wildfires Caused by SDG&E Equipment	**2017 Estimated RAMP Total (000s)**	**2018 Estimated RAMP Total (000s)**	**2019 Estimated RAMP Total (000s)**
08165, RAMP - INCREMENTAL - CNF	26,155	39,209	40,035
09137, RAMP - INCREMENTAL TL649 OTAY-SAN YSIDRO-BORDER SW POLE REPLACE	412	854	0
10144, RAMP - INCREMENTAL - TL691 AVO-MON WOOD TO STEEL	68	162	0
10146, RAMP - INCREMENTAL TL695 TALEGA WOOD TO STEEL	123	1,140	0
10147.001, RAMP - INCREMENTAL TL697 SAN LUIS REY WOOD TO STEEL	98	1,162	0
10147.002, RAMP - INCREMENTAL TL690A - PENDLETON SOUTH - WOOD TO STEEL	98	1,162	0
10149, RAMP - INCREMENTAL TL6912 WOOD TO STEEL POLE REPLACEMENT	66	245	0
11253, RAMP - BASE - WIRELESS FAULT INDICATORS	340	4,386	4,345
12243, RAMP - BASE - PHASOR MEASUREMENT UNITS (DISTRIBUTION)	2,016	2,016	2,016
12246, RAMP - BASE - ADVANCED GROUND FAULT DETECTION	321	321	321
12247, RAMP - BASE - SMART ISOLATION & RECLOSIN	1,356	1,356	1,356
12249, RAMP - BASE - ADVANCED WEATHER STATION INTEGRATION & FORECAST	208	208	988
13247, RAMP - BASE - FIRM	57,780	57,780	57,780
15259, RAMP - INCREMENTAL - FIRE THREAT ZONE ADV PROTECTION SCAD	1,337	1,337	1,337
17254, RAMP - BASE - ACCELERATED POLE LOADING - QA QC PORTION IS RAMP	270	4,582	40,430
Total	**90,648**	**115,920**	**148,608**

SDG&E-3 Employee, Contractor and Public Safety	2017 Estimated RAMP Total (000s)	2018 Estimated RAMP Total (000s)	2019 Estimated RAMP Total (000s)
901.002, RAMP - BASE WORK STANDARDS & METHODS	800	800	800
906.0, RAMP - BASE CONTRACT ADMINISTRATION POOL	5,872	7,392	9,370
112610.002, RAMP - BASE - CONTRACTOR SAFETY PROGRAM	0	0	-1
Total	**6,672**	**8,192**	**10,169**

SDG&E-4 Distributed Energy Resources (DERs)	2017 Estimated Incremental (000s)	2018 Estimated Incremental (000s)	2019 Estimated Incremental (000s)
13264.001, RAMP - INCREMENTAL - DISTRIBUTED GENERATION INTERCONNECT PRO	507	321	0
132640.002, RAMP - INCREMENTAL DISTRIBUTED GENERATION INTERCONNECT PRO - COLLECTIBLE	0	138	0
Total	**507**	**459**	**0**

SDG&E-8 Aviation Incident	2017 Estimated RAMP Total (000s)	2018 Estimated RAMP Total (000s)	2019 Estimated RAMP Total (000s)
17242, RAMP - INCREMENTAL -TWIN ENGINE HELICOPTER	10,000	0	0
Total	**10,000**	**0**	**0**

SDG&E-12 Electric Infrastructure Integrity	2017 Estimated RAMP Total (000s)	2018 Estimated RAMP Total (000s)	2019 Estimated RAMP Total (000s)
229, RAMP - BASE - CORRECTIVE MAINT PROGRAM	10,803	10,803	10,803
230.001, RAMP - BASE - CABLE REPLACEMENT	11,800	15,757	15,464
230.002, RAMP - INCREMENTAL - DOWNTOWN SUBSTATION	0	10,500	100
236, RAMP - INCREMENTAL CAPITAL RESTORATION OF SERVICE	10,832	11,162	11,502
289, RAMP - BASE - DOE SWITCH/MANHOLE REPLACEMENT	5,438	5,438	5,438
6247, RAMP- BASE - REPLACEMENT OF LIVE FRONT EQUIPMENT	685	685	685
6260.001, RAMP - INCREMENTAL – 4 KV	0	7,164	9,114

SDG&E-12 Electric Infrastructure Integrity	2017 Estimated RAMP Total (000s)	2018 Estimated RAMP Total (000s)	2019 Estimated RAMP Total (000s)
MODERNIZATION - DISTRIBUTION			
6260.002, RAMP - INCREMENTAL – 4 KV MODERNIZATION - SUBSTATION	0	1,790	2,279
10265, RAMP- BASE - AVIAN PROTECTION	1,635	1,635	1,635
11144, RAMP – INCREMENTAL - ON RAMP AERIAL LIGHT	0	1,256	0
11249, RAMP - BASE - INSTALL SCADA ON LINE CAPACITORS	289	5,346	5,295
11261, RAMP - INCREMENTAL - SEWAGE PUMP STATION REBUILDS	1,546	331	1
11267, RAMP - BASE – SCADA EXPANSION	0	6,976	6,976
12266, RAMP - BASE - CONDITION BASED MAINTENANCE - SMART GRID	1,546	1,546	1,546
14249, RAMP – INCREMENTAL - SF6 SWITCH REPLACEMENT	3,509	14,088	14,088
16252, RAMP - INCREMENTAL – ELECTRIC INTEGRITY	788	14,858	52,406
16255.001, RAMP – INCREMENTAL - RTU MODERNIZATION	1,085	4,200	3,700
16255.002, RAMP - INCREMENTAL -SCADA MASTER MODERNIZATION	4,884	4,777	0
162590, RAMP – INCREMENTAL - OIR CIRCUITS	0	0	3,842
16260, RAMP - INCREMENTAL - MORRO HILL SUBSTATION REBUILD	12	1,118	3,751
87232.001, RAMP - BASE – POLE REPLACEMENT AND REINFORCEMENT	13,943	13,943	13,943
93240, RAMP - INCREMENTAL - DISTRIBUTION CIRCUIT RELIABILITY CONSTRUCTION	2,800	2,990	4,949
99282, RAMP - INCREMENTAL - REPLACE OBSOLETE SUBSTATION EQUIPMENT	1,144	8,144	15,144
Total	**72,739**	**144,507**	**182,661**

APPENDIX D
GLOSSARY OF ACRONYMS

ACSS/AW	Aluminum Conductor, Aluminum Clad Steel Supported
AES	Advanced Energy Storage
AFV	Alternate Fueled Vehicle
AMI	Advanced Meter Initiative
ANSI	American National Standards Institute
APLIC	Avian Power Line Interaction Committee
BK	Bank
BQ	Batiquitos
BTM	Beyond the Meter
BSMD	Borrego Springs Microgrid Demonstration
BY	Base Year
CA	Contract Administration
CAISO	California Independent System Operator
CARB	California Air Resources Board
CBD	Capital Budget Documentation
CBM	Condition Based Maintenance
CC	Chicarita
CCDC	Centre-City Development Corporation
CFSP	Community Fire Safety Program
CIAC	Contributions in Aid of Construction
CIP	Communication Infrastructure Providers
CMP	Corrective Maintenance Program
CNF	Cleveland National Forest
CPUC	California Public Utilities Commission ("Commission")
CSW	Chollas West
DER	Distributed Energy Resource
DERMS	Distributed Energy Management Systems
DG	distributed generation
DLP	Dynamic Load Profile
DMS	Distribution Management System (sometimes with Outage Management System as OMS/DMS)
DOE	Do Not Operate Energized' or U.S. Department of Energy
ECS	Enhanced cable strategy
ED	Electric Distribution
EDW	Enterprise Data Warehouse
EII	Electric Infrastructure Integrity
EMD	Electric Motor Drive
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
EPIC	Electric Program Investment Charge
ERA	Electric Reliability Assessment
ET&D	Electric Transmission and Distribution
EV	Electric Vehicle

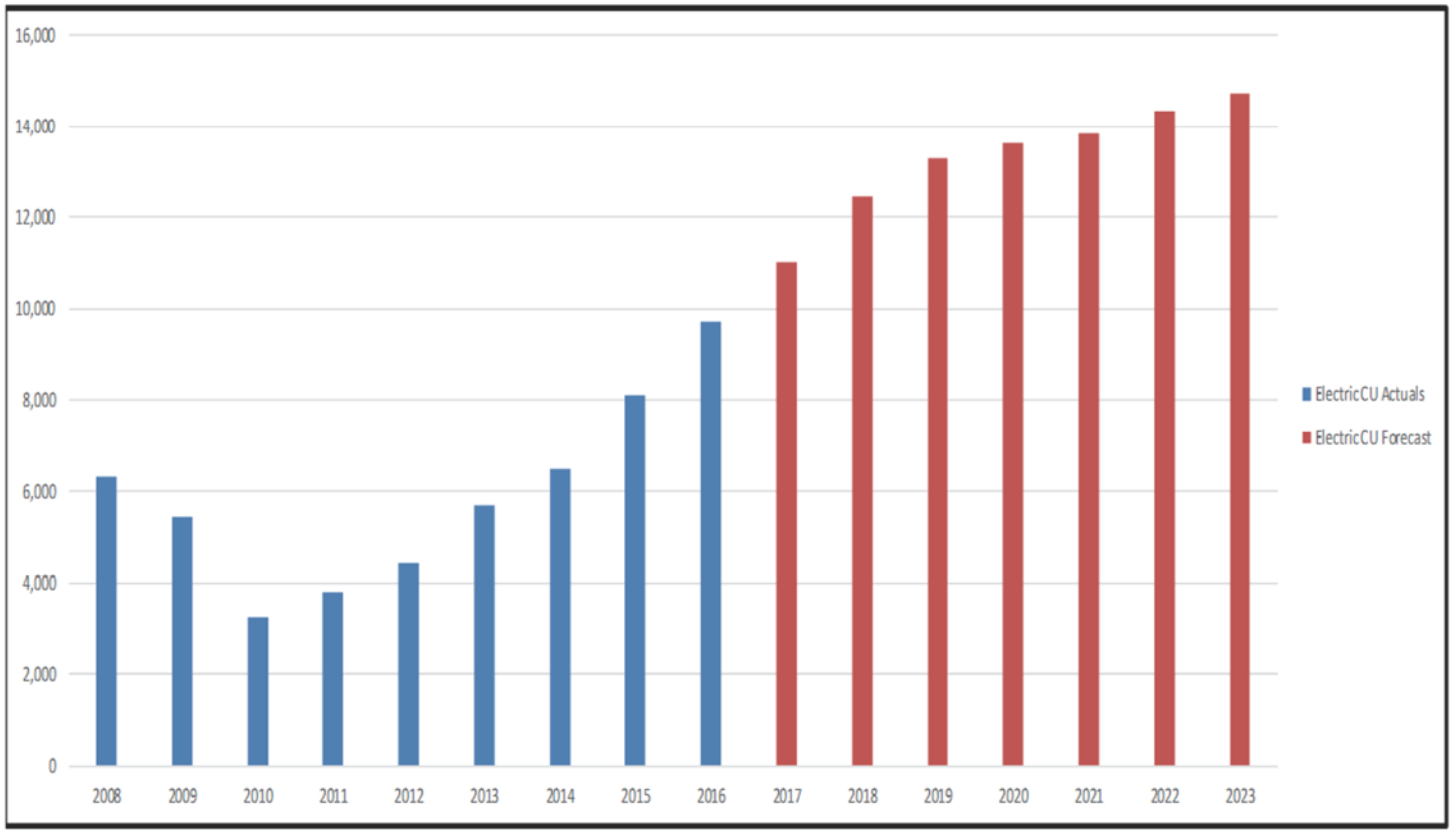
FAA	Federal Aviation Administration
FCP	Falling Conductor Protection
FERC	Federal Energy Regulatory Commission
FR3	Envirotemp FR3 fluid, a substitute for conventional transformer oils developed by Cooper Power Systems)
FSMSUP	US Forest Service Master Special Use Permit
FTZ	Fire Threat Zone
FiRM	Fire Risk Mitigation
GH	Grant Hill
GIS	Geographical Information System
GO	General Order
HAN	Home Area Network
HRFA	Highest Risk Fire Area
IOU	Investor Owned Utility
IP	Internet Protocol
ITF`	Integrated Test Facility
JM	Jamacha
kV	kilovolt
LC	Los Coches
LE	Local Engineering
LI	Lilac
LTC	Load Tap Changer
LiDAR	Light Detection and Ranging
MAR	Margarita
MIO	Mechanically Inoperable
MMBA	Master Meter Balancing Account
MOU	Memorandum of Understanding
MSH	Mesa Heights
MSPU	Master Special Use Permit
MVA	Mega Volt Ampere (million VA)
MW	Megawatt
NB	New Business
NEDO	New Energy and Development Organization
NEM	Net Energy Metering
NERC/CIP	North American Electric Reliability Corporation, Critical Infrastructure Protection
NMS	Network Management System
OES	San Diego County Office of Emergency Services
OH	overhead
OIR	Order Instituting Rulemaking
OL	Otay Lakes
OMS	Outage Management System (sometimes with Distribution Management System as OMS/DMS)
OP	Ordering Paragraph
OPEX GIS	Operational Excellence Geographic Information System
OT	Old Town

PFM	Petition for Modification
PLS	Point Loma Sewage Substation
PLS-CADD	Power Line Systems Computer Aided Design and Drafting
PLWTP	Point Loma waste water treatment plant
PME	Pad Mounted Gear
PMU	Phasor Measurement Unit
PO	Poway
POM	Pomerado
PQ	Power Quality
PRiME	Pole Risk Mitigation and Engineering
PV	Photovoltaic
RAMP	Risk Assessment Mitigation Phase
RAT	Reliability Assessment Team
RFS	Remove from Service (sometimes Retire from Service)
RMS	Root-mean square
RMV	Rancho Mission Viejo
RTDS	Real Time Digital Simulator
RTU	Remote Terminal Units
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SANDAG	San Diego County Association of Governments
SAP	Financial Software
SCADA	Supervisory Control and Data Acquisition
SDG&E	San Diego Gas & Electric Company
SEA	Substation Equipment Assessment
SF6	Sulfur Hexafluoride, a dielectric gas
S-MAP	Safety Model Assessment Proceeding
SUP	special use permits
SW	Steel/Wood
SWPL	Southwest Power Link
SWPPP	Storm Water Pollution Prevention Plan
TCM	Transmission Construction & Maintenance
TCO	total cost of ownership
TL	Transmission Line
TRC	Technical Review Committee
TTM	To the meter
TY	Test Year
UCLA	University of California at Los Angeles
UG	underground
VAr	Volts-amps reactive (sometimes VAR)
VRG	Vanadium-Redox Flow
WFI	Wireless Fault Indicator
WRRM	Wildfire Risk Reduction Model
WTS	Wood-to-Steel
20SD	City of San Diego Surcharge Program

APPENDIX E
CONSTRUCTION UNIT FORECAST

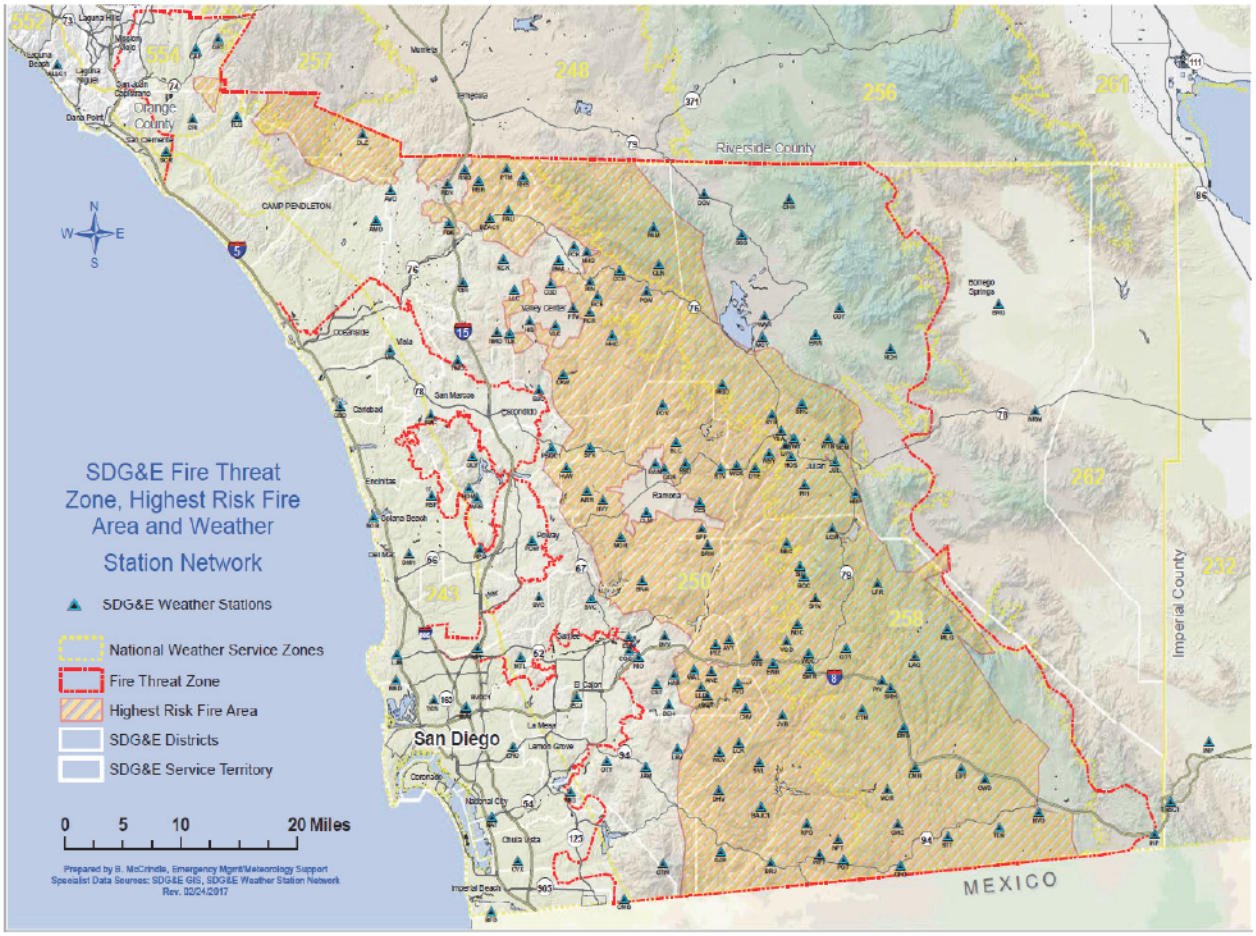
Construction Unit History & Forecast

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
ELECTRIC CU ACTUALS	6,346	5,466	3,277	3,819	4,441	5,685	6,499	8,115	9,726							
ELECTRIC CU FORECAST										11,023	12,464	13,288	13,648	13,830	14,364	14,743



* *Based on April, 2017 Forecast and Used in 2019 GRC*

APPENDIX F
MAP OF SDG&E FIRE THREAT ZONE, HIGH RISK FIRE AREA, AND WEATHER STATION NETWORK



SDG&E 2019 GRC Testimony Revision Log –December 2017

Exhibit	Witness	Page	Line	Revision Detail
SDGE-14	Alan Colton	AFC-xix	Summary Table	Changes 2017 444,957 to 445,116 – 2018 589,652 to 589,811 – 2019 702,590 to 702,749
SDGE-14	Alan Colton	AFC-xix	Summary Request	Changes 2017 444,957 to 445,116 – 2018 589,652 to 589,811
SDGE-14	Alan Colton	AFC-1	Table AFC-1	Changes 2017 444,957 to 445,116 – 2018 589,652 to 589,811 – 2019 702,590 to 702,749
SDGE-14	Alan Colton	AFC-16	Table AFC-4	Changes 2017 74,704 to 74,863 – 2018 108,259 to 108,418 – 2019 103,289 to 103,448
SDGE-14	Alan Colton	AFC-16	Table AFC-4	Changes 2017 444,957 to 445,116 – 2018 589,652 to 589,811 – 2019 702,590 to 702,749
SDGE-14	Alan Colton	AFC-25	Line 8	Changes Forecast Method from five-year average to zero-based
SDGE-14	Alan Colton	AFC-34	footnote	Footnote added, forecast method correction
SDGE-14	Alan Colton	AFC-35	footnote	Footnote added, CIAC exclusion
SDGE-14	Alan Colton	AFC-74	Line 10	Changes Forecast Method from base year to zero-based.
SDGE-14	Alan Colton	AFC-76	Table AFC-11	Changes 2017 (109) to 50 – 2018 841 to 1,000 – 2019 (109) to 50
SDGE-14	Alan Colton	AFC-77	Table AFC-11	Changes 2017 74,704 to 74,863 – 2018 108,259 to 108,418 – 2019 103,289 to 103,448
SDGE-14	Alan Colton	AFC-82	Line 28	Changes Forecast Method from five-year average to four-year average
SDGE-14	Alan Colton	AFC-83	Line 30	Changes 2017 (109) to 50 – 2018 841 to 1,000 – 2019 (109) to 50
SDGE-14	Alan Colton	AFC-92	Line 9	Changes Forecast Method from zero based to three-year average
SDGE-14	Alan Colton	AFC-A-3	Appendix A	Changes 2017 (109) to 50 – 2018 841 to 1,000 – 2019 (109) to 50
SDGE-14	Alan Colton	AFC-A-7	Appendix A	Changes 2017 444,957 to 445,116 – 2018 589,652 to 589,811 – 2019 702,590 to 702,749
SDGE-14	Alan Colton	AFC-B-3	Appendix B	Changes 2017 (109) to 50 – 2018 841 to 1,000 – 2019 (109) to 50
SDGE-14	Alan Colton	AFC-B-6	Appendix B	Changes 2017 444,957 to 445,116 – 2018 589,652 to 589,811 – 2019 702,590 to 702,749