Company: San Diego Gas & Electric Company (U 902 M)
Proceeding: 2024 General Rate Case
Application: A.22-05-015/-016 (cons.)~~6~~
Exhibit: SDG&E-12-R-E

REVISED

PREPARED DIRECT TESTIMONY OF

TYSON SWETEK

(ELECTRIC DISTRIBUTION O&M)

ERRATA

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

~~August 2022~~May 2023

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~~SDG&E 2024 GRC Testimony Revision Log – August 2022~~

SUMMARY

ELECTRIC DISTRIBUTION (In 2021 $)			
	2021 Adjusted-Recorded (000s)	**TY2024 Estimated (000s)**	**Change (000s)**
Total Non-Shared Services	110,831~~110,833~~	130,961~~132,721~~	20,130~~21,888~~
Total Shared Services (Incurred)	0	0	0
Total O&M[1]	110,831~~110,833~~	130,961~~132,721~~	20,130~~21,888~~

Summary of Request

San Diego Gas & Electric (SDG&E or Company) is requesting the Commission adopt its Test Year 2024 (TY 2024) forecast of $130,961,000~~132,721,000~~ for Electric Distribution Operations and Maintenance (O&M), to maintain the delivery of clean, safe, and reliable electric service to the Company's customers. SDG&E prioritizes its work to comply with applicable laws and regulations and to provide system integrity and reliability in accordance with its commitment to safety. SDG&E's longstanding commitment to safety focuses on three primary areas: 1) public safety, 2) employee safety, and 3) contractor safety. SDG&E has a safety-first culture that is embedded in the way the Company carries out its work, design and build its system, and operate and maintain its system. This safety-first culture is stressed to SDG&E employees from initial training, through project design, prioritization of work, operation of the system, inspection and maintenance, and construction. Over this last General Rate Case (GRC) cycle, SDG&E has continued to pursue its goal of driving safety risks to zero and has continued to see steady improvement in its safety performance as a result. Safety and risk reduction for employees, contractors, and the public remain core values at the Company.

In addition to achieving excellent performance in safety in recent years, the reliability of SDG&E's electric service has also been an area of consistent superior performance. SDG&E's best-in-class reliability performance has resulted in recognition and awards from third parties. SDG&E has been ranked "Best in the West" in reliability by the PA Consulting Group, earning

[1] The Total O&M table contained in Section I, Summary of Differences, in the June 12, 2023 rebuttal testimony of Tyson Swetek (Ex. SDGE-212) presented a TY 2024 estimated (forecasted) total O&M request of $130,962 in thousands. The $1 in thousands difference between the rebuttal value and the TY 2024 total O&M request presented in this errata is due to rounding.

their regional ReliabilityOne award for sixteen consecutive years.[2] In addition, SDG&E also received the PA Consulting Group's national ReliabilityOne award in 2014, 2018, and 2021,[3] and was recently recognized by the PA Consulting Group in 2021 for Outstanding Grid Sustainability.

My testimony addresses the forecasted costs associated with operating and maintaining the SDG&E electric distribution system in a safe and reliable manner. The O&M electric distribution costs are broken down into 17 primary cost categories, two of which comprise the majority (62.3%) of the overall forecast. The two major categories are Electric System Operations (32~~1.6~~%) and Electric Regional Operations (30.3~~7~~%). Each specific work category is described in greater detail in my testimony. The testimony also provides business justification for several information technology (IT) capital projects, three memorandum accounts, and fleet vehicles needs related to SDG&E's electric operations.

In preparing my forecasts for TY 2024 requirements, historical 2017 to 2021 spending levels were analyzed, underlying cost drivers were considered, and future requirements were assessed. Forecast methodologies were selected, based on future expectations for the cost category, taking into account the underlying cost drivers. The forecast methodologies used include:

- Forecasts based on historical averages; and
- Forecasts based on the base-year (2021).

The majority of workpapers utilize the base-year methodology for forecasting due to recent sustained upward cost pressures further outlined in detailed testimony. In addition, my testimony identifies work requirements incremental to levels of historical spending necessary to maintain the safe and reliable operation of the electric distribution system. Finally, attached to

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[2] MarketScreener.com, Sempra Operating Company SDG&E Wins National Award for Electric Reliability in the U.S. (November 19, 2021) available at https://www.marketscreener.com/quote/stock/SEMPRA-ENERGY-14471/news/Sempra-Operating-Company-SDG-E-Wins-National-Award-for-Electric-Reliability-in-the-U-S-37084247/.

[3] PA Consulting, In a tie, Florida Power & Light Company and San Diego Gas & Electric both win a National Reliability Award at PA Consulting's 21st Annual ReliabilityOne® Awards (November 18, 2021) available at https://www.paconsulting.com/newsroom/releases/florida-power-light-company-and-san-diego-gas-electric-both-win-a-reliabilityone-national-reliability-award-18-november-2021/.

my testimony as Appendix C is SDG&E's Grid Modernization Plan pursuant to Decision (D.) 18-03-023.[4]

[4] SDG&E notes that its Grid Modernization Plan is the result of a collaboration between various business units and subject matter experts. Accordingly, SDG&E reserves the right to identify the appropriate subject matter expert(s) to address any specific issues and/or present further testimony in rebuttal testimony as may be necessary.

ERRATA REVISED PREPARED DIRECT TESTIMONY OF TYSON SWETEK (ELECTRIC DISTRIBUTION O&M)

I. INTRODUCTION

A. Summary of Electric Distribution O&M Costs and Activities

My testimony supports the Test Year 2024 forecasts for operations and maintenance (O&M) costs for non-shared services for the forecast year 2024, associated with the Electric Distribution O&M area for SDG&E. Table TS-1 summarizes my sponsored costs.

TABLE TS-1
Test Year 2024 Summary of Total Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
Categories of Management	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
A. Reliability and Capacity	2,313	2,461	148
B. Construction Management	4,0568	4,0435	-13
C. Electric System Operations	31,073	41,9487	10,875
D. Kearny Operations Services	2,2356	2,179	-567
E. ET&D: Substation C&O	10,3621	9,5179	-845
F. Distribution Design and Project Management	820	1,3054	485
G. Electric Regional Operations	35,359	39,66640,768	4,3075,408
H. Skills & Compliance Training	2,839	3,483829	644990
I. Service Order Team (SOT)	4,061	4,069	8
J. Electric Engineering	2,0843	2,195504	111420
K. Troubleshooting	9,634	9,6343	0
L. Portfolio & Project Management	487	512	25
M. Compliance Management	3,061	7,274	4,213
N. Officer	1,287	1,287	0
O. Regional Public Affairs	1,160	1,388	228
Total Non-Shared Services	**110,831**	**130,9612,721**	**20,1301,888**

Electric Distribution Operations & Maintenance is responsible for expenses required to operate and maintain SDG&E's electric distribution system. Expenses presented are reasonable and should be adopted by the California Public Utilities Commission (CPUC). This forecast supports SDG&E's fundamental philosophy to achieve operational excellence by providing customers with the cleanest, safest, and most reliable electricity in North America. SDG&E continues to operate in compliance with all regulatory requirements and maintains a high level of customer service. SDG&E requests the Commission adopt its TY 2024 forecast of $1302,961721,000 for Electric Distribution O&M expenses, set forth in this chapter. For matters

related to SDG&E's Electric Distribution Capital requests, please see the testimony of Oliva Reyes (Exhibit (Ex.) SDG&E-11).

SDG&E operates and maintains an electric distribution system that serves approximately 3.7 million people, through approximately 1.49 million meters. SDG&E's service territory spans more than 4,100 square miles from the California-Mexico border north to Southern Orange County and Riverside County, and from the San Diego County Coastline east to Imperial County. SDG&E's system includes 135 distribution substations, 1,052 distribution circuits, 223,046 poles, 14,919 miles of underground systems, 8,902 miles of overhead systems, and various other components of distribution equipment. Additionally, SDG&E owns and maintains approximately 38,000 streetlights. SDG&E's distribution system (as of January 2022) is further characterized by a customer mix of approximately 1.33 million residential, 158,000 commercial and industrial customers. There is an average of approximately 1,400 customers per circuit. The electric distribution system consists of predominantly underground facilities, approximately 63%. This percentage is much larger than that of other large California Investor Owned Utilities (IOUs). The underground system can lead to higher inspection and maintenance costs given the potential for traffic control and hazardous waste services needed to perform manhole inspections, and extra manpower required to safely perform inspections on pad-mounted equipment. The primary distribution voltage is predominantly 12 kilovolts (kV), with some large areas of 4kV. The 4kV systems are being converted to 12kV through a combination of attrition, maintenance upgrades, and programmatic efforts.

Costs within this testimony are being driven by several major trends both within the utility industry and in SDG&E's operating environment. The top trends affecting this testimony include costs that scale with capital construction, shortages of skilled electric distribution labor, a new regulation requiring compliance, and increased maintenance associated with the growth in electric distribution system automated equipment. I address each of these top trends below.

Costs that Scale with Capital Construction

There is an upward pressure in O&M cost associated with increasing capital construction. The O&M expenses forecasted are a small percentage of the overall cost of the new infrastructure installations and are due to factors such as minor units of property installed at the time of capital installations, standards and work practices that must be developed in support of new technology, and improvements to the capital project delivery process. The largest of these

costs found within individual workpapers supporting this testimony is related to storeroom charges of small materials, which scale directly with the capital construction levels. Other notable cost increases include additions of specialized labor resources, improvements that streamline project quality and delivery at scale, and work to improve cost estimating within capital projects.

Shortages of Skilled Electric Distribution Labor

Due to the increased electric infrastructure construction within the state of California caused primarily by wildfire hardening activities, the demand for skilled distribution labor has increased. SDG&E has seen higher costs and attrition rates within its electric distribution lineman, designer, engineer, and operator job classifications. To mitigate potential impacts to SDG&E's ability to deliver its safety infrastructure enhancement commitments and continue to provide safe and reliable service to customers, SDG&E has begun taking targeted mitigation measures which have associated costs discussed within testimony. Some of these measures include increasing enrollment in qualification programs for most key skill positions, insourcing some positions to meet short-term demand, and in some instances increasing labor costs to meet new market rates.

New Compliance Program

A new CPUC Decision, D.21-10-019 requires pole owners to provide new data points such as asset information on pole attachments, the status of attachment requests, attachment design information, and structural loading information. SDG&E must both upgrade its systems and perform field surveys in order to collect data required under this decision.

Increased Distribution System Automation

There has been a large increase in the use of supervisory control and data acquisition (SCADA)[5] technology on SDG&E's electric system, especially for purposes related to wildfire mitigation. SCADA service restorers are utilized to minimize public safety power shutoff (PSPS) events, enable sensitive relay protection to detect and isolate downed power lines, and to provide more visibility to the system. There are approximately 2,386 SCADA field sites installed and the Company is forecasting an eight percent average annual increase based on a

[5] SCADA is a system of software and hardware elements that allows industrial organizations to: Control industrial processes locally or at remote locations. Monitor, gather, and process real-time data.

trending of the past three years of historic data. By the end of 2024, forecasted installed field SCADA sites are expected to be approximately 2,933. SDG&E anticipates this growth trend to continue at a rapid pace, in part due to additional drivers such as customer energy electrification and use of distributed energy resources (DER) on the electric system. The increase in number of these SCADA installations has caused a similar need for increases in the maintenance and business technology support resources necessary and required to install and maintain this equipment, which enables continued availability for use in safe and reliable operation of the electric distribution system.

B. Support To and From Other Witnesses

My testimony also references the testimony and workpapers of several other witnesses, either in support of their testimony or as referential support for mine. A quick reference list is detailed below:

- Estela de Llanos (Exhibit SDG&E-02: Sustainability Policy)
  - Sustainability/Climate Policy (Section III.A) - DER adoption
- Gregory S. Flores and R. Scott Pearson (Exhibit SCG-03/Exhibit SDG&E-03, Chapter 2: RAMP to GRC Integration)
  - Risk Assessment Mitigation Phase Integration (Section II) - Translation of risk mitigation programs from 2021 RAMP Reports into individual witness areas.
- Oliva Reyes (Exhibit SDG&E-11: Electric Distribution Capital)
  - Construction Management (Section IV.B.3) – Labor Cost Allocation for associated fleet vehicles
  - Electric System Operations (Section IV.C.3) – SCADA Head End project reference
  - Distribution Design & Project Management (Section IV.F.3) – Builder Services Portal and Automated Utility Design Projects
  - Electric Engineering (Section IV.J.3) – Basis for O&M estimates
- Jonathan Woldemariam (Exhibit SDG&E-13: Wildfire Mitigation and Vegetation Management)
  - Sustainability, Climate Policy, and Safety Culture (Section III.B) – ICS Structure

- Electric Engineering (Section IV.J.3) – Basis for O&M estimates

- Arthur Alvarez (Exhibit SDG&E-22: Fleet Services)
  - Construction Management (Section IV.B.3) – Fleet vehicle needs
  - Substation C&O (Section IV.E.3) – Fleet vehicle needs
  - Distribution System Control & Protection (Section IV.E.1.3) – Fleet vehicle needs
  - Electric Regional Operations (Section IV.G.3) – Fleet vehicle needs
  - Portfolio & Project Management (Section IV.M.3) – Fleet vehicle needs
- William J. Exon (Exhibit SDG&E -25 Chapter 2: Information Technology
  - Reliability & Capacity (Section IV.A.3) – Explanation of need for the distribution interconnection information system (DIIS) information technology (IT) capital projects
  - Electric System Operations (Section IV.C.3) – Explanation of need for the Reliability and Operational Safety Enhancements (ROSE), Smart Grid Operations, Distributed Energy Resource Management (DERMS), Electric Load Curtailment, and Grid Operations Small Cap IT capital projects.
  - Distribution Design & Project Management Section IV.F.3) – Reference to Builder Services Portal and Automated Utility Design project cost
  - Compliance Management (Section IV.M.3) – Explanation of need for the Cross-Functional Work Management Enhancement and Telecom Attachment Management System (TAMS) IT Capital Projects.
- Kenneth J. Deremer (Exhibit SDG&E-31: Safety. Risk and Asset Management Systems)
  - Sustainability, Climate Policy, and Safety Culture (Section III.B) - Reference to Safety and Risk Management System (SMS) testimony

- Electric Engineering (Section IV.J.3) – Reference to testimony in explanation of Asset Management framework.

- Christine Fischer (Exhibit SDG&E-42: Miscellaneous Revenue)
  - Reliability & Capacity (Section IV.A.2) – O&M costs associated with generation interconnection projects

- Jason Kupfersmid (Exhibit SDG&E-43: Regulatory Accounts)
  - Reliability & Capacity (Section IV.A.1) – Explanation of the use and need for the Integration Capacity Analysis and Location Net Benefit Analysis (ICLNBMA) and Distribution Generation Statistics (DGSMA) memo accounts.
  - Compliance Management (Section IV.M.3) – Explanation of the use and need for the Track 2 Costs (T2CMA) memo account.

C. Information Technology and Fleet Vehicle Needs

Within each non-shared cost category, I also speak to the business need for either Information Technology capital projects or Fleet vehicle additions, and reference other expert witness testimony in which costs for these projects and vehicles are located. A quick reference for finding locations within my testimony where fleet vehicles and IT capital projects are addressed can be found in the "Support to and From Other Witnesses" section (I.B). The tables below summarize the requested IT project and Fleet Vehicle costs by workpaper. As mentioned above, these costs are generated from other witness areas.

TABLE TS-2
Summary of IT Capital Costs by Workpaper

Workpaper	Estimated 2022 Costs (000s)	Estimated 2023 Costs (000s)	Estimated 2024 Costs (000s)
(1ED001) Reliability & Capacity	1,325	1,570	1,409
(1ED003) Electric System Operations	8,442	5,828	5,947
(1ED015) Compliance Management	2,195	1,329	222

TABLE TS-3
Summary of Fleet Vehicle Costs by Workpaper

Workpaper	Estimated 2022 Costs (000s)	Estimated 2023 Costs (000s)	Estimated 2024 Costs (000s)
(1ED002) Construction Management	0	8	28
(1ED006) Substation C&O	0	29	47
(1ED006.002) Control & Protection	0	39	65
(1ED008) Electric Regional Operations	0	14	65
(1ED014) Portfolio & Proj Management	0	27	36

D. Grid Modernization Plan

D.18-03-023 requires the IOUs to present their respective Grid Modernization Plan (GMP) for review and evaluation in the GRC.[6] My testimony presents SDG&E's GMP at Appendix C hereto. SDG&E's GMP includes a 10-year grid modernization vision that integrates DER into distribution system planning and operations, allowing markets and customers to more fully realize the value of DER. SDG&E's GMP was finalized following a public workshop hosted by the CPUC on March 15, 2022.

E. Organization of Testimony

My testimony is organized as follows:

- Introduction
- Identification of Risk Assessment Mitigation Phase (RAMP) integration activities within the testimony
- Discussion on Sustainability, Climate Policy, and Safety Culture initiatives with references to the appropriate workpapers
- Testimony on 17 Non-Shared Cost Categories, broken down into four sections each
    - Description of Costs & Underlying Activities
    - Forecast methodology
    - Cost Drivers
    - Other Drivers
- Conclusion

[6] D.18-03-023, Ordering Paragraph 4 at 34-35.

II. RISK ASSESSMENT MITIGATION PHASE INTEGRATION

Certain costs supported in my testimony are driven by activities described in SoCalGas and SDG&E's respective 2021 RAMP Reports (the 2021 RAMP Reports).[7] The 2021 RAMP Reports presented an assessment of the key safety risks for SoCalGas and SDG&E and proposed plans for mitigating those risks. As discussed in the testimony of the RAMP to GRC Integration witnesses R. Scott Pearson and Gregory S. Flores (Ex. SCG-03/SDG&E-03, Chapter 2), the costs of risk mitigation projects and programs were translated from the 2021 RAMP Reports into the individual witness areas.

In the course of preparing the Electric Distribution O&M GRC forecasts, SDG&E continued to evaluate the scope, schedule, resource requirements, and synergies of RAMP-related projects and programs. Therefore, the final presentation of RAMP costs may differ from the ranges shown in the 2021 RAMP Reports. Table TS-4 provide summaries of the RAMP-related costs supported in my testimony.

TABLE TS-4
Summary of RAMP O&M Costs*

ELECTRIC DISTRIBUTION Summary of RAMP O&M Costs (In 2021 $)	BY2021 Embedded Base Costs (000s)	TY2024 Estimated Total (000s)	TY2024 Estimated Incremental (000s)
RAMP Risk Chapter			
SDG&E-Risk-2 Electric Infrastructure Integrity	1,289	1,192	-97
SDG&E-Risk-8 Incident Involving an Employee	2,448	2,700	252
Sub-total	**3,737**	**3,892**	**155**
RAMP Cross-Functional Factor (CFF) Chapter			
SDG&E-CFF-1 Asset Management	0	6	6
SDG&E-CFF-6 Records Management	921	921	0
Sub-total	**921**	**927**	**6**
Total RAMP O&M Costs	**4,658**	**4,819**	**161**

* CFF-related information in accordance with the March 30, 2022 Assigned Commissioner Ruling in A.21-05-011/-014 (cons.) is provided in the RAMP to GRC Integration testimony of R. Scott Pearson and Gregory S. Flores (Ex. SCG-03/SDG&E-03, Chapter 2).

[7] *See* Application (A.) 21-05-011/-014 (cons.) (RAMP Proceeding). Please refer to the RAMP to GRC Integration testimony of R. Scott Pearson and Gregory S. Flores (Ex. SCG-03/SDG&E-03, Chapter 2) for more details regarding the 2021 RAMP Reports.

A. RAMP Risk and Cross-Functional Factor Overview

As summarized in Table TS-4 above, my testimony includes costs to mitigate the risks and cross-functional factors (CFF) included in the 2021 RAMP Report.[8] These risks and CFFs are further described in Table TS-5 below:

TABLE TS-5
RAMP Risk and CFF Chapter Description

SDG&E-2 – Electric Infrastructure Integrity (EII)	SDG&E's EII risk is defined as the risk of an asset failure, caused by degradation, age, operation outside of design criteria due to unexpected events or field conditions (*e.g.*, force of nature) or an asset no longer complying with the latest engineering standards, which results in a safety or reliability incident. This risk includes underground assets in the high fire threat districts (HFTDs).
SDG&E-8 – Incident Involving Employee (IIE)	SDG&E's IIE risk is defined as the risk of an incident, involving one or more on-duty employees, that causes serious injury or fatality to a company employee.
SDG&E-CFF-1 – Asset Management	The Asset Management CFF describes an enterprise-wide framework that provides a standardized approach for managing risk and safety across assets and activities. The framework integrates people, processes, data, and technology to enable data-driven decision making through governance, strategy, data consolidation and analytics, and continuous improvement.
SDG&E-CFF-6 – Records Management	The Records Management CFF describes how inadequately maintained records can have impacts on employee and public safety as well as reliability.

In developing my request, priority was given to these key safety risks to assess which risk mitigation activities Electric Distribution O&M currently performs and what incremental efforts are needed to further mitigate these risks. While developing the GRC forecasts, SDG&E evaluated the scope, schedule, resource requirement, and synergies of RAMP-related projects and programs to determine costs already covered in the base year and those that are incremental increases expected in the test year.

Messrs. Pearson and Flores (Ex. SCG-03/SDG&E-03, Chapter 2) discuss all of the risks and CFFs included in the 2021 RAMP Reports and the RAMP to GRC integration process.

[8] Unless otherwise indicated, references to the 2021 RAMP Report refer to SDG&E's RAMP Report.

B. GRC Risk and CFF Activities

Table TS-6 below provides a narrative summary of the forecasted RAMP-related activities that I sponsor in my testimony.

TABLE TS-6
Summary of RAMP Risk and CFF Activities

RAMP ID	Activity	Description
SDG&E-Risk-2-C25	Substation Inspection & Repairs General Order (GO) 174	SDG&E's Substation Inspection and Repair Program adheres to GO 174 while promoting safety for SDG&E personnel and contractors by providing a safe operating and construction environment within the substation fence.
SDG&E-Risk-8-C01	Mandatory Employee Health and Safety Training Programs and Standardized Policies	The Mandatory Employee Health and Safety Training Programs and Standardized Policies promote mitigating the risk of an incident involving SDG&E employees.
SDG&E-Risk-8-C04	Employee Behavioral Accident Prevention Process (BAPP) Program	The BAPP Program is a partnership between management, volunteers, and front-line employees that provides a structured process for continuous safety improvements specific to the high-risk tasks and situations faced by front-line employees.
SDG&E-Risk-8-C08	OSHA Voluntary Protection Program (VPP)	The OSHA VPP includes implementation of effective health and safety management systems, *e.g.*, Hazard Identification Cards and the Safety Incentive Program to promote safe activities and improve safety performance.
SDG&E-Risk-8-C10	Personal Protective Equipment (PPE)	PPE protect employees from the risk of injury by creating a barrier against workplace hazards.
SDG&E-Risk-8-New01	Industrial Athletic Trainer	Programs established by the Industrial Athletic Trainer will promote on-site conditioning and recovery training with the objective of reducing/minimizing physical injuries.
SDG&E-CFF-1-01	AIM (Gov, Strat, AIP)	The Asset Integrity Management (AIM) program establishes the Investment Prioritization initiative,

RAMP ID	Activity	Description
		which incorporates an enterprise-wide, multi-attribute value framework methodology to demonstrate appraisal of capital investments in a consistent, transparent, repeatable, and standardized manner.
SDG&E-CFF-6-New01	Geographical Information System (GIS) Documentation	GIS Documentation includes the storing and using of information in the GIS data base to manage many functions, including: switching on the system, asset risk/analytics programs, coordinating planned system enhancements, regulatory reporting, accounting.

These activities are discussed further below in Section IV.B through Section IV.E, Sections IV.G and H, and Sections IV.J and K, as well as in my workpapers. For additional information and a roadmap, please refer to Appendix B, which contains a table identifying by workpaper the TY 2024 forecast dollars associated with activities in the 2021 RAMP Report that are discussed in this testimony.

The RAMP risk mitigation efforts are associated with specific actions, such as programs, projects, processes, and utilization of technology. For each of these mitigation efforts, an evaluation was made to determine the portion, if any, that was already performed as part of historical activities (*i.e.*, embedded base costs) and the portion, if any, that was incremental to base year activities. Furthermore, for the incremental activities, a review was completed to determine if any portion of incremental activity was part of the workgroup's base forecast methodology. The result is what SDG&E considers to be a true representation of incremental increases over the base year.

My incremental request supports the ongoing management of these risks that could pose significant safety, reliability, and financial consequences.

C. Changes from RAMP Report

As discussed in more detail in the RAMP to GRC Integration testimony of Messrs. Pearson and Flores (Ex. SCG-03/SDG&E-03, Chapter 2), in the RAMP Proceeding, the Commission's Safety Policy Division (SPD) and intervenors provided feedback on the Companies' 2021 RAMP Reports. Appendix B in (Ex. SCG-03/SDG&E-03, Chapter 2)

provides a complete list of the feedback and recommendations received and the Companies' responses.

General changes to risks scores or Risk Spend Efficiency (RSE) values are primarily due to changes in the Multi-Attribute Value Framework (MAVF) and RSE methodology, as discussed in the RAMP to GRC Integration testimony. Other than as discussed below, the RAMP-related activities described in my GRC testimony are consistent with the activities presented in the 2021 RAMP Report.

Changes from the 2021 RAMP Report presented in my testimony, including updates to forecasts and the amount and timing of planned work, are summarized as follows:

- Electric Geographical Information System (GIS) documentation activities are included as a specific project associated with SDG&E-CFF-6 Records Management.
- Industrial Athletic Trainer is included as a specific mitigation with SDG&E-Risk-8 Incident Involving an Employee.

III. SUSTAINABILITY AND SAFETY CULTURE

Sustainability, safety, and reliability are the cornerstones of SDG&E's core business operations and are central to SDG&E's GRC presentation. SDG&E is committed to not only deliver clean, safe, and reliable electric and gas service, but to do so in a manner that supports California's climate policy, adaptation, and mitigation efforts. SDG&E has prioritized achieving long-term sustainability through aggressive goals such as managing to a net zero greenhouse gas (GHG) emissions by 2045 and reducing safety incidents in the public, within its employee workforce, and with contractors working on the system to zero. This section summarizes some key areas of my testimony that support achieving these goals.

A. Sustainability

As described in the Sustainability Policy testimony of Estela de Llanos (Ex. SDGE-02), SDG&E's adoption of DER is an important component for reducing reliance on harmful GHG emitting technology. Additionally, SDG&E has a strategic focus on replacing sulfur hexafluoride (SF6) containing equipment from its system. SF6 is a GHG with approximately 22,000 times the environmental impact of carbon dioxide.

1. Enabling DER Technology

SDG&E is leveraging operational technology to optimize customer value in adopting behind the meter renewables and DER based microgrids. These DER assets support State and Company goals that reduce dependence on GHG emitting technology, enhance electric reliability, and mitigate impacts during PSPS events. Specifically, installations of energy storage systems throughout the SDG&E service territory have been utilized to support the California energy market and support the creation of microgrids. As DER penetration increases on SDG&E's system, further investment into SDG&E's advanced distribution management system (ADMS) is needed. This system monitors the electric distribution network and identifies system issues. Further investment will increase the accuracy in forecasting in a high DER environment, allowing the system to identify issues before they occur. Additionally, investment into a distributed energy resource management system (DERMS) will allow for optimizing energy storage charging limitations, serve to aggregate customer DER dispatch to the wholesale market, and enable use of customer resources for electric distribution system services. All of these uses provide more benefits in meeting the changing needs of the grid.

Customers deserve an efficient process to connect their DER assets to the electric system. SDG&E's continued investment in enhancing its customer generation interconnection process and customer interconnection portal, also known as the DIIS, supports this efficient and customer friendly experience.

More details on DER enablement can be found in the SDG&E's Grid Modernization Plan attached to my testimony as Appendix C.

2. SF6 Emission Tracking

SDG&E's SF6 tracking and reporting program is a key component of managing GHG emissions of this environmentally sensitive electric insulating medium. The program tracks and reports emissions data to jurisdictional agencies. The long-term goal is to eliminate SF6 emissions from both the electric distribution and transmission systems by removing and replacing switches with SF6 as the insulating medium, with switches using more environmentally friendly insulating properties.

B. Safety Culture

SDG&E is committed to providing safe and reliable service to its customers. The Company's safety-first culture focuses on public, employee, and contractor safety, with this commitment embedded in every aspect of its work, and at all levels of the organization.

A comprehensive approach is essential to keeping field workers safe and building a strong safety culture within the electric distribution operations and maintenance teams. SDG&E's approach includes identification of risks as they emerge or before incidents occur and designed solutions to mitigate those risks identified. This combination allows for an adaptable program that continually refocuses on the greatest threats to the safety of the public, SDG&E's employees, and contractors. Additionally, building designed solutions may encompass many programs, all of which are captured in the Safety Management System (SMS). Launched in 2020, the SMS aligns and integrates safety management, risk management, asset management, and emergency management across the entire organization. The SMS takes a holistic approach to "safety" and expands beyond traditional occupational safety principles to include public safety, asset safety, system safety, cyber safety, and psychological safety for improved safety performance and culture. SDG&E's SMS is a systematic, enterprise-wide framework to collectively manage and reduce risk and promote continuous improvement in safety performance through deliberate, routine, and intentional processes. SDG&E adopted a de-centralized SMS organizational structure where risk and accountability is retained at the operational level. The SMS Executive-level and Director-level teams bring cross-functional leaders together to share safety best practices, lessons learned and opportunities for improvement. The Director – Electric Regional Operations serves as a SMS Governance Team member and has identified operational support across the districts and departments within the organization to operationalize the SMS processes. For more information on the SMS, please see Safety, Risk & Asset Management Systems testimony of Kenneth J. Deremer (Ex. SDG&E-31).

Identification of growing safety risk is critical to enable SDG&E to educate field workers about hazards that affect safety and that focused effort is placed to create the most efficient mitigation programs for the identified risks. This approach minimizes the chances of serious injury or fatalities before an incident occurs. For a detailed explanation of risks addressed in this testimony, see the above Section II, Risk Assessment Mitigation Phase Integration. SDG&E utilizes the Behavior Based Safety (BBS) program, which captures data on at-risk behaviors as

well as positive behaviors. The program then positively reinforces the corrected actions, which further builds and maintains SDG&E's safety culture. Another focus area is driving down the impacts electric infrastructure damage/failure may have on public safety. SDG&E's asset management framework seeks to aggregate asset failure data through creation of data systems and enhanced root cause analysis of those failures. The data assesses past and emerging trends and seeks to optimize the value of programs that mitigate failures. For more information on the Asset Management program, see the testimony of Mr. Deremer (Ex. SDG&E-31). SDG&E's employees are also the eyes and ears of emerging threats to safety. SDG&E has enhanced a near-miss reporting program, increasing the volume of near miss reports by a significant percent with 251 reports being submitted in calendar year 2021 and 82 reports in 2022 thru April 18. These reports are disseminated throughout the Company in order to raise awareness of safety risks and aggregated to identify trends. Please see Mr. Deremer's testimony (Ex. SDG&E-31) for more information on the near-miss reporting program.

Creating focused mitigation programs that efficiently target risk areas are essential to the success of SDG&E's safety culture and safety performance. There are several programs driving costs within my testimony that target safety risk to the public, employee, and contractors. First and foremost is training resources needed to maintain core safe job skills within SDG&E's field workforce. This includes industrial trainers who teach the importance of field employees maintaining physical fitness as a means to prevent instances of sprains and strains, which are the most frequent type of employee injury. Additionally, SDG&E is introducing a new Municipality Electric Hazard Awareness program, which will create engagement with local jurisdictions to promote safe behaviors within those entities. The SDG&E electric distribution workforce is also trained to respond to any and all emergencies related to its electric distribution systems. This includes managing programs designed to mitigate the frequency and impact of fires during a Santa Ana wind event. During emergencies, SDG&E electric operations team utilizes the Incident Command Structure (ICS) to unify priorities and resource management under a single command. This allows a faster response, efficient prioritization of resources to public safety issues, and improving communication and support to employees and contractors responding to the event. For more information on SDG&E's ICS structure, see the Wildfire Mitigation and Vegetation Management testimony of Jonathan Woldemariam (Ex. SDG&E-13).

TABLE TS-7
COST CATEGORY REFERENCE TO PROGRAMS IDENTIFIED IN THIS SECTION

Section	Program	Workpaper
Enabling DER Technology	ADMS/DERMS System Development	Electric System Operations
Enabling DER Technology	DIIS and distributed generation interconnection process	Reliability and Capacity
SF6 Tracking	SF6 Tracking and Reporting	Electric Engineering
Safety Culture	Industrial Trainers	Skills & Compliance Training
Safety Culture	Municipality Electric Hazard Awareness Program	Skills & Compliance Training

IV. NON-SHARED COSTS

"Non-Shared Services" are activities that are performed by a utility solely for its own benefit.[9] Corporate Center provides certain services to the utilities and to other subsidiaries. For purposes of this general rate case, SDG&E treats costs for services received from Corporate Center as Non-Shared Services costs, consistent with any other outside vendor costs incurred by the utility. Table TS-8 summarizes the total non-shared O&M forecasts for the listed cost categories.

TABLE TS-8
Non-Shared O&M Summary of Costs*

ELECTRIC DISTRIBUTION (In 2021 $)			
Categories of Management	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
A. Reliability and Capacity	2,313	2,461	148
B. Construction Management	4,0568	4,0435	-13
C. Electric System Operations	30,1510	41,0265	10,875
C.1 ESO: GIS	922	922	0
D. ET&D: Operations Services	2,2356	2,179	-567
E. ET&D: Substation C&O	6,7865	5,80910	-9775
E.1 ET&D: Substation C&O: Relay & SCADA	3,576	3,7089	1323
F. Distribution Design and Project Management	820	1,3054	4854
G. Electric Regional Operations	35,35960	39,66640,769	4,3075,409

[9] As opposed to "shared costs" which are borne in support of both Sempra owned CPUC regulated utilities.

ELECTRIC DISTRIBUTION (In 2021 $)			
Categories of Management	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
H. Skills & Compliance Training	2,839	3,483~~829~~	644~~990~~
I. Service Order Team (SOT)	4,061	4,069	8
J. Electric Engineering	2,084~~3~~	2,195~~504~~	111~~420~~
K. Troubleshooting	9,634	9,634	0
L. Portfolio & Project Management	487	512	25
M. Compliance Management	3,061	7,274	4,213
N. Officer	1,287	1,287	0
O. Regional Public Affairs	1,160	1,388	228
Total Non-Shared Services	**110,831~~3~~**	130,961~~132,721~~	20,130~~21,888~~

* *Note: Totals may include rounding differences*

The following subsections describe each of the workpaper activities and forecasts for those workpapers in more detail. For each workpaper, I describe the costs and activities associated with that workpaper, the forecast methodology, and cost drivers. For the workpapers with significant cost drivers and incremental cost pressures, additional support for the forecast is provided.

A. Reliability & Capacity (1ED001)

TABLE TS-9
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
A. Reliability and Capacity	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Reliability and Capacity	2,313	2,461	148
Total	**2,313**	**2,461**	**148**

1. Description of Costs and Underlying Activities

Reliability and Capacity covers activities related to providing administrative and technical support associated with managing constraints on the electric distribution system. Typical activities include forecasting, planning, designing, and responding to utilization of the electric distribution system to serve customers with safe and reliable electric energy. Applicable safety related activities (*e.g.*, training, PPE) are included within the overall funding request.

Electric distribution system load increases come in the form of new customer connections to the system and increased loads from existing customers. New or existing customer load growth drives the installation of new and upgraded facilities, circuits, and substations. Another function covered under this workpaper is advising on generation interconnections submitted through the Wholesale Distribution Access Tariff (WDAT) and Electric Rule 21. Responsibilities include designing the electric distribution system to facilitate the construction of electric facilities to connect new customers to SDG&E's system and ultimately increase the capacity of the electric distribution system infrastructure to support both new load and/or DER throughout the service territory. SDG&E is responsible for developing, implementing, and guiding on all aspects correlated with distribution resources planning (DRP) processes at SDG&E.[10] These tasks consist of analysis, developing reports, developing new analytical tools, providing comments to proposed decisions, adhering to final decisions, conducting detailed presentations, and leading or collaborating in stakeholder-driven planning processes. Active support is provided to O&M activities including staffing the Emergency Operations Center and Construction and Operations districts during major events and storms. Other responsibilities include reviewing and revising distribution planning design standards, reviewing fusing requests and providing engineering input on planning worksheets, approving load studies, participating in distributed generation and renewable resource studies, integrating advanced technologies, designing utility owned interconnection facilities for DER, project management for specific GRC-approved projects, responding to internal and external customer data requests, training, and attending relevant technical committee meetings.

The Reliability Team is responsible for reviewing, coding, and auditing outage information to enable correct classification, duration, customer counts, and indices. This team leads root cause analysis for unplanned, primary outages to enable data integrity for metrics related to reliability. The team also maintains the official data repository for outage data, known as the Reliability Database, which is the foundation for data reporting to both internal and external entities. Common metrics tracked include System Average Interruption Duration Index (SAIDI), System Average Interruption Frequency Index (SAIFI), and Customer Average Interruption Duration Index (CAIDI). Other responsibilities include responding to customer

[10] *See* D.18-02-004 for a discussion on the distribution resources planning processes.

inquiries related to outage information for their account(s) and supporting CPUC reporting requirements. Some of these requirements are listed below:

Integration Capacity Analysis and Location Net Benefit Analysis Memorandum Account (ICLNBMA)

The ICLNBMA is a memo account to capture incremental costs associated with mandated DRP processes such as the interconnection capacity analysis, locational net benefit analysis, and distribution investment deferral framework. The memo account tracks the incremental cost to implement and integrate a portal to provide system information to DER developers as mandated through the DRP proceeding. For further explanation related to the regulatory accounting treatment, please refer to the Regulatory Accounts testimony of Jason Kupfersmid (Ex. SDG&E-43).

Distribution Generation Statistics Memorandum Account (DGSMA)

The DGSMA is a memo account to capture SDG&E's share of the incremental costs incurred by a contractor to maintain and expand the California Distributed Generation (DG) Statistics (DG Stats) website. The website, which is mandated by CPUC Resolution E-5030 (October 24, 2019), provides information on the proliferation of DGs and the effectiveness of DG programs. Please refer to the Regulatory Accounts testimony of Jason Kupfersmid (Ex. SDG&E-43).

2. Forecast Method

The forecast method developed for this cost category is three-year average recorded data. This method, along with including incremental adjustments as discussed in the Cost Driver section below, is most appropriate because a multi-year average accounts for recent year-to-year variation, while the three-year average represents the growth trends in generation interconnections and increasing complexity of interconnections (*e.g.*, significantly more batteries paired with rooftop solar). As the work in this area has shifted more to generation interconnection projects, the labor allocations were reviewed and adjusted to reflect the change in work. Rising O&M costs associated with generation interconnection projects are offset by interconnection fees received as miscellaneous revenue and are discussed in the Miscellaneous Revenue testimony of Christine Fischer (Ex. SDG&E-42).

3. Cost Drivers

The cost drivers behind this forecast are DER interconnection workload demands and related compliance projects, annual Synergi software training, and engineering retention.

a. DER Interconnection Workload Demands and Compliance Projects

To accommodate an increase in regulatory proceedings involving customer generation, the workforce needs to be further developed and expanded. To achieve this, a Distribution Compliance Manager, project managers, engineers, and analysts will be added throughout 2022, 2023, and 2024. The persons filling these positions will be responsible for handling regulatory proceedings and compliance requirements as well as various tariffs, such as: WDAT and WDAT small generator interconnection agreements; Electric Rule 21 Tariff and Electric Rule 21 Working Group implantations; Net Energy Metering (NEM) – Successor Tariff, Virtual Net Metering, Net Metering Aggregation, and Solar on Multifamily Affordable Housing; implementation, tracking, and costing for Notification Only Approach Pilot, DIIS 5.0 enhancement, and interpretation of interconnection rules.

b. Annual Synergi Training

SDG&E uses an industry accepted software program called Synergi as part of modeling the impacts of DER interconnecting to the electric system. Updated versions and new features are at a minimum annually incorporated into this software. SDG&E is purchasing virtual licensed annual Synergi training with unlimited seats as an efficient and time saving means to train new employees on the software and to keep existing users current on revisions and new features.[11] The cost of this annual training is comparable to sending two to three individuals to in person training and presents SDG&E with significant cost savings while enabling employees to be fully trained on the Synergi software.

c. Engineering Retention

There is upward pressure related to attracting and retaining skilled employees due to market wide resource shortages and demand for skilled workers. Engineering salaries are adjusted to reflect the results of an engineering salary market analysis performed by SDG&E.

[11] Building a Better Business is an ongoing business optimization and continuous improvement initiative at SDG&E, undertaken to support our mission to improve lives and communities by building the cleanest, safest and most reliable energy infrastructure company in America.

4. Other Drivers

a. IT Projects

There are two IT Capital projects related to this workpaper, in which I speak to the business need. For information on costs related to these projects, please see the IT testimony of William J. Exon (Ex. SDG&E-25, Chapter 2).

DIIS 6.0 – Rule 21 and New Energy Metering Enhancements – IT CAPITAL

Aligning with Commission directives to the large IOUs to utilize Institute of Electrical and Electronic Engineers (IEEE) 2030.5 communication standards within the interconnection process,[12] DIIS 6.0 is a project to enhance SDGE's current DIIS to enable the configuration files of a planned new DER system to be integrated into the interconnection process. IEEE 2030.5 has been selected within the Rule 21, Section 5, proceeding to be the default method of communication in California between smart inverters and the IOUs. Significant effort has been made by all parties including utilities, DER service providers and manufacturers to create a "plug and play" ecosystem for enabling all DER to participate as part of California's planned high DER future. This project is to develop and implement a tool to manage requirements of IEEE 2030.5.

DIIS – Rule 21 and New Energy Metering Enhancements – IT CAPITAL

This project will make enhancements to SDG&E's interconnection portal as well as incorporate recent CPUC mandates from various NEM and Rule 21 proceedings. The portal will be expanded to include additional interconnection processes such as WDATs, back-up generator applications, and pre-applications. Additionally, the portal will be updated to capture information supporting IEEE 2030.5 based communications for telemetry and control purposes. The improvements to be achieved with this second DIIS project also pertain to activities discussed in Commission rulemaking[13] and will include Vehicle-to-Grid (V2G) projects. Finally, these costs cover the need to integrate downstream systems such as GIS to incorporate newly captured portal information.

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[12] Rulemaking (R.) 17-07-007, Order Instituting Rulemaking to Consider Streamlining Interconnection of Distributed Energy Resources and Improvements to Rule 21 (July 21, 2017) at 8-9.

[13] *Id*. 10-11.

B. Construction Management (1ED002)

TABLE TS-10
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
B. Construction Management	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Construction Management	4,0568	4,0435	-13
Total	**4,0568**	**4,0435**	**-13**

1. Description of Costs and Underlying Activities

The primary role of the Construction Management group is to provide construction management and field oversight of all construction performed by contractors on the electric distribution system. This oversight promotes all work being built to SDG&E Engineering, Design, and Safety standards and in accordance with GO 95 and GO 128 rules for construction.

The O&M portion of construction work conducted by the Construction Management group includes O&M activities that are associated with completing construction of capital projects, installation and removal of transformers, and repairs and management of street lighting.

The Construction Management group is also responsible for administrative activities associated with Construction Management-managed capital construction work. Activities in this capacity span from pre-construction to post-construction and project closeout. Construction Management oversees the preparation of job packages issued for construction and performs activities such as verification of jurisdictional permits and environmental releases, and issuance and tracking of material purchase orders. For construction projects which require bidding by contractors, the group coordinates with Supply Management to prepare and issue requests for proposal, followed thereafter by evaluation of bids received and awarding of construction contracts. Construction Management works with project managers, budget owners, designers and engineers, and the construction contractor to monitor the successful construction of projects in accordance with project timelines and budgets. The group supports invoice review and the construction closeout process, including correction by contractors of punch-list items identified by SDG&E Construction quality assurance (QA)/quality control (QC) and monitoring of the "as-built" documentation process to enable accurate recordkeeping pertaining to SDG&E facilities.

Construction Management also supports the Electric Regional Operations Corrective Maintenance Program (Compliance Management Program (CMP), a GO 165 compliance program) by monitoring and tracking those jobs which are constructed by contractors, including pole and transformer replacements, quality control follow-up services, and fire risk mitigation services.

a. Description of RAMP Mitigations

RAMP-related costs for Construction Management include costs for (1) Mandatory Employee Health and Safety Training Programs and Standardized Policies, and (2) PPE. As described in Table TS-6 above: (1) The Mandatory Employee Health and Safety Training Programs and Standardized Policies includes employee health and safety training programs that Construction Management personnel attend to promote mitigating the risk of an incident involving SDG&E employees; and (2) PPE protect employees from the risk of injury by creating a barrier against workplace hazards. PPE includes clothing and equipment designed to protect employees while performing their job (*e.g.*, flame resistant clothing, gloves, protective eyewear). All employees who are required to use PPE are trained on when PPE is necessary, which PPE is necessary, how to properly don/remove/adjust/wear PPE, limitations of PPE and the proper care/maintenance/life/disposal of PPE.

Table TS-11 below provides the RAMP activities, their respective cost forecasts, and the RSEs for this workpaper. For additional details on these RAMP activities, please refer to my workpapers Ex. SDG&E-12-WP 1ED002.

TABLE TS-11: RAMP Activity O&M Forecasts by Workpaper
In 2021 Dollars ($000)

Workpaper	RAMP ID	Activity	2021 Embedded-Recorded	TY 2024 Estimated Totals	Change	GRC RSE*
1ED002	SDG&E-Risk-8-C01	Mandatory Employee Health and Safety Training Programs and Standard Policies	3	8	5	0
1ED002	SDG&E-Risk-8-C10	Personal Protective Equipment	6	8	2	0

* An RSE value is not calculated for these activities

2. Forecast Method

The forecast method developed for this cost category is a three-year average. Labor costs include the O&M portion of multiple employees whose labor costs are split among various plan categories. The O&M percentage of this labor varies depending on the activities performed by the employees. Non-labor costs are primarily composed of O&M construction costs associated with capital construction, which vary depending upon the capital project and therefore also vary year to year. A three-year average forecast methodology is most appropriate because it accounts for these variations while still representing recent sustained costs that are expected into the foreseeable future. SDG&E considered utilizing a five-year average but determined that it would not be appropriate as higher costs in 2017 and 2018 do not align with the more applicable three-year average forecasting results.

3. Cost Drivers

SDG&E TY 2024 forecasted costs for Construction Management O&M are unchanged from the three-year average adjusted recorded expense level.

4. Other Drivers

a. Fleet Vehicles

Below, I speak to the fleet vehicle needs related to this workpaper. Costs for the fleet vehicle additions are included in the Fleet Services testimony of Arthur Alvarez (Ex. SDG&E-22).

Construction Management Fleet Vehicle Needs

Additional Field Construction Advisors will be hired in the Construction Management group to provide field oversight of construction of capital projects performed by contractors. New fleet vehicles are needed in order for these employees to travel to the construction sites which they oversee. Labor costs associated with the additional employees are forecasted as a portion of labor costs for capital projects and are included in the Electric Distribution Capital testimony of Oliva Reyes (Ex. SDG&E-11).

C. Electric System Operations (1ED003)

TABLE TS-12
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
C. Electric System Operations	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Electric System Operations	30,151~~0~~	41,026~~5~~	10,875
Total	**30,150**	**41,025**	**10,875**

1. Description of Costs and Underlying Activities

SDG&E is committed to maintaining a safe working environment for employees and a safe electrical distribution system for the public. The Electric System Operations organizations perform around-the-clock supervision of the electric system, both during normal operating conditions and during emergency conditions (system stress, red flag warnings, elevated fire weather conditions, storms, etc.). The organizations manage situational awareness and workflow management technology needed to comply with safety regulation regarding documentation, managing field worker safety, and monitoring the system to enable safe and reliable power delivery to SDG&E's customers.

Control Centers

Mission Control is the name given to SDG&E's facility that houses several monitoring systems, control functions, and a portion of our essential operational workforce. The facility is shared by Electric Grid Operations and Electric Distribution Operations. Both departments include operators who are vital for safe monitoring, dispatch, and operations of automated systems. The operators have the responsibility and authority to implement real-time actions to promote safe and reliable work on the SDG&E electric distribution system, following all SDG&E policies, standards, and procedures.

Operator Training

The Mission Control Training Program was established in 2016 and provides initial and continual training for Distribution System Operators (DSOs). The purpose of the SDG&E Mission Control Training Program is to produce and maintain highly trained, well-qualified, and competent operating personnel using a systematic approach to training. Distribution trainers administer a 24-month operator qualification program and provide skills refresher training to

enable DSOs to have the skills and knowledge needed to safely provide coordination of field worker activities on the system.

Technology

The data systems in use and personnel in the Mission Control facility operate on a 24/7/365 schedule. Additionally, data systems that support SDG&E operations continue to support increased workloads due to steady system growth, a high volume of replacements for aging system infrastructure, requirements to comply with CPUC reporting, risk mitigation efforts related to safety, reliability, and security, and increasing customer expectations for outage information.

Integration of SCADA telemetry and controls into the operational data systems is also performed within Electric System Operations. SCADA devices enhance security and reliability and help manage wildfire risk. SCADA devices provide remote telemetry to the control centers for situational awareness, allow for automated remote switching, and automatically isolate system issues.

Storeroom

Storeroom functions assist field crews with logistics and material support needed to perform daily construction, both during normal and emergency operations. Moreover, managing the financial data accuracy of inventory or fixed asset allocation to construction work is a key component performed by the storeroom. The storeroom enables material to be physically accounted for and the inventory value to be correct and accurately represented within the accounting system. SDG&E's storeroom also accounts for bulk orders of low-cost material types, such as nuts and bolts, which are typically charged to a general account, as direct charging these small items to each construction job would be financially infeasible.

2. Forecast Method

The forecast method developed for this cost category is base year. This method, along with including incremental adjustments as discussed in the Cost Driver section below, is most appropriate because it best captures sustained storeroom cost increases incurred due to elevated construction levels. It also incorporates increased staffing levels, due to filling recent System Operator vacancies.

3. Cost Drivers

The cost drivers behind this forecast are storeroom upward pressures, DSO workforce development, SDG&E's grid modernization plan and emergency load curtailments, and skilled labor positions needed to maintain the SCADA system.

a. Storeroom Cost Pressures in Support of the Capital Plan

Low-value material items that are replenished as "truck stock" consist of bulk type materials that are not individually inventoried or managed by the district warehouses. These materials include items like nuts, bolts, washers, connectors, electrical tape, and some daily consumption items. Because inventory, accounting, and freight allocation to individual jobs is cost prohibitive, these items are not directly charged to the O&M account or capital budgets for which they are used. Storeroom costs generally scale with the amount of construction activities being performed, consisting of a roughly 2.56 percent cost of overall capital construction. Upward cost pressures in this GRC cycle are attributed to increases to SDG&E's forecasted capital plan. See my workpapers Ex. SDG&E-12 WP 1ED003 for a more detailed cost breakdown.

b. DSO Workforce Development

The Electric Distribution Operations Control Center (EDOCC) is responsible for operating the electric distribution system safely and reliably for planned and unplanned events (*e.g.*, outages). One of the main resources within the Center are the DSOs. This group supports 24/7 operations management and oversight to enable field workers to have the proper safety authorizations when making system changes to the electric distribution system. The DSOs are also responsible for directing unplanned outage restoration activities on the electric distribution system, having a direct impact on the reliability of the system and impacts SDG&E's customers see. The DSOs are also critical to implementing wildfire mitigation measures during the heightened fire risk season. These measures include but are not limited to enabling sensitive relaying, removing reclosing functions, enforcing visual patrol requirements prior to re-energizing overhead lines, and safely performing PSPS events.

With the continued high industry demand for DSOs, there has been close to a 40% attrition over the last four years, and further DSO attrition is expected as the position feeds several other critical job positions including SDG&E's Transmission System Operators (TSO). Additionally, due to the high skill requirements of the job, the long-term success rate of the DSO

qualification program has been below 50%. Costs are forecasted to increase in order to hire an additional DSO trainee class, which will accelerate the output of trainees qualified through the program over the next 2-years. Furthermore, the increase in the DSO and trainee workforce places an upward pressure on the training program required to build and maintain the skills of the DSO workforce. These skills are required to safely operate SDG&E's electric distribution system.

c. Reliability and Safety

Advanced Distribution Management System (ADMS) Support

The ADMS is a software tool utilized to manage and monitor all activity on the electric distribution system. SDG&E implemented its ADMS in 2012, enabling electronic workflow for tracking system upgrades, enhancing outage identification and customer notifications, and improving overall situational awareness capabilities in the Electric Distribution Control Center. Since then, SDG&E has continuously invested in the technology to incorporate and/or improve features such as simulating the impact of residential solar output on the Electric Distribution System, creating situational awareness for wildfire risk areas, and creating the ability to automate some levels of Fault Location, Isolation, and Service Restoration (FLISR) technology, also known as self-healing circuits. The ADMS requires continued investment in order to drive safe operation of the electric system, minimize customer outage times, and improve customer outage communication. The project also supports SDG&E's grid modernization efforts and is part of the Grid Modernization Plan. Attached to my testimony as Appendix C.

Planned investment in the ADMS benefits electric system safety and reliability. Expanded functionality will enable situational awareness and safety in wildfire risk events, integrate additional data to better identify fault locations, improve functionality for daily workflow, enhance customer communication for unplanned and planned outages, and advance outage and reliability analytics. These new functions will be accomplished through implementing and configuring hardware and software, designing new integrations, and providing ongoing user support for an increasingly complex system. Additional O&M resources (four full time equivalents [FTEs]) will be needed to support the implementation of these enhancements, provide desktop support for users related to these enhancements, and manage ongoing data accuracy required to enable continued function of the system.

The ADMS is also critical for mitigating the impacts of Distributed Energy Resources (DERs) connecting to the electric system. Connecting DER technologies, which can change energy flow direction on the electric system, introduce complex load and voltage patterns that may lead to poor power quality service to customers, create a potential hazard to employees, and potentially damage the electric system. An important capability within the ADMS needed to enable detection and deploy advanced mitigation of DER's on SDG&E's electric system, such as Volt-Var optimization and accurate load forecasting/modeling, is the system model. The system model simulates and communicates to the DSO, the real-time and forecasted load and voltage patterns occurring on the electric system. In order to improve the system model accuracy, the projects referenced above will seek automated solutions for identifying data quality issues from existing data sources feeding into the system model and also integrate new data sources.

The ADMS will also facilitate interaction with the Local Area Distribution Controller (LADC), or Microgrid controller. The LADC helps optimize DER assets within an electric microgrid environment. Planned investment will integrate the LADC with SDG&E's existing SCADA system, and this integration allows for remote initiation of semi-autonomous control over the DER assets contained within the microgrid under different scenarios such as islanding, peak shaving, and black start. The semi-autonomous control also helps optimize the DER assets in the efforts to control voltage, active and reactive power, current frequency, and power factor. Enhancements to the ADMS will allow for easier access for the DSO to manage setpoints, which will be used in these different scenarios. These ADMS enhancements may also be dependent on DERMS capabilities listed above.

Supervisory Control and Data Acquisition (SCADA) Workforce Development

The SCADA system communicates with smart-enabled field hardware to provide monitoring and remotely control those devices from the Electric Distribution Control Center. In recent years, SDG&E has seen high growth in the application and proliferation of these devices, which are used to minimize impacts of unplanned outages to customers, provide increased visibility of impacts of DERs on the electric distribution system at a local level, and minimize the impacts of PSPS events. The number of installed SCADA field sites is forecast to increase by an average eight percent per year for the next three years, which has placed an upward pressure on the skilled staff (SCADA analysts and technologists) who build and maintain the SCADA system. In addition, transition to a new SCADA platform has created O&M upward

pressures in both licensing and software developer maintenance costs associated with the tool. For more information on the SCADA Head-End upgrade, please see the Electric Distribution Capital testimony of Oliva Reyes (Ex. SDG&E-11).

4. Other Drivers

a. IT Projects

There are four IT Capital projects related to this workpaper, in which I speak to the business need. For information on costs related to these projects, please see the IT testimony of William J. Exon (Ex. SDG&E -25, Chapter 2).

Reliability and Operations Safety Enhancements (ROSE) and Smart Grid Operations (SGO) – IT CAPITAL

The Reliability and Operational Safety Enhancements (ROSE) and Smart Grid Operations IT capital projects have business needs presented under this cost category, section IV.3.c titled "Advanced Distribution Management System (ADMS) Support.

Distributed Energy Resource Management System (DERMS) – IT CAPITAL

The DERMS IT capital budget code seeks to fund implementing a group of new IT systems and modules that enhance current systems and which will work in conjunction with ADMS to establish two-way communication and control of customer and aggregator DER's throughout SDG&E's service territory. Specifically, these systems will target and enable specific Electric Distribution services, which are planned to consist of dispatching DERs to manage system constraints, provide system reliability support, and manage volt and var optimization. Additionally, future development of the technology will support dynamic charging and dispatching limits, which will optimize their use in the larger generation market. The project also supports SDG&E's grid modernization efforts and is part of the Grid Modernization Plan. See Appendix C, attached to my testimony. Within the TY 2024 GRC, SDG&E expects its efforts on DERMS to focus on the following:

1) Build direct dispatch capabilities for large capacity (1MW and above) energy storage
2) Engage with commissioner staff, customers, DER developer, aggregators, and other key stakeholders in establishing key use cases for smart inverter operationalization.
3) Facilitate appropriate level of procurement efforts and collaborate with vendors to develop, pilot, and implement the needed functionalities to support the use cases on a technological level.

The DERMS project will explore the following functionalities including but not limited to:

- Dynamic limit management
- Aggregator Communication
- Direct DER Communication
- DER Communication Management
- DER Monitoring, control, and data exchange with ADMS
- 2030.5 Integration

Emergency Load Curtailment IT Tool – IT CAPITAL

Emergency Load Curtailment (ELC) describes the processes undertaken by SDG&E to shed customer load in order to prevent potential infrastructure failure due to local overloads on the electric system and/or to assist the California Independent System Operator (CAISO) in correcting a statewide or regional imbalance between available system resources and system demand. Moreover, the loss of generation in Southern California, and low voltage throughout California and/or within the SDG&E system are some of the various reasons why manual load shedding may be necessary.

The ELC IT budget code seeks to implement a new tool that supports ELC through providing multiple functions. First, when a decision is declared that a load shed will be needed, the tool allows the user to accurately identify the potential customer impacts utilizing the utilizing the latest forecast from the CAISO. Second, the tool communicates those forecasted impacts through both internal channels to emergency responders and to customers through SDG&E's website.

Grid Small Cap – IT CAPITAL

The IT Electric Grid Ops Small Capital budget code is needed to fund replacement of electric transmission legacy hardware required for the Transmission SCADA system. This budget code supports purchasing replacements for defective, broken, or expired components, including legacy equipment that is prone to failure and no longer supported by the vendor. Reliable operation of the Transmission SCADA system is critical to monitor generation resources and system load calculation errors. Moreover, the Transmission SCADA system monitors communication that has been lost, providing a higher level of awareness of potential electric system issues. The forecast reflects the project timeline for the next three years and entails only hardware assets and hardware labor.

D. Geographical Information Systems (GIS) (1ED003.001)

TABLE TS-13
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
C.1 Electric System Operations: GIS	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Electric System Operations: GIS	922	922	0
Total	**922**	**922**	**0**

1. Description of Costs and Underlying Activities

Enterprise GIS Services (EGISS) is the section of Electric Distribution Operations that creates and maintains all electric distribution, transmission, telecommunications, and substation data in SDG&E's enterprise GIS system. EGISS digitizes the data in a preliminary state, energizes the data in real-time, reconciles and converts design work orders into construction order as-builts, scans them to a central repository, records details in the GIS system, and identifies these assets for tax and franchise fee calculations and reports. SDG&E's enterprise GIS is a direct input of information into many operational and planning tools used by engineering and operations; thus, accurate and timely data is essential for safety and reliability.

a. Description of RAMP Mitigations

RAMP-related costs for Electric System Operations include the costs for GIS Documentation. As described in Table TS-6 above: GIS Documentation includes storing information in and using information from the GIS data base to manage switching on the system, asset risk/analytics programs, coordinating planned system enhancements, regulatory reporting, accounting, and many other functions. For electric transmission and distribution, GIS includes the electric connectivity model that feeds the electric network management application, allowing for the safe and reliable operation of the electric system. GIS provides field crews with accurate asset information to prevent the incorrect identification and operation of assets and reduce the likelihood of an electrical incident. The outage management integration of GIS provides the base network model enabling the operators to geospatially monitor their work activities and verify the connectivity model to validate proper safe isolation points for field and public safety. GIS is also utilized during emergency events due to the use of real-time fire data, such as fire parameters, weather data, and crew locations it provides. Incorrect record keeping within GIS

can lead to improper communication, during planned and unplanned outages with customers affecting SDG&E's longstanding commitment to public and customer safety

Table TS-14 below provides the RAMP activities, their respective cost forecasts, and the RSEs for this workpaper. For additional details on these RAMP activities, please refer to my workpapers Ex. SDG&E-12-WP 1ED003.

TABLE TS-14: RAMP Activity O&M Forecasts by Workpaper
In 2021 Dollars ($000)

Workpaper	RAMP ID	Activity	2021 Embedded-Recorded	TY 2024 Estimated	Change	GRC RSE*
1ED003.001	SDG&E-CFF-6-New	GIS Documentation	921	921	0	0

* An RSE value was not calculated for this activity

2. Forecast Method

The forecast method developed for this cost category is base year. This method, along with including incremental adjustments as discussed in the Cost Driver section below, is most appropriate because it is directly correlated with the quantity of FTEs supporting this activity, which is stable for the foreseeable future.

3. Cost Drivers

SDG&E TY 2024 forecasted costs for Electric System Operations: GIS are unchanged from the base-year average adjusted recorded expense level.

4. Other Drivers

SDG&E has not identified any other drivers for this sub-workpaper.

E. Electric Transmission & Distribution: Operations Services (1ED005)

TABLE TS-15
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
D. ET&D Operations Services	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. ET&D Operations Services	2,2356	2,179	-567
Total	**2,2356**	**2,179**	**-567**

1. Description of Costs and Underlying Activities

Electric Transmission and Distribution (ET&D): Operations Services performs a variety of support functions centered around Safety and Service. ET&D: Operations Services consists of several functional working groups described below.

Tool Repair

This group is responsible for the maintenance, repair, fabrication, and acquisition of new tooling to support the needs of groups such as Electrical Regional Operations, ET&D: Substation Construction & Operations (C&O), Troubleshooting, Skills and Compliance Training, and others.

Equipment Salvage

This group is responsible for salvaging electric distribution equipment removed from service. Activities include the disposal or refurbishment of equipment such as overhead and underground transformers, capacitors, SF6 switches, oil switches, and the associated gas and oil reclamation and recycling services.

Transformer Repair and High Voltage Testing

This group operates a high voltage test station that tests and confirms the electrical condition of transformers, regulators, mechanical jumpers, grounds, hot sticks and other live line tools and equipment. Their responsibilities also include transformer, regulator, and street light controller repair, as well as field testing new equipment received by the logistics group for quality control.

Protective Equipment Testing Lab

This group is lab certified to inspect and test rubber goods used for electrical worker personal protection. The lab is responsible for inventorying and providing verification of proper electrical ratings and physical condition for rubber gloves and live line tools assigned to SDG&E's electrical workers, at mandated intervals.

Business Controls and Training

This group provides several support functions to ET&D: Operations Services and ET&D: Substation C&O. This group is responsible for the oversight of internal ET&D control procedures and policies to enable compliance and develop process improvements. The group also facilitates both compliance and job skill training for ET&D employees, ensuring compliance

with internal and external guidelines and regulations, and curating and developing new training content to meet demand.

a. Description of RAMP Mitigations

RAMP-related costs for ET&D: Operations Services include costs for (1) Occupational Safety and Health Administration (OSHA) Voluntary Protection Program (VPP), and (2) PPE. As described in Table TS-6 above: (1) The OSHA Voluntary Protection Program includes implementation of effective health and safety management systems to prevent fatalities, injuries, and illnesses of employees. Several programs and processes are being employed as part of VPP to promote safe activities and improve safety performance, including Hazard Identification Cards and the Safety Incentive Program. Hazard Identification Cards are used as a proactive measure for employees to report and resolve hazards in the workplace. Each card is collected withing a tracking system and increases awareness of the hazard among the workforce. The Hazard Identification Card empowers the employee in the resolution process of correcting the hazard by giving the employee the ability to resolve the hazard on their own, if possible, or work with additional departments for assistance and guidance on resolving the hazard. A workflow process is established for standardizing how each Hazard Identification Card is processed and reviewed. The Safety Incentive Program is a reward-based program focused on leading safety indicators, promoting workplace safety through positive reinforcement of observed safe behaviors and voluntary participation in various safety and risk reduction programs. Employees can receive incentive points, which can then be redeemed for rewards, by submitting Near Miss Reports, submitting Hazard Identification Cards, making safety recommendations, taking the lead on resolving known safety issues, participating in safety subcommittees and analysis of safety issues, or by demonstrating additional safety-related behaviors. These activities and other employee time dedicated to fostering an enhanced safety environment are key components of the overall VPP; (2) PPE protect employees from the risk of injury by creating a barrier against workplace hazards. PPE includes clothing and equipment designed to protect employees while performing their job (*e.g.*, flame resistant clothing, gloves, protective eyewear). All employees who are required to use PPE are trained on when PPE is necessary, which PPE is necessary, how to properly don/remove/adjust/wear PPE, limitations of PPE and the proper care/maintenance/life/disposal of PPE. In addition, the ET&D: Operations Services group performs inspections and tests of PPE which is used by SDG&E employees. PPE which is

inspected and tested by the ET&D: Operations Services group includes, but is not limited to, rubber gloves, rubber blankets, rubber sleeves, rubber line hose, and live line tools. The PPE maintained by the ET&D: Operations Services group is used by multiple working groups at SDG&E, including Electric Regional Operations, ET&D: Substation C&O, Troubleshooting, Skills and Compliance Training, and others.

Table TS-16 below provides the RAMP activities, their respective cost forecasts, and the RSEs for this workpaper. For additional details on these RAMP activities, please refer to my workpapers Ex. SDG&E-12-WP 1ED005.

TABLE TS-16: RAMP Activity O&M Forecasts by Workpaper
In 2021 Dollars ($000)

Workpaper	RAMP ID	Activity	2021 Embedded-Recorded ($000)	TY2024 Estimated Total ($000)	TY2024 Estimated Incremental ($000)	GRC RSE
1ED005	SDG&E-Risk-8-C08	OSHA Voluntary Protection Program	9	69	60	196
1ED005	SDG&E-Risk-8-C10	Personal Protective Equipment	980	730	-250	0*

* An RSE value is not calculated for this activity

2. Forecast Method

The forecast method developed for this cost category is three-year average. This method, along with including incremental adjustments as discussed in the Cost Driver section below, is most appropriate for both labor and non-labor because the workload for this group is driven by factors that vary from year-to-year, such as the quantity of equipment removed from service that can be tested and repaired versus safely disposed of. In addition, tools and rubber goods are inspected and tested based upon time-based cycles, so although the quantity and associated costs can vary year-to-year, an average provides the best forecast for a typical year. Sustained increases in workload and rising union labor rates for the employees who perform the inspection, testing, and repair activities occurred in 2019 making the three-year average the most appropriate forecast.

3. Cost Drivers

The cost driver behind this forecast is workforce development.

a. Workforce Development

Additional employees are needed in the controls and training group in order to provide additional oversight of business processes and facilitate employee training. This group was formed within the last three years and requires more employees in order to achieve its compliance and process improvement goals. A new training specialist is needed to support and assist substation training instructors, including coordination of substation entry training, examinations, and substation entry authorization. A project controls analyst is needed to support invoice charging, interface with supply management to onboard vendors and order material and prepare budget reports. A new VPP Project Manager is needed to run the ET&D VPP program, including efforts for initial certification and re-certification.

4. Other Drivers

SDG&E has not identified any other drivers for this workpaper.

F. Electric Transmission & Distribution: Substation C&O (1ED006)

TABLE TS-17
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
E. ET&D: Substation C&O	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. ET&D: Substation C&O	6,7865	5,80910	-975
Total	**6,7865**	**5,80910**	**-975**

1. Description of Costs and Underlying Activities

Electric Transmission & Distribution: Substation C&O and associated support organizations are responsible for the installation, inspection, and maintenance of approximately 135 distribution substations on the SDG&E system. Substation equipment maintained includes approximately 304 distribution power transformers and their associated load tap changers or voltage regulators, and approximately 1,672 circuit breakers including oil, air, and vacuum classifications, and their associated line and bus disconnect switches. Substation equipment also includes inspection and maintenance for all substation equipment including batteries, buses, support structures, capacitor banks, reactors, grounding systems, fire suppression systems, and perimeter fences and gates. The substation inspection and resulting corrective maintenance program managed by this group is established in compliance with GO 174, CAISO maintenance

requirements, and SDG&E's maintenance standards. This program is critical to the safe operation and reliability of all electric distribution substation facilities.

a. Description of RAMP Mitigations

RAMP-related costs for Electric Transmission & Distribution: Substation C&O include costs for (1) Substation Inspection and Repair GO 174, (2) OSHA Voluntary Protection Program, and (3) PPE. As described in Table TS-6 above: (1) SDG&E's Substation Inspection and Repair Program adheres to GO 174 while promoting safety for SDG&E personnel and contractors by providing a safe operating and construction environment, within the substation fence. Goals for this program include: meeting all of the requirements of GO 174, achieving a level of station availability satisfactory to SDG&E's health and safety programs and maintenance standards, and assuring compliance with all sections of the CAISO TCA. The program involves routine inspections at reoccurring cycles. A security check is also performed once per week, and a more detailed inspection is planned monthly or bimonthly, which takes a visual look at equipment and attempts to identify any problems, like environmental hazards caused by equipment oil leaks; (2) The OSHA Voluntary Protection Program includes implementation of effective health and safety management systems to prevent fatalities, injuries, and illnesses of employees. Several programs and processes are being employed as part of VPP to promote safe activities and improve safety performance, including Hazard Identification Cards and the Safety Incentive Program. Hazard Identification Cards are used as a proactive measure for employees to report and resolve hazards in the workplace. Each card is collected withing a tracking system and increases awareness of the hazard among the workforce. The Hazard Identification Card empowers the employee in the resolution process of correcting the hazard by giving the employee the ability to resolve the hazard on their own, if possible, or work with additional departments for assistance and guidance on resolving the hazard. A workflow process is established for standardizing how each Hazard Identification Card is processed and reviewed. The Safety Incentive Program is a reward-based program focused on leading safety indicators, promoting workplace safety through positive reinforcement of observed safe behaviors and voluntary participation in various safety and risk reduction programs. Employees can receive incentive points, which can then be redeemed for rewards, by submitting Near Miss Reports, submitting Hazard Identification Cards, making safety recommendations, taking the lead on resolving known safety issues, participating in safety subcommittees and analysis of safety

issues, or by demonstrating additional safety-related behaviors. These activities and other employee time dedicated to fostering an enhanced safety environment are key components of the overall VPP; (3) PPE protect employees from the risk of injury by creating a barrier against workplace hazards. PPE includes clothing and equipment designed to protect employees while performing their job (*e.g.*, flame resistant clothing, gloves, protective eyewear). All employees who are required to use PPE are trained on when PPE is necessary, which PPE is necessary, how to properly don/remove/adjust/wear PPE, limitations of PPE and the proper care/maintenance/life/disposal of PPE.

Table TS-18 below provides the RAMP activities, their respective cost forecasts, and the RSEs for this workpaper. For additional details on these RAMP activities, please refer to my workpapers Ex. SDG&E-12-WP 1E006.

TABLE TS-18: RAMP Activity O&M Forecasts by Workpaper
In 2021 Dollars ($000)

Workpaper	RAMP ID	Description	2021 Embedded-Recorded ($000)	TY 2024 Estimated Totals ($000)	TY2024 Estimated Incremental ($000)	GRC RSE
1ED006	SDG&E-Risk-2-C25	Substation Inspection and Repair GO 174	1,289	1,192	-97	0*
1ED006	SDG&E-Risk-8-C08	OSHA Voluntary Protection Program	228	145	-83	196
1ED006	SDG&E-Risk-8-C10	Personal Protective Equipment	132	143	11	0*

* An RSE value is not calculated for this activity

2. Forecast Method

The forecast method developed for this cost category is three-year average. Distribution substation maintenance activities are determined by time-based cycles, with the amount of scheduled maintenance therefore varying from year to year. In addition, the amount of unscheduled maintenance, including that which results from the substation inspection program, is also variable from year to year. A three-year average, along with including incremental adjustments as discussed in the Cost Driver section below, is most appropriate because it smooths out the variability of these maintenance activities and provides a good forecast of the

typical annual maintenance costs, while also reflecting a recent increase in costs that were not present in years prior to the most recent three years.

3. Cost Drivers

The cost drivers behind this forecast are workforce development, Medeco key system, and infrared inspections.

a. Workforce Development

Substation Electricians

New electrician assistant classes are necessary to eventually enter the electrician apprentice program. The electrician apprentices assist journeyman in completing field work operating and maintaining the Company's electric system by operating tools and equipment necessary to accomplish this work. Employees progress from electrician assistant to apprentice electrician to journeyman electrician in approximately four years. In the next three-years, there is a need for a new electrician assistant class annually to replace those who retire, quit, or go to other departments. There is an increase in labor costs associated with hiring additional candidates in advance to account for anticipated attrition through the electrician qualification program.

Substation Condition Based Maintenance

In addition to electrician apprentices, an engineer will be added to support SDG&E's Condition Based Maintenance program (CBM). The CBM program addresses aging assets and performs condition assessments that feed data to asset health and lifecycle strategies. Currently, the CBM program is supported through the expertise of a contracted specialist. Upward pressures will address insourcing and expanding the program to cover a larger percentage of the SDG&E substation equipment fleet. SDG&E plans to hire additional engineering support.

b. Medeco Key System

The Medeco electronic key system is utilized to secure all electric substations and the system is designed to meet both North American Reliability Council Critical Infrastructure Protection (NERC CIP) requirements and SDG&E's physical security requirements. The Medeco key system was rolled out in 2016 and electronic keys and lock cylinders are starting to exceed their useful life, leading to failures. This upward pressure will address replacement of these keys and cylinders as failures occur.

c. Infrared Inspections

Infrared inspections are performed by crews in the Substation C&O group, but they have previously only been performed on the transmission system and the distribution system within high fire threat districts (HFTD). Expanding infrared inspections to the distribution system in the Non-HFTD would mitigate the risk of issues with electrical connections and equipment that cannot be seen during SDG&E's traditional visual inspections. This is especially important because it will help mitigate failing connections in the coastal zones caused by coastal corrosion. Left undetected, these issues could cause an equipment failure that could lead to an ignition, wire down, or outage.

4. Other Drivers

a. Fleet Vehicles

Below, I speak to the fleet vehicle needs related to this workpaper. Costs for the fleet vehicle additions are included in the Fleet Services testimony of Arthur Alvarez (Ex. SDG&E-22).

Substation C&O Fleet Vehicle Needs

Fleet vehicles are used by personnel in the ET&D: Substation C&O group to travel to substation work sites and to transport materials and tools to those sites. Additional new fleet vehicles are needed for the increase in substation electricians and other recent hires in the group.

G. Distribution System Control & Protection (1ED006.002)

TABLE TS-19
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
E.1 ET&D: Substation C&O: Relay & SCADA	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. ET&D: Substation C&O; Relay & SCADA	3,576	3,708~~9~~	132~~3~~
Total	**3,576**	**3,708~~9~~**	**132~~3~~**

1. Description of Costs and Underlying Activities

The Distribution System Control & Protection group within Substation C&O performs maintenance of protective relays and control systems installed in both substations and electric distribution field devices. Relay systems are critical to the safe operation of the electric system

because they identify system disturbances and quickly isolate them. Fast relay action prevents further damage from system faults and minimizes potential injury to the public and field personnel. Additionally, SDG&E employs both sensitive relay functions and removing reclosing as wildfire mitigation protocols. The System Control & Protection organization performs routine preventive maintenance at fixed time-based intervals to maintain reliable operation of protective relays and relay controls. They also perform timely corrective maintenance, which is troubleshooting and repairing systems that alarm or fail to function properly, in order to enable 24/7 operation of these devices. Lastly, the group downloads events captured during system outages and system emergencies to better investigate the cause of failures. This sometimes requires around the clock staffing during major events, as well as during system emergencies, *e.g.*, unscheduled load shedding and earthquakes. As SDG&E's SCADA system has expanded, the scope and scale of maintenance and installation required has also expanded. It now includes distribution voltage regulators, capacitors, distribution reclosers, weather stations, other distribution SCADA controlled equipment and switchgear, and aircraft warning lights.

a. Description of RAMP Mitigations

RAMP-related costs for System Control & Protection include costs for PPE. As described in Table TS-6 above: PPE protect employees from the risk of injury by creating a barrier against workplace hazards. PPE includes clothing and equipment designed to protect employees while performing their job (*e.g.*, flame resistant clothing, gloves, protective eyewear). All employees who are required to use PPE are trained on when PPE is necessary, which PPE is necessary, how to properly don/remove/adjust/wear PPE, limitations of PPE and the proper care/maintenance/life/disposal of PPE.

Table TS-20 below provides the RAMP activities, their respective cost forecasts, and the RSEs for this workpaper. For additional details on these RAMP activities, please refer to my workpaper Ex. SDG&E-12-WP 1ED006.002.

TABLE TS-20: RAMP Activity O&M Forecasts by Workpaper
In 2021 Dollars ($000)

Workpaper	RAMP ID	Activity	2021 Embedded-Recorded	TY 2024 Estimated	Change	GRC RSE*
1ED006.002	SDG&E-Risk-8-C10	Personal Protective Equipment	22	27	5	0

* An RSE value is not calculated for this activity

2. Forecast Method

The forecast method developed for this cost category is three-year average. System protection maintenance activities are determined by time-based cycles, with the amount of scheduled maintenance therefore varying from year to year. In addition, the amount of unscheduled corrective maintenance is also variable from year to year. A three-year average, along with including incremental adjustments as discussed in the Cost Driver section below, is most appropriate because it smooths out the variability of these maintenance activities and provides a good forecast of the typical annual maintenance costs, while also reflecting a recent increase in costs that were not present in years prior to the most recent three years.

3. Cost Drivers

The cost drivers behind this forecast are workforce development.

a. Workforce Development

As modern relay systems advance, the skills and education required to perform Relay and SCADA technician work is increasing. New modern microprocessor-based devices, computer-driven test equipment, as well as new complex control systems for devices such as series capacitors and synchronous condensers, are driving this change. The frequency and type of training for relay technicians is increasing to keep up with the skillset required to perform these key job functions. In addition, there is a higher turnover amongst new technicians due to the increasing complexities of the job. Given the additional regulatory requirements and the skilled workforce necessary, SDG&E is planning on hiring additional employees for this work group. SDG&E plans on hiring five Relay Technicians to perform maintenance of substation relay and control systems. There are also plans to hire five SCADA Technicians to install, operate, maintain, and test distribution circuit equipment including but not limited to power circuit breakers, service restorers, regulators, transformers, relays, motors, batteries, battery chargers and distribution SCADA controls. Two RTU Technicians will be hired to perform construction and maintenance of substation and field distribution metering and control equipment.

4. Other Drivers

a. Fleet Vehicles

Below, I speak to the fleet vehicle needs related to this workpaper. Costs for the fleet vehicle additions are included in the Fleet Services testimony of Arthur Alvarez (Ex. SDG&E-22).

Distribution System Control & Protection Fleet Vehicle Needs

Fleet vehicles are used by personnel in the Distribution Control & System Protection group to travel to work sites at substations and in the field and to transport materials and tools to those sites. Additional new fleet vehicles are also needed for the increase in Technicians.

H. Distribution Design and Project Management (1ED007)

TABLE TS-21
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
F. Distribution Design and Project Management	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Distribution Design and Project Management	820	1,3054	4854
Total	**820**	**1,3054**	**4854**

1. Description of Costs and Underlying Activities

Design and Project Management (DPM)'s responsibilities vary widely, but all relate to the preparation of construction orders. Department personnel perform the design and engineering necessary to develop comprehensive construction orders, from which additions and modifications to electric distribution systems are constructed. Such construction orders range from simple services for individual customers to new installations and modifications to large complex distribution systems that serve subdivisions, commercial centers, and high-rise towers. Also included are construction orders for converting electric overhead lines to underground through various government programs and relocating existing facilities to accommodate both private party requestors and government agencies. The construction order development process includes meeting with customers, government agencies, and other utilities in planning and coordinating additions and modifications to the electric distribution system. Department personnel perform a variety of engineering calculations, analytical assessments, secure and execute contracts, and special agreements. In addition, Project Management personnel prepare and assemble the construction order job packages for distribution to customers, contractors, other utilities, and all participating departments within SDG&E. All new project managers and planners go through a series of training courses to learn the roles, tools, and responsibilities to efficiently complete these tasks.

The construction orders developed by Project Management represent capital work. However, many capital projects include a small component of O&M. There are also some small construction orders for which the work is considered O&M because of its limited scope. As such, Project Management's time is split between capital and O&M projects, with 98% of personnel time charged to Capital and 2% charged to O&M. The relatively small O&M component of Project Management is addressed in this cost center.

2. Forecast Method

The forecast method developed for this cost category is Base Year Recorded. This method is appropriate because it most closely represents the annual O&M costs that is roughly 2% of Project Management's total budget. The rest of the budget is comprised of capital expenses. The base year recorded was used as opposed to averages to specifically account for an increased FTEs count in 2021 needed to support increased workload due to increased meter sets for new business, more aggressive undergrounding, and additional response for improvements for municipal customers.

3. Cost Drivers

The cost drivers behind this forecast are distribution designer workforce development, software, and customer service enhancements.

a. Distribution Designer Workforce Development

Due to increased demand in California for Electric Distribution design resources, SDG&E's distribution design function experienced a relatively high 15% attrition rate (compared to the long-term historical 7% average) in 2021. Additionally, this functional area has seen a 6% rate of internal transfers. In response to this demand, SDG&E has increased its workforce by 14% in 2021. Also in 2021, 44% of the organization had less than two years of experience. SDG&E plans to further increase its workforce to support implementation of Electric Rule 45 with execution timelines imposed by the CPUC and regulatory requirements anticipated to affect R15/16 timelines. This increase is also in response to an increase in bi-directional power flow generators and service request projects associated with implementing Rule 21 V2G, the State's goals to increase the availability of low-income housing, and the backlog of projects in the entitlement phase associated with the building community ramping up to address the housing crisis in San Diego County. This increased hiring rate will also impart upward pressure on learning, development, and training support. All new planners and designers

participate in a fifteen-week training program and increased consulting services are being utilized to provide this training support.

b. Software

Builder Services Portal

Builders Services Portal System Enhancement has O&M components to be covered by impacted cost centers. For more information on IT Capital costs, see testimony of William J. Exon (Ex. SDG&E -25, Chapter 2) and for more information on the business need for this project, see the Electric Distribution Capital testimony of Oliva Reyes (Ex. SDG&E-11).

Automated Utility Design

Automated Utility Design implementation has O&M components to be covered by impacted cost centers. For more information on IT Capital costs, see testimony of William J. Exon (Ex. SDG&E -25, Chapter 2) and for more information on the business need for the project, see the Electric Distribution Capital testimony of Oliva Reyes (Ex. SDG&E-11).

Design Software Licensing

There are two drivers associated with design software licensing. First, the licensing, maintenance, and support service costs of a Portable Document Format markup and editing software designed specifically for the Architecture, Engineering, and Construction industry that allows for greater collaboration and efficiency. Second, the licensing of commercial computer-aided design and drafting software applications. This second licensing cost was added due to a timing issue since the costs needed to be amortized over three years as it was not paid and/or included in the base year forecasting methodology chosen.

c. Customer Service Enhancements

The design and project management group performs customer driven work, therefore the customer service improvement initiative drives standardizations to improve overall customer experience for new business customers and their residential or commercial projects. This will allow customers to see the status of deliverables from their end and SDG&E's end and what has been submitted and still needs to be submitted to keep the project moving forward. Once the information has been submitted by the customer, they can follow the progress status until completion.

4. Other Drivers

SDG&E has not identified any other drivers for this workpaper.

I. Electric Regional Operations (1ED008)

TABLE TS-22
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
G. Electric Regional Operations	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Electric Regional Operations	35,3595~~60~~	~~40,769~~ 39,666	~~5,409~~ 4,307
Total	**35,3595~~60~~**	**~~40,769~~ 39,666**	**~~5,409~~ 4,307**

1. Description of Costs and Underlying Activities

Electric Regional Operations (ERO) includes all electric distribution crews, planners, schedulers, and support staff located in six districts (Beach Cities, Construction Metro, Eastern, Northeast, North Coast and Orange County) and two satellite operating centers (Ramona and Mountain Empire), which covers SDG&E's entire electric distribution system and service territory of approximately 1.49 million customers in San Diego and southern Orange counties.

ERO is comprised of electric linemen, apprentices, line assistants, schedulers, planners, office support personnel, project managers, supervisors, and management personnel. The ERO workforce conducts training required by various Company organizational units including Safety, Electric Distribution Engineering, Fleet, Environmental, as well as various governmental agencies (the CPUC, Occupational Safety and Health Administration (OSHA), State of California). The ERO workforce also reviews and updates standards and practices to address operational incident patterns.

The primary job functions include:

Inspection and maintenance of the electric distribution system

In compliance with CPUC GOs 95, 128, and 165, and SDG&E standards, the ERO workforce proactively completes annual patrols and detailed inspections based on reoccurring intervals of all facilities within the service territory. Jobs created based on infractions found are then written, scheduled, and completed in accordance with the CPUC GOs.

Restoration of service after outages

ERO crews, made up of a working foreman, lineman, apprentices, and line assistants respond to, repair, and restore primary and secondary electric outages in both the underground and overhead systems based on internal Company service level policies and reliability targets.

Crews leverage the safety training that they have received to implement public and employee safety protocols while conducting all restoration activities.

Repairing service problems and addressing other customer issues

Service crews, typically made up of a lineman and apprentice respond to, repair, and restore overhead and underground service problems. Service crews also address miscellaneous customer issues in accordance with OSHA and Company safety standards.

Constructing new electric infrastructure

The ERO workforce proactively analyzes infrastructure assets to help maintain a safe and reliable system. This is done by project proposals, design, scheduling, and construction that aligns with the Company's capital work plan from beginning to end.

Scheduling and Forecasting

The ERO's scheduling and forecasting team analyzes availability of resources versus projected work to proactively forecast the long-term electric construction portfolio for the ERO workforce. The scheduling team implements an effective resource allocation philosophy when developing work plans for the electric crews, on both a strategic and real-time basis.

a. Description of RAMP Mitigations

RAMP-related costs for Electric Regional Operations include costs for (1) Mandatory Employee Health and Safety Training Programs and Standardized Policies, (2) Employee Behavioral Accident Prevention Process Program, and (3) PPE. As described in Table TS-6 above: (1) The Mandatory Employee Health and Safety Training Programs and Standardized Policies includes employee health and safety training programs that Construction Management personnel attend to promote mitigating the risk of an incident involving SDG&E employees; (2) The Employee Behavioral Accident Prevention Process (BAPP) Program is a partnership between management, volunteers, and front-line employees (employee led and management supported) that provides a structured process for continuous safety improvements specific to the high-risk tasks and situations faced by front-line employees. The BAPP volunteers rely on hazard and risk assessment checklists, developed from historical injury analytics, to perform observations focused on key areas of critical risk. These volunteers also conduct on the spot accountability conversations, defining Safe and At Risk behaviors, and also collect safety data. This collected data is further analyzed and utilized to identify and further act on undiagnosed risk exposure. The BAPP teams work with leadership to drive hazard and risk removal and

mitigation efforts; (3) PPE protect employees from the risk of injury by creating a barrier against workplace hazards. PPE includes clothing and equipment designed to protect employees while performing their job (*e.g.*, flame resistant clothing, gloves, protective eyewear). All employees who are required to use PPE are trained on when PPE is necessary, which PPE is necessary, how to properly don/remove/adjust/wear PPE, limitations of PPE and the proper care/maintenance/life/disposal of PPE.

Table TS-23 below provides the RAMP activities, their respective cost forecasts, and the RSEs for this workpaper. For additional details on these RAMP activities, please refer to my workpapers SDG&E-12-WP 1ED008.

TABLE TS-23: RAMP Activity O&M Forecasts by Workpaper
In 2021 Dollars ($000)

Workpaper	RAMP ID	Description	2021 Embedded-Recorded ($000)	TY 2024 Estimated Totals ($000)	TY2024 Estimated Incremental ($000)	GRC RSE
1ED008	SDG&E-Risk-8-C01	Mandatory Employee Health and Safety Training Programs and Standard Policies	165	165	0	0*
1ED008	SDG&E-Risk-8-C04	Employee Behavioral Accident Prevention Process Program	71	71	0	123
1ED008	SDG&E-Risk-8-C10	Personal Protective Equipment	532	532	0	0*

* An RSE value is not calculated for this activity

2. Forecast Method

The forecast method developed for this cost category is base year. For labor and non-labor, the base year method, along with including incremental adjustments as discussed in the Cost Driver section below, provides an appropriate baseline in comparison to future targets for the organization due to implementation of our strategic staffing plan to meet Company safety and

compliance targets. The increase in cost for skilled labor unique to the base year provides a more accurate representation of future years.

3. Cost Drivers

The following contribute to incremental cost pressures: Safety and Reliability, Corrosion Zone Enhancements, ERO Intelligent Image Processing.

a. Safety and Reliability

SDG&E proposes to hire an additional eight lineman and 24 line assistants to meet existing and future workload and reliability demands per year, which also accounts for the loss of twenty lineman due to attrition. Trained and skilled utility lineman are in high demand throughout the state of California and aggressive hiring is necessary to support the need to perform the core electric regional operations activities of inspection and maintenance, emergency and outage response, and infrastructure repair and replacement. The training process to develop a line assistant into a lineman takes an average of four to five years and the risk of a reduction in skilled utility labor could lead to losing our capability to deliver safe reliable power to our customers. Additional resources including skilled trainers, management and administrative support are also needed to support the hiring and development process of these lineman. Please refer to my Skills & Compliance Training testimony set forth in section H, for additional information regarding these requests.

b. Corrosion Zone Enhancements

The goal of the corrosion zone enhancement program is to address the ongoing safety concerns of the increased rate of equipment failures, specifically caused by coastal climate contamination resulting in corrosion. This program includes the proactive visual and mechanical inspection and installation of corrosion resistant, bi-metallic connectors in highly contaminated regions to mitigate corrosion, increase service life, and reduce failures. For details regarding the cost methodology utilized for the program, see my workpapers.

c. Intelligent Image Processing

The cost driver behind this non-labor incremental cost is for electric infrastructure data collection via car mounted cameras for ERO utilization of imagery and model predictions for emergencies, outages, construction fielding, and other ad hoc (non-compliance related) uses. The scope of this program includes car mounted camera imagery data collection and acquisition, QA review and processing by a subject matter expert and cloud consumption costs related to

intelligent image processing utilized for model predictions and machine learning to support ERO. The ultimate goal of this program is to increase the quality of SDG&E's inspection programs by leveraging and validating the capabilities of machine learning and drive down cost long term. Data validation and iterative testing of the technology will continue past 2024. Acquiring the necessary equipment and the collection and validation of the initial imagery data and will likely take five years. Leveraging the full machine learning to drive down costs of inspections is estimated to be in the five-seven year range.

4. Other Drivers

a. Fleet Vehicles

Below, I speak to the fleet vehicle needs related to this workpaper. Costs for the fleet vehicle additions are included in the Fleet Services testimony of Arthur Alvarez (Ex. SDG&E-22).

Electric Regional Operations Fleet Vehicle Needs

The driver behind these costs is an additional bucket truck with an extended boom length that is needed in order to perform the scope of work in rural portions of SDG&E service territory. Along with the bucket truck, a line truck is needed for increase overhead work due to the Wildfire Mitigation Plan (WMP), Drone Investigation, Assessment and Repair (DIAR), and CMP workload. Another bucket truck is also needed to provide the ability to run a Service Order Team Crew.

J. Skills & Compliance Training (1ED009)

TABLE TS-24
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
H. Skills & Compliance Training	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Skills & Compliance Training	1,898	2,542~~888~~	~~990~~ 644
2. Skills & Compliance Training (TNG)	941	941	0
Total	**2,839**	**3,483~~829~~**	**~~990~~ 644**

1. Description of Costs and Underlying Activities

The Skills and Compliance Training (SCT) organization is responsible for the development and training of the electric distribution workforce. The workforce consists of electric field personnel, non-electrical support personnel, and first line supervision. Subject

matter experts (SMEs) borrowed from the field comprise eighty percent of the instructor workforce. Using SMEs from the field promotes a skilled and expert workforce capable of utilizing safe work practices, new technology, best work practices and operating procedures, and building to construction standards. Skills and Compliance Training programs support a workforce with the required skills to safely and reliably maintain and operate the electric distribution and transmission system in compliance with GOs 95, 128, 165, as well as SDG&E's standards, work methods and operating procedures. Core training consists of the programs described below.

Training Facilities

The organizations training facilities and training yards support training through reinforcing improved safety fundamentals, familiarity with relevant equipment, and an opportunity to practice work methods such as the use of hot sticks and rubber gloves in different scenarios, tower and wire rescue with rope training, and replacing cable and tees in a working environment, among others.

Compliance Training

The SCT organization provides annual training required by existing federal, state, and local safety and environmental regulations. All electric field personnel are required to maintain proficiency regarding: (1) emergency rescue techniques, (2) safety and environmental policies and procedures applicable to individual work responsibilities, and (3) non-commercial and commercial vehicle operator training (initial and refresher) for safe driving practices.

Equipotential Zone (EPZ) / Personal Protective Grounding Training

The SCT organization has developed enhanced EPZ/Personal Protective Grounding training for its Electric Distribution and Transmission Construction & Maintenance field workforce. An equipotential zone is a delineated work zone buffer that protects a worker from electric shock from differences in electric potential between objects in the work area (which can be caused by circumstances such as induced voltage, line reenergization, or lightning). This annual training is designed to enable work crews to have a thorough understanding of the hazards involved with differences in electrical potential and maintain proficiency in establishing an EPZ and proper application of personal protective grounding. The SCT organization has the need to continue to build out overhead and underground scenarios in virtual and/or augmented reality to support virtual reality build out of underground modules around real scenarios such as

replacing tees and cable in support of improving Company's personnel knowledge of protective bonding knowledge.

Electric Linemen Development

SDG&E has a three-year state-approved apprenticeship program for the development of journeymen electrical workers, with certification by the joint apprentice committee.

SDG&E has Implemented the National Utility Training Fund (NUTIF) curriculum tailored to the three-year apprentice program. This involves:

- New three-year nationwide curriculum (NUTIF/International Brotherhood of Electrical Workers)
- Focus on electrical theory & practical hands-on scenarios
- Curriculum consistent with no room for variation to produce a more reliable workforce
- Smart device platform
- Immediate feedback from testing & tutorial direction

Equipment Operations and Commercial Drivers' Training

All qualified SDG&E employees with valid Class "A" and "B" driver licenses must undergo training required by both state and federal regulations and agencies.

Additional Ancillary Training & Services

The SCT organization also supports training for other business units, such as Advanced Metering Operations, Customer Service Field, Transmission, Gas Operations, Project Management, and other organizations. Skills Training modernizing our Learning Management System to include real-time reporting and dashboards, developing E-learnings, and expanding an on-line application to support training on hand-held smart devices. In addition, SCT is moving forward with developing and sustaining training around new software technologies as well as enhancing the development and training of storm processes, public safety power shut off procedures, and emergency response procedures and ICS. Continued modernization of all aspects of our Troubleshooter and Fault-Finding program is underway and needs to be sustained with the goal of integrating 2.5 D, E-learning, videos, and smart devices into their entire curriculum. Continued efforts to utilize virtual and augmented reality in areas of our CMP program is needed in order to continue the build out of fire ignition infractions and other

overhead infractions to better the Company's inspectors and equipment with tools in support of intelligent imaging.

Specialized Task-Specific Development and Training Programs

These programs are conducted for Relief Electric Troubleshooters, Relief Fault Finding Specialists, Electric Meter Test Electricians, and lead cable splicers. Relief Electric Troubleshooters and Relief Fault Finding Specialists are journeymen linemen who fill Electric Troubleshooter and Fault Finding Specialist shifts when permanent Electric Troubleshooters or Fault Finding Specialists are unavailable due to sickness, vacation, or holidays. They also periodically work as Relief Electric Troubleshooters on a "training shift" in order to maintain their troubleshooting skills.

a. Description of RAMP Mitigations

RAMP-related costs for Skills and Compliance Training include costs for (1) PPE, and (2) Industrial Athletic Trainer. As described in Table TS-6 above: (1) PPE protect employees from the risk of injury by creating a barrier against workplace hazards. PPE includes clothing and equipment designed to protect employees while performing their job (*e.g.*, flame resistant clothing, gloves, protective eyewear). All employees who are required to use PPE are trained on when PPE is necessary, which PPE is necessary, how to properly don/remove/adjust/wear PPE, limitations of PPE and the proper care/maintenance/life/disposal of PPE.; (2) The Industrial Athletic Trainer is responsible for on-site strength conditioning and recovery training with the objective of reducing physical injuries by promoting overall fitness of the company's field employees. The industrial athletic program will be implemented to reduce musculoskeletal disorders (MSD) and other OSHA defined strains and sprains, which is the most common type of employee injury and often preventable with proper techniques.

Table TS-25 below provides the RAMP activities, their respective cost forecasts, and the RSEs for this workpaper. For additional details on these RAMP activities, please refer to my workpapers Ex. SDG&E-12-WP 1ED009.

TABLE TS-25: RAMP Activity O&M Forecasts by Workpaper
In 2021 Dollars ($000)

Workpaper	RAMP ID	Activity	2021 Embedded-Recorded ($000)	TY 2024 Estimated Totals ($000)	TY2024 Estimated Incremental ($000)	GRC RSE
1ED009	SDG&E-Risk-8-New01	Industrial Athletic Trainer	0	~~495~~ 149	~~495~~ 149	19
1ED009	SDG&E-Risk-8-C10	Personal Protective Equipment	113	113	0	0*

* An RSE value was not calculated for this activity

2. Forecast Method

The forecast method developed for this cost category is base year. For labor and non-labor, the base year method, along with including incremental adjustments as discussed in the Cost Driver section below, provides an appropriate baseline in comparison to future targets for the organization. Based on a recent organization growth due to the increased cost of instructors to develop skilled labor, base year will provide a more accurate representation of business needs. Workpaper Ex. SDG&E-12-WP 1EDO09.001 follows the forecast method of the main workpapers Ex. SDG&E-12-WP 1ED009.

3. Cost Drivers

The following contribute to incremental cost changes: the industrial athletics program and the electrical hazard awareness program for municipalities.

a. Industrial Athletic Program

The cost driver behind Industrial Athletic Program is to support the on-boarding of three contract industrial athletic trainers to support SDG&E's vision of "Building a Better Lineman" by extending the Skills training program to include the entire workforce within Electric Distribution Operations. This would include on-site strength conditioning and recovery training at SDG&E's C&O Centers with a goal of reducing injuries by strengthening our employees physically and reducing attrition. The industrial athletic program will be implemented to reduce OSHA defined strains and sprains, which is the most common type of employee injury, in order to achieve target zero.

b. Electrical Hazard Awareness in Municipalities

The cost driver behind Electrical Hazard Awareness in Municipalities is to support the on-boarding of three contracted qualified electrical worker instructors to support public safety outreach in an effort to educate our first responders, public workers, and general public around electrical hazard awareness.

4. Other Drivers

SDG&E has not identified any other drivers for this workpaper.

K. Service Order Team (1ED010)

TABLE TS-26
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
I. Service Order Team	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Service Order Team	4,061	4,069	8
Total	**4,061**	**4,069**	**8**

1. Description of Costs and Underlying Activities

The Service Order Team (SOT) is responsible for planning, overseeing, and managing new additions and modifications to commercial and residential electric system, primarily related to secondary voltage services. The SOT acts as the SDG&E customer representative for these projects, communicating and negotiating with internal and external entities as needed to successfully manage customer expectations, service, meter locations, and project status and costs, while ensuring customer satisfaction and meeting project schedules. While the majority of the work is capital-related, a substantial amount of O&M expense for the SOT includes disconnect/reconnect work associated with residential solar. Other O&M expenses include the teams' support of the construction operations for storm recovery, coordinating Communication Infrastructure Providers (CIP) 5G network attachments to utility infrastructure, supporting utility upgrades related to home remodeling, employee training, and other replacement of non-capital electrical equipment.

2. Forecast Method

The forecast method developed for this cost category is base year. For labor and non-labor, the base year method, along with including incremental adjustments as discussed in the Cost Driver section below, provides the best outlook moving forward as it captures the increase in FTEs in 2021 required to respond to and manage the approximate 31 percent increase in completed service order requests (in comparison to in 2018). In addition, SDG&E periodically evaluates labor allocations between capital and O&M work. Recent trends have caused a shift in a portion of the labor allocation from capital to O&M which will be maintained moving forward.

3. Cost Drivers

The key driver contributing to incremental cost changes is service upgrade demand.

a. Service upgrade demand

As SOT is responsible for planning, overseeing, and managing new additions and modifications to commercial and residential electric system, primarily related to services, the team consistently monitors standardization to verify the process is streamlined, consistent, and customer focused. Recent years have shown an increase in service requests related to unmetered services, CIPs 5G network attachments, solar installations, and upgraded installs due to an increase in home remodeling. For SDG&E to maintain its level of service with the sustained increase in requests (referenced in the forecast methodology for this workpaper), SOT will reorganize the reporting structure by adding a new position to oversee all district SOT teams to help standardize workflows.

4. Other Drivers

SDG&E has not identified any other drivers for this workpaper.

L. Electric Engineering (1ED012)

TABLE TS-27
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
J. Electric Engineering	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Electric Engineering	2,0176	2,128437[14]	111420
2. Electric Engineering (TNG)	67	67	0
Total	**2,083**	**2,195504**	**111420**

1. Description of Costs and Underlying Activities

The Electric Engineering group is responsible for all equipment pertaining to the distribution network. Responsibilities include the development and maintenance of overhead and underground equipment specifications, risk analysis and mitigation, as well as the development of construction standards and work methods to enable safe and reliable customer service throughout the 4kV and 12kV electric distribution system. The specification requirements include all service standards for customer facilities as well as design manual standards for all of our project management design teams. Creation of new codes to estimate the required material, labor, and equipment for construction as well as maintenance of existing codes to support the design teams. Real-time support for operations and constructions teams are also daily requirements. New and revised construction standards and material specifications are designed to provide community safety and system reliability while keeping pace with technology advancements in areas such as fire-preparedness, communication technology improvements, and renewable integration. The electric standard practices developed by the team establish uniform and safe work methods and procedures and inspection requirements to enable regulatory compliance with all governing agencies. Construction standards and standard practices are used by Company and contractor construction forces throughout the SDG&E electric distribution system.

[14] SDG&E has identified an error with respect to the O&M/Capital allocation in the workpapers that resulted in the O&M forecast being overstated by approximately $300,000 and incorrectly categorized as non-labor. SDG&E will make the correction to testimony and workpapers at the next available opportunity.

The Engineering team is also responsible for field equipment investigations to determine failure causes and note trends. The team works with manufacturers to get the right equipment for our system with respect to functionality, reliability, and safety. As new types of equipment and technology are introduced, the engineering team provides technical scoping and justification for new programs to install new equipment, develops implementation plans, and provides project management. Other examples to develop reliability enhancements and safety risk reduction by the engineering team include developing and utilizing analytical tools to perform assessments of system-wide programmatic improvements which can be associated with mitigations discussed in the 2021 RAMP Report's Electric Infrastructure Integrity risk chapter (SDG&E-Risk-2).

Environmental requirements and associated impacts are also managed in engineering, an example of this is the SF6 tracking and reporting program, which tracks and appropriately reports emissions of this environmentally sensitive GHG. The long-term goal is to remove these switches and eliminate SF6 emissions from SDG&E's distribution system. Lastly, corrosion impacts are rapidly increasing with changes in environmental conditions and are having significant impacts on system safety and reliability. This team is instrumental in providing products to mitigate corrosion impacts on the system and in the development of training to inform workforce of new work methods to reduce these types of failures.

Within Electric Engineering, there is an Associate Engineer program. The Associate Engineer program is an ongoing training program that is a key component of the effort to develop and maintain engineers in SDG&E's workforce.

a. Description of RAMP Mitigations

RAMP-related costs for Electric Engineering include costs for (1) PPE, and (2) Asset Integrity Management (AIM). As described in Table TS-6 above: (1) PPE protect employees from the risk of injury by creating a barrier against workplace hazards. PPE includes clothing and equipment designed to protect employees while performing their job (*e.g.*, flame resistant clothing, gloves, protective eyewear). All employees who are required to use PPE are trained on when PPE is necessary, which PPE is necessary, how to properly don/remove/adjust/wear PPE, limitations of PPE and the proper care/maintenance /life/disposal of PPE.; (2) The AIM program advances the development and implementation of a comprehensive, sustainable and risk informed Asset Management System (AMS), which encompasses people, process, data, analytics, and technology. The AIM program's Integrated Operating Model and Asset

Management Plan alignment establish systematic and coordinated activities and practices through which the Company optimally and sustains and asset systems and their associated performance, risks, and expenditures over their life cycles to effectively allocate resources.

Table TS-28 below provides the RAMP activities, their respective cost forecasts, and the RSEs for this workpaper. For additional details on these RAMP activities, please refer to my workpapers Ex. SDG&E-12-WP 1ED012.

TABLE TS-28: RAMP Activity O&M Forecasts by Workpaper
In 2021 Dollars ($000)

Workpaper	RAMP ID	Activity	2021 Embedded-Recorded ($000)	TY 2024 Estimated Totals ($000)	TY2024 Estimated Incremental ($000)	GRC RSE*
1ED012	SDG&E-Risk-8-C10	Personal Protective Equipment	20	20	0	0
1ED012	SDG&E-CFF-1-1	AIM (Gov, Strat, AIP)	0	6	6	0

* RSE values were not calculated for these activities

2. Forecast Method

The forecast method developed for this cost category is base year 2021 recorded data. The forecast method, along with including incremental adjustments as discussed in the Cost Driver section below, is the most representative forecast due to recent workload increases. Starting in 2020, additional O&M costs were realized in order to deliver an increased volume of engineering and design needed for SDG&E's electric system hardening program. Electric Engineering supports these primarily capital projects, which increased significantly in 2020 and 2021, and will continue at the higher level for the foreseeable future. These projects have associated O&M expenditure. When factoring this in, base year 2021 recorded data with incremental adjustments is the most appropriate forecasting methodology for this work paper.

Workpaper Ex. SDG&E-12-WP 1EDO12.001 follows the forecast method of the main workpapers Ex. SDG&E-12-WP 1ED012.

3. Cost Drivers

The cost drivers behind this forecast are engineering capabilities, asset management cross functional support, Design Unit Update Initiative (DUUI), failed equipment root cause, and software.

a. Engineering Capabilities

All overhead and underground work requires engineering support as well as additional engineering resources needed to support the increasing electric capital and wildfire related workloads. Another driver is an increasing work scope updating and expanding standards related to hardening the distribution system. There is also an increasing level of effort required to remain compliant with the need to review and give guidance on pole loading calculations throughout the Company's service territory. The costs for these engineers will be allocated approximately 98% capital and 2% O&M.[15] This 2% upward O&M pressure is a result of the capital program demands listed above. Please see the Electric Distribution Capital testimony of Oliva Reyes (Ex. SDG&E-11) and the Wildfire Mitigation and Vegetation Management testimony of Jonathan Woldemariam (Ex. SDG&E-13) for further details of the capital programs driving these costs.

In addition to the increase in workloads, there is upward pressure related to attracting and retaining skilled employees due to market wide resource shortages and demand for skilled workers. Engineering salaries reflect the results of an engineering salary market analysis performed by SDG&E.

b. Asset Management Cross Functional Support

The Asset Integrity Management Program will expand Operation Model activities to create cross-functional alignment between accountable business units. This expansion, which involves adding supporting Business Advisors to the Electrical Engineering group, will promote implementing overarching strategies for managing and balancing the risk of all assets and asset lifecycles. The Business Advisors will support programs discussed in the 2021 RAMP Report's Asset Management Cross-Functional Factor chapter (SDG&E-CFF-1) support the implementation of the Operating Model, and perform the associated new capabilities and processes being enabled for Electric Engineering to operate under a comprehensive, sustainable and risk-informed asset management system. The Business Advisors will also provide support for updates and for continually evolving the asset management system. The cost driver part of the RAMP mitigation effort as described in Table TS-6 above, RAMP ID, SDG&E-CFF-1. For

[15] ~~SDG&E's workpapers inadvertently use a 3% O&M allocation factor in the forecast calculations. SDG&E will make the correction to its workpapers at the next available opportunity.~~

further details, please refer to the Safety, Risk and Asset Management System testimony of Kenneth J. Deremer (Ex. SDG&E-31).

c. Design Unit Update Initiative (DUUI)

The project objective is to make enhancements to our estimating tools to enhance project estimates. Design units are the cost/labor/material details utilized for cost estimating different infrastructure installations in support of capital and maintenance projects. The DUUI will perform a comprehensive update to SDG&E's design units. This update will help the engineering teams improve capital project forecasting and lead to a more efficient allocation of resources. As part of the project, new control processes will be established to minimize the need and frequency of future updates.

d. Failed Equipment Root Cause

Destructive testing and root cause analysis of failed equipment, performed by consultants in a lab, will be expanded. This will be conducted to understand the failure mechanism of equipment, identify potential warranty issues, and improve acquisition of new distribution equipment, along with determining proactive measures to avoid failures of this type in the future. Understanding the root cause of failed equipment is an important component of managing our assets, as it will help with developing work method practices and selecting safer and more reliable equipment.

4. Other Drivers

SDG&E has not identified any other drivers for this workpaper.

M. Troubleshooting (1ED013)

TABLE TS-29
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
K. Troubleshooting	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Troubleshooting	9,634	9,634	0
Total	**9,634**	**9,634**	**0**

1. Description of Costs and Underlying Activities

The Operations & Engineering (O&E) workgroup covers six districts and two satellite locations within SDG&E's service territory. The O&E workgroups for each of the six districts consist of Electric Troubleshooters, engineers, technical assistants, and management supervision. The O&E workgroup is responsible for engineering and system troubleshooting to enable reliable and safe electric service to SDG&E customers. Electric Troubleshooters are a key resource, acting as SDG&E's first responders. The Electric Troubleshooters have the specific skills necessary to timely restore electric service during emergencies and unplanned interruptions while protecting public and employee safety. During service interruptions, Electric Troubleshooters are tasked with isolating affected areas of SDG&E's distribution system and implementing restoration efforts that will minimize the impact of any service interruptions to SDG&E customers. During emergencies, Electric Troubleshooters work closely with emergency response agencies to protect the public and SDG&E's employees from potentially hazardous conditions. Electric Troubleshooters act as the primary interface with customers who are experiencing service problems. Electric Troubleshooters perform a variety of additional tasks including substation and field switching, substation security checks, and routine safety patrols related to SDG&E's inspection and maintenance CMP. The remainder of the O&E workgroup provides necessary engineering, compliance administration, and supervisory support, all essential to providing safe and reliable service.

a. Description of RAMP Mitigations

RAMP-related costs for Troubleshooting include costs for (1) Mandatory Employee Health and Safety Training Programs and Standardized Policies, and (2) PPEs. As described in Table TS-6 above: (1) The Mandatory Employee Health and Safety Training Programs and Standardized Policies includes employee health and safety training programs that Construction Management personnel attend to promote mitigating the risk of an incident involving SDG&E employees; (2) PPE protect employees from the risk of injury by creating a barrier against workplace hazards. PPE includes clothing and equipment designed to protect employees while performing their job (*e.g.*, flame resistant clothing, gloves, protective eyewear). All employees who are required to use PPE are trained on when PPE is necessary, which PPE is necessary, how to properly don/remove/adjust/wear PPE, limitations of PPE and the proper care/maintenance /life/disposal of PPE.

Table TS-30 below provides the RAMP activities, their respective cost forecasts, and the RSEs for this workpaper. For additional details on these RAMP activities, please refer to my workpapers Ex. SDG&E-12-WP 1ED013.

TABLE TS-30: RAMP Activity O&M Forecasts by Workpaper
In 2021 Dollars ($000)

Workpaper	RAMP ID	Activity	2021 Embedded-Recorded ($000)	TY 2024 Estimated Totals ($000)	TY2024 Estimated Incremental ($000)	GRC RSE*
1ED013	SDG&E-Risk-8-C01	Mandatory Employee Health and Safety Training Programs and Standardized Policies	27	27	0	0
1ED013	SDG&E-Risk-8-C10	Personal Protective Equipment	33	33	0	0

* An RSE value was not calculated for these activities

2. Forecast Method

The forecast method developed for this cost category is base year. For labor and non-labor, the base year method provides an appropriate forecast in comparison to other methods due to an increase in the cost of skilled labor.

3. Cost Drivers

SDG&E TY 2024 forecasted costs for Troubleshooting O&M are unchanged from the base year adjusted recorded expense level.

4. Other Drivers

SDG&E has not identified any other drivers for this workpaper.

N. Portfolio & Project Management (1ED014)

TABLE TS-31
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
L. Portfolio & Project Management	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Portfolio & Project Management	487	512	25
Total	**487**	**512**	**25**

1. Description of Costs and Underlying Activities

Portfolio & Project Management is responsible for effectively managing transmission, distribution, and substation projects as well as energy storage, system hardening, and system interconnection projects by focusing on clearly defined project scope, schedule, and budget. This group manages projects from preliminary design through energization, ensuring consistent project management responsibility throughout the life of the project.

In addition, Portfolio & Project Management is responsible for managing the entire electric portfolio and providing project services and controls, including capital project accounting support, document control management, project scheduling, and quality assurance/quality control. Portfolio management is responsible for aligning all capital projects to the Company vision, strategy, and priorities. They work to unify business units across SDG&E by focusing on budget and resource utilization while promoting accountability and efficiency.[16] Project accounting supports the Company in compliance with internal and external financial policies and requirements through contract invoice review, audit support, monthly accruals, and SOX compliance. Document control and project scheduling is provided to maintain project timelines and meet schedule goals while verifying that all documents for projects are labeled and safely stored for the required document retention timeline as required. QA/QC support is provided to validate quality in design, construction, and manufacturer fabrication. This is accomplished through design reviews, post construction checks, manufacturer audits, special inspections, pole inspections, and vendor reviews. Additionally, this department is responsible for testing and qualifying electric distribution design resources. This verifies that all work is built to SDG&E Design and Safety Standards and is in accordance with GO 95 and GO 128 design and construction specifications.

2. Forecast Method

The forecast method developed for this cost category is base year. This method, along with including incremental adjustments as discussed in the Cost Driver section below, was selected as current staffing and activity levels are most representative of the costs moving forward, as they include the addition of the portfolio management functional roles and the

[16] Building a Better Business is an ongoing business optimization and continuous improvement initiative at SDG&E, undertaken to support our mission to improve lives and communities by building the cleanest, safest and most reliable energy infrastructure company in America.

expansion of the quality assurance/quality control team. These roles support efficient processing of work to enable greater, more streamlined capacity and reduce cycle times for all electric system projects and validate quality in design, construction, and manufacturer fabrication

3. Cost Drivers

The following contribute to incremental cost changes: enterprise project management standardization.

a. Enterprise Project Management Standardization

Portfolio and Project Management is seeking to fill additional roles supporting project management, QA/QC activities, document control and management policies, and scheduling to continue to sustain the portfolio management role to verify efficient workflow and processing for increased capacity. Additions to the workforce to improve enterprise standardization will cause additional upward pressure on O&M at a two percent O&M to 98 percent capital split.

New Project Management roles are also needed to provide support for new battery storage projects and to further support electric system hardening initiatives. A specialized QA/QC team is responsible for the review and analysis of projects including a constructability review, validation of the engineering and design information, and post-construction verification to validate everything was built to SDG&E engineering, design, and safety standards and in accordance with GO 95 and GO 128 rules for construction. Additional personnel are needed to support these reviews with the expanding clean transportation, transmission, distribution, and system hardening work throughout the service territory.

Also, with the focus on enterprise standardization, portfolio management has been focusing on achieving efficiencies throughout the organization to enable greater workflow throughout the groups.[17] Additional team members are planned to provide specialized support for document management and scheduling software, allowing project managers to focus on project delivery.

[17] Building a Better Business is an ongoing business optimization and continuous improvement initiative at SDG&E, undertaken to support our mission to improve lives and communities by building the cleanest, safest and most reliable energy infrastructure company in America

4. Other Drivers

a. Fleet Vehicles

Below, I speak to the fleet vehicle needs related to this workpaper. Costs for the fleet vehicle additions are included in the Fleet Services testimony of Arthur Alvarez (Ex. SDG&E-22).

Project & Portfolio Management Fleet Vehicle Needs

Four new crew cab trucks equipped with standard fire prevention tools are required for the additional project management and QA/QC team members needed for the increased electric system hardening work. Vehicles will be used by project managers to provide field support to electric system hardening work and will be used by the QA/QC advisors to provide field support with compliance and quality inspections on job sites.

O. Compliance Management (1ED015)

TABLE TS-32
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
M. Compliance Management	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Compliance Management	3,061	7,274	4,213
Total	**3,061**	**7,274**	**4,213**

1. Description of Costs and Underlying Activities

The Compliance Management workgroup is focused on ensuring that SDG&E maintains its compliance with internal and external regulations, policies, and procedures as they relate to operating and maintaining the electric distribution system in a safe, reliable, and efficient manner. The two main subsections that comprise the Compliance Management workgroup are the Compliance Management Group and the Program Management Group. Additional information on each of the subsections and their function is presented below.

Compliance Management Group

Compliance Management Group (CMG) has the responsibility to manage regulatory compliance to GOs 95, 128, 165 and 166. The group carries out its function through audits, statistical analysis, reporting, and training of field personnel. It also maintains the relationship

with the CPUC's Safety Policy Division to comply with CPUC requests regarding the electric distribution system. CMG also maintains responsibility for all joint utility processes related to CIP attachments, assuring compliance with CPUC D.98-10-058, SDG&E's structural licensing process. CIP attachment management includes QA/QC of new applications, oversight of CIP attachment transfers/buddy poles (*i.e.*, joint utility communication forms), and pole data record-management (related to regulatory requirements and joint attachments).

Program Management Group

Program Management Group is responsible for developing and centrally managing the patrol, inspection, and maintenance elements related to the GO 165 CMP. Functions include developing policies and procedures, training field employees, statistical reporting and analysis, budgeting, leading practice initiation, and other similar program management related activities. Other related inspection/maintenance programs overseen by the Program Management group include Avian Protection Program management, Wood Pole Inspection Program, Graffiti Abatement and detailed inspections in the High Fire Threat District, and related corrections in the fire threat zones.

2. Forecast Method

Labor and non-labor forecasts for Compliance Management are based on the 2021 base year data. This forecast methodology, along with including incremental adjustments as discussed in the Cost Driver section below, best represents workload forecasts due to CMP cycles and structures which fall outside of the HFTD, which vary over a ten-year cycle making a three or five year average ineffective. The base year best represents expected costs during this GRC cycle.

3. Cost Drivers

The following contribute to incremental cost changes: compliance with a newly adopted Commission Decision to provide pole attachment data points, special/CIP wood pole intrusive testing, QA/QC cost pressures, and wood pole intrusive testing in non-HFTD.

a. Pole Attachment Data Points

The CPUC issued D.21-10-019 on October 26, 2021 requiring pole owners to provide 20 data points such as asset information on attachments, the status of attachment requests,

attachment design information, and structural loading information.[18] The data will be managed through a database to be developed and operated by the pole owners.

SDG&E's systems currently have limited or no ability to track information on portions of the 20 data fields. Collection of the data to comply with D.21-10-019 will require field surveying approximately 176,000 poles. In addition, D.21-10-019 includes a three-year compliance schedule to provide all of the required data points. The costs to comply with this decision are front loaded and include an estimated $9.0 million dollars in 2024. The TY 2024 GRC funding request for this Category reflects collecting the $9.0 million incurred in 2024 plus some other ongoing residual expenses during the 2024-2027 period. Additional information can be found in the O&M workpapers. See Ex. SDG&E-12-WP-R at section 1ED015 – Compliance Management.

Although SDG&E seeks recovery for this program in this GRC, absent a memorandum account to track the incremental Track 2 costs, SDG&E would not have reasonable opportunity to recover the costs associated with implementing the new requirements directed in the Track 2 Decision prior to the effective date of its next GRC application. A Track 2 cost memorandum account (T2CMA) will be needed to provide a cost-recovery mechanism for SDG&E's compliance costs for 2022-2023. For further explanation related to the regulatory accounting treatment, please refer to the Regulatory Accounts testimony of Jason Kupfersmid (Ex. SDG&E-43).

b. Special/CIP Wood Pole Intrusive

Unplanned wood pole intrusive inspections are requested by internal and external stakeholders to gather and provide current data on the capacity of the pole to handle current or changing loads. This information is needed by the applicant to determine whether a pole can handle the load associated with a new or changed attachment. SDG&E performs and incurs the cost for these inspections. The number of requests from third-party attachment parties due to 5G cellular communication capability and expansion of service by various communication providers in SDG&E's service territory has increased significantly resulting in higher costs for performing these special inspections. SDG&E anticipates that these requests will continue to increase.

[18] D.21-10-019, Ordering Paragraph 1 at 125, and Attachment A.

c. QA/QC Cost Pressures

Cost pressures are related to increased labor rates for the qualified personnel utilized that perform review and analysis of joint use applications. The review and analysis include constructability review and validation of the engineering and design information supplied by the applicant.

d. Wood Pole Intrusive Inspections in Non-HFTD

Wood pole intrusive inspections occur on a non-uniform ten-year cycle. Approximately 95% of all wood poles are located in the non-HFTD and an increased number of poles will be due for inspection during the TY 2024 forecast and post-test year periods than the previous five years.

4. Other Drivers

a. IT Projects

There are two IT Capital projects related to this workpaper, in which I speak to the business need. For information on costs related to these projects, please see the IT testimony of William J. Exon (Ex. SDG&E -25, Chapter 2).

Cross-Functional Work Management System – IT CAPITAL

This IT capital project seeks to make database enhancements to capture information related to CPUC D.21-10-019 mentioned in my testimony in section IV.M.3.a. Please refer to this section of my testimony for more details.

Telecommunications Attachment Management System (TAMS) – IT CAPITAL

TAMS was developed in compliance with CPUC D.20-07-004 that set forth ten pole-specific data requirements to be shared by pole owners through a database that would increase nondiscriminatory access to poles and conduit by competitive communications providers. Continued enhancements are needed to modernize the system and meet mandated CPUC requirements. These enhancements include: migration to a cloud-based operating environment; integrations with mobile field solutions and enterprise systems such as SAP and GIS; meeting a CPUC requirement to provide the communications companies with map access. The costs associated with development and implementation of these enhancements are IT capital expenditures.

P. Officer (1ED016)

TABLE TS-33
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
N. Officer	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Officer	1,287	1,287	0
Total	**1,287**	**1,287**	**0**

1. Description of Costs and Underlying Activities

This workgroup includes the costs for officers and administrative assistants in support of the Electric Distribution Organization. The total salaries are a direct labor charge and any cross-over amounts allocated to electric transmission are excluded from this account as an indirect charge and not included in the requested expenses. Typical activities included in this account include officer activities in support of electric distribution.

2. Forecast Method

The forecast method developed for this cost category is base year. This method is most appropriate because the base year reflects the same officer and administrative assistant structure going forward.[19]

3. Cost Drivers

SDG&E TY 2024 forecasted costs for Officer O&M are unchanged from the base year adjusted recorded expense level.

4. Other Drivers

SDG&E has not identified any other drivers for this workpaper.

[19] After submitting this testimony, SDG&E became aware of an error in this Category's adjusted recorded dollars during the 2017-2019 time period. However, the error does not impact the forecast and funding request for this Category nor the forecast and funding request for any other witness, as such the error was not corrected.

Q. Regional Public Affairs (1ED017)

TABLE TS-34
Summary of Workpaper Costs

ELECTRIC DISTRIBUTION (In 2021 $)			
O. Regional Public Affairs	**2021 Adjusted-Recorded (000s)**	**TY2024 Estimated (000s)**	**Change (000s)**
1. Regional Public Affairs	1,160	1,388	228
Total	**1,160**	**1,388**	**228**

1. Description of Costs and Underlying Activities

SDG&E's Regional Public Affairs group supports electric and gas distribution operations through its work with regional and local governments on issues regarding proposed regulations, permitting, and emergency preparedness and response. Regional Public Affairs also educates officials at the county and city levels about utility issues that could impact customers. In addition to communicating with government agencies, Regional Public Affairs serves as the point of contact in the 125 communities SDG&E serves. Typical activities include educating stakeholders about utility operational activities, programs and services, responding to stakeholder inquiries, resolving customer complaints, and working with underserved communities.

2. Forecast Method

Labor and non-labor forecasts for Regional Public Affairs are based on the base year 2021 recorded data. The base year methodology, along with including incremental adjustments as discussed in the Cost Driver section below, best represents the outlook going forward to support increased relations with various municipalities and our increase in capital project programs.

3. Cost Drivers

The following contribute to incremental cost changes: city of San Diego Franchise commitments.

a. City of San Diego Franchise Commitments

The driver behind this forecast is the addition of two FTEs for Franchise Commitments to the City of San Diego, specifically implementing and ensuring compliance with the terms of existing franchises as it directly relates to the utility's existing or proposed operations.

4. Other Drivers

SDG&E has not identified any other drivers for this sub-workpaper.

V. CONCLUSION

The costs represented in this testimony are a reasonable and necessary forecast of the requirements to manage SDG&E's electric distribution system safely and efficiently and align with supporting SDG&E's mission to provide customers with the cleanest, safest, and most reliability power in North America. My testimony supports programs and activities that further this cause in all three areas of this mission. Forecasts were developed by using both historical expenditures and specific project estimates, assessing upward pressures, and using all available information to develop reasonable forecasts. As described in my testimony, many of the core business activities remain the same as described in previous rate cases with incremental cost drivers identified in my introduction section, which include: costs that scale with capital construction, shortages of skilled electric distribution labor, a new compliance initiative, and increased reliance on electric distribution system automation.

The values of public, employee, and contractor safety continue to drive the majority of activities within my testimony. The compilation of O&M costs along with IT capital projects, fleet vehicles, and memorandum accounts described in my testimony will allow SDG&E to operate its system in a way that continues to prioritize public and employee safety, system maintenance and reliability, meet environmental and regulatory compliance, develop the workforce, introduce new systems, address mature and aging equipment, and mitigate risk. I respectfully request the Commission approve the cost forecasts described in my testimony and workpapers. This concludes my prepared direct testimony.

VI. WITNESS QUALIFICATIONS

My name is Tyson Swetek. My business address is 8316 Century Park Court, San Diego, California, 92123. I am employed by SDG&E as the Director of Electric Distribution Operations. I have been employed by SDG&E since 2004. I have over 15 years of experience in the utility industry. While with SDG&E, I have held various positions in the functional areas of Wildfire Mitigation, Transmission Engineering, Substation Construction and Maintenance, Distribution Construction and Maintenance, and Distribution Operations.

My present responsibilities include Electric Distribution Operations and the Enterprise GIS services workgroup. Before starting my current position, I was the Wildfire Mitigation Programs Manager. Before that, I was the Manager of Transmission Engineering group, responsible for the design and project management of SDG&E's capital transmission projects. Prior to that, I worked as the Operations and Engineering Manager at SDG&E's Substation Construction and Maintenance group responsible for capital construction and substation inspection and maintenance. Prior to that, I was the Operations and Engineering manager at one of SDG&E's district field offices in charge engineering, operations, and maintenance tasks.

I earned a Bachelor of Science in Electrical Engineering from California Polytechnic State University and a Master of Business from San Diego State University. I am a registered Professional Engineer in California.

I have testified previously to this Commission.

APPENDIX A –
GLOSSARY OF TERMS

A	Application
ADMS	Advanced Distribution Management System
AIM	Asset Integrity Management
BAPP	Behavior Accident Prevent Process
BBS	Behavior Based Safety
BC	Budget Code
C&O	Construction & Operations
CAIDI	Customer Average Interruption Duration Index
CAISO	California Independent System Operator
CBM	Condition Based Maintenance
CFF	Cross-Function Factor
CIP	Communication Infrastructure Providers
CMG	Compliance Management Group
CMP	Compliance Management Program
CPUC	California Public Utility Commission
D	Decision
DER	Distributed Energy Resource
DERMS	Distributed Energy Resource Management System
DG	Distributed Generation
DGSMA	Distribution Generation Statistics Memorandum Account
DIIS	Distribution Interconnection Information System
DPM	Design and Project Management
DRP	Distribution Resources Planning
DSO	Distribution System Operator
DUUI	Design Unit Update Initiative
EDOCC	Electric Distribution Operations Control Center
EGISS	Enterprise GIS Services
EII	Electric Infrastructure Integrity
ELC	Emergency Load Curtailment
EPZ	Equipotential Zone
ERO	Electric Regional Operations

ESO	Electric System Operations
ET&D	Electric Transmission & Distribution
FLISR	Fault Location, Isolation, and Service Restoration
FTE	Full Time Equivalent
GHG	Greenhouse Gas
GIS	Geographical Information System
GMP	Grid Modernization Plan
GO	General Order
GRC	General Rate Case
HFTD	High Fire Threat District
ICS	Incident Command Structure
IIE	Incident Involving an Employee
ILNBMA	Integration Capacity Analysis and Locational Net Benefit Analysis Memorandum Account
IOU	Investor Owned Utility
IT	Information Technology
LADC	Local Area Distribution Controller
kV	Kilovolt
MAVF	Multi-Attribute Value Framework
NEM	Net Energy Metering
NUTIF	National Utility Training Fund
O&E	Operations & Engineering
O&M	Operating and Maintenance
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
PSPS	Public Safety Power Shutoff
QA	Quality Assurance
QC	Quality Control
RAMP	Risk Assessment Mitigation Phase
ROSE	Reliability and Operational Safety Enhancements
RSE	Risk Spend Efficiency
SAIDI	System Average Interruption Duration Index

SAIFI	System Average Interruption Frequency Index
SCADA	Supervisory Control And Data Acquisition
SCT	Skills and Compliance Training
SDG&E	San Diego Gas and Electric
SF6	Sulfur hexafluoride
SME	Subject Matter Expert
SMS	Safety Management System
SOT	Service Order Team
SPD	Safety Policy Division
TSO	Transmission System Operator
TY	Test Year
V2G	Vehicle-to-Grid
VPP	Voluntary Protection Program
WDAT	Wholesale Distribution Access Tariff
WP	Work Paper

APPENDIX B

RAMP ACTIVITIES BY WORKPAPER

RAMP Activities by Workpaper

ELECTRIC DISTRIBUTION
RAMP Activity O&M Forecasts by Workpaper (In 2021 $)

Workpaper	RAMP ID	Description	BY2021 Embedded Base Costs (000s)	TY2024 Estimated Total (000s)	TY2024 Estimated Incremental (000s)	GRC RSE*
1ED002.000	SDG&E-Risk-8 – C01	Mandatory Employee Health and Safety Training Programs and Standardized Policies	3	8	5	0
1ED002.000	SDG&E-Risk-8 – C10	Personal Protective Equipment	6	8	2	0
1ED003.001	SDG&E-CFF-6 – New01	GIS Jobs Processed	921	921	0	0
1ED005.000	SDG&E-Risk-8 – C08	OSHA Voluntary Protection Program	9	69	60	196
1ED005.000	SDG&E-Risk-8 – C10	Personal Protective Equipment	980	730	-250	0
1ED006.000	SDG&E-Risk-2 – C25	Substation Inspections & Repairs GO-174	1,289	1,192	-97	0
1ED006.000	SDG&E-Risk-8 – C08	OSHA Voluntary Protection Program	228	145	-83	196
1ED006.000	SDG&E-Risk-8 – C10	Personal Protective Equipment	132	143	11	0
1ED006.002	SDG&E-Risk-8 – C10	Personal Protective Equipment	22	27	5	0
1ED008.000	SDG&E-Risk-8 – C01	Mandatory Employee Health and Safety Training Programs and Standardized Policies	165	165	0	0
1ED008.000	SDG&E-Risk-8 – C04	Employee Accidental Behavior Program	71	71	0	123
1ED008.000	SDG&E-Risk-8 – C10	Personal Protective Equipment	532	532	0	0

1ED009.000	SDG&E-Risk-8 – C10	Personal Protective Equipment	113	113	0	0
1ED009.000	SDG&E-Risk-8 – New01	Industrial Athletic Trainer	0	495	495	19
1ED012.000	SDG&E-CFF-1 – 01	AIM (Gov, Strat, AIP)	0	6	6	0
1ED012.000	SDG&E-Risk-8 – C10	Personal Protective Equipment	20	20	0	0
1ED013.000	SDG&E-Risk-8 – C01	Mandatory Employee Health and Safety Training Programs and Standardized Policies	27	27	0	0
1ED013.000	SDG&E-Risk-8 – C10	Personal Protective Equipment	33	33	0	0
Total			**4,658**	**4,812**	**154**	

* An RSE value was not calculate for an activity with a “0” RSE value

APPENDIX C

SDG&E'S GRID MODERNIZATION PLAN

SDG&E 2024 GRC Testimony Revision Log – August 2022

Exhibit	Witness	Page	Line or Table	Revision Detail
SDG&E-12	Tyson Swetek	TS-vi	Summary Table	Updated dollars to reflect change to Compliance Management category Total Non-Shared Services and Total O&M New (2024, change): $132,721, $21,888 Old (2024, change): $139,296, $28,463
SDG&E-12	Tyson Swetek	TS-vi		Updated text to reflect change to Compliance Management category New: "…forecast of $132,721,000…" Old: "…forecast of $139,296,000 …"
SDG&E-12	Tyson Swetek	TS-vii		Updated text to reflect changes New: (62.3%), (31.6%), (30.7%) Old: (58.7%), (29.4%), (29.3%)
SDG&E-12	Tyson Swetek	TS-1	Table TS-1	Updated dollars Compliance Management New (2024, change): $7,272, $4,213 Old (2024, change): $13,850, $10,789 Total Non-Shared Services New (2024, change): $132,721, $21,888 Old (2024, change): $139,296, $28,463
SDG&E-12	Tyson Swetek	TS-1	Line 18	Updated text to reflect change New: "…forecast of $132,721,000…" Old: "…forecast of $139,296,000 …"
SDG&E-12	Tyson Swetek	TS-16	Table TS-8	Updated dollars Compliance Management New (2024, change): $7,272, $4,213 Old (2024, change): $13,850, $10,789 Total Non-Shared Services New (2024, change): $132,721, $21,888 Old (2024, change): $139,296, $28,463
SDG&E-12	Tyson Swetek	TS-36	Table TS-16	Corrected RSE value for SDG&E-Risk-8-C08 to 196 from 84

Exhibit	Witness	Page	Line or Table	Revision Detail
SDG&E-12	Tyson Swetek	TS-39	Table TS-18	Corrected RSE value for SDG&E-Risk-8-C08 to 196 from 84
SDG&E-12	Tyson Swetek	TS-50	Table TS-23	Corrected RSE value for SDG&E-Risk-8-C04 to 123 from 53
SDG&E-12	Tyson Swetek	TS-58	Table TS-27	Added footnote 13 informing of an identified error that was not corrected
SDG&E-12	Tyson Swetek	TS-61	Line 19	Added footnote 14 informing of an identified error that was not corrected
SDG&E-12	Tyson Swetek	TS-67	Table TS-32	Updated dollars New (2024, change): $7,274, $4,213 Old (2024, change): $13,850, $10,789
SDG&E-12	Tyson Swetek	TS-69	Lines 13-18	Added text explaining change to forecast and funding request associated with data collection to comply with D.21-10-019
SDG&E-12	Tyson Swetek	TS-71	Line 24	Added footnote 18 informing of an identified non-impacting error that was not corrected
SDG&E-12	Tyson Swetek	TS-B-1	Appendix B	Corrected RSE value for SDG&E-Risk-8-C08 to 196 from 84
SDG&E-12	Tyson Swetek	TS-B-1	Appendix B	Corrected RSE value for SDG&E-Risk-8-C04 to 123 from 53

APPENDIX C

SDG&E'S GRID MODERNIZATION PLAN

Appendix C

Grid Modernization Plan

Grid Modernization Plan Overview

Over the past decades, San Diego Gas and Electric Company ("SDG&E" or "the Company") has made investments in innovative, cutting-edge technologies and programs that have made it a leader in utility wildfire safety and grid resiliency. From integrating automation and control technologies, to implementing efficient work processes, to designing and building microgrids, our investments are already benefiting our customers and serve as a foundation for the grid of the future. SDG&E and its customers are also no strangers when it comes to integrating distributed energy resource ("DER") technologies. As of April 2022, SDG&E has over 240,000 DER installations throughout its system, installed at a rate of over 2,000 each month. These DER installations represent approximately one in every six households in SDG&E's service territory, with over 2,000 megawatts ("MW") in aggregate nameplate capacity.

The California Public Utilities Commission ("Commission" or "CPUC") has defined the modern grid:

> A modern grid allows for the integration of distributed energy resources (DERs) while maintaining and improving safety and reliability. A modern grid facilitates the efficient integration of DERs into all stages of distribution system planning and operations to fully utilize the capabilities that the resources offer, without undue cost or delay, allowing markets and customers to more fully realize the value of the resources, to the extent cost-effective to ratepayers, while ensuring equitable access to the benefits of DERs. A modern grid achieves safety and reliability of the grid through technology innovation to the extent that is cost-effective to ratepayers relative to other legacy investments of a less modern character.[1]

Consistent with this definition, SDG&E believes that the future grid needs to be dynamic, robust, and resilient, and it must evolve to support continued DER proliferation and enhancements to safety and reliability through assimilation of other emerging technology. The future grid also needs to empower customers, increase renewable generation, integrate electric vehicles ("EV") and reduce greenhouse gas ("GHG") emissions while simultaneously maintaining and improving system safety, reliability, operational efficiency, security, and

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[1] D.18-03-023, p.7.

customer privacy. Thus, SDG&E's grid modernization vision is to innovate and optimize a grid that is safe and reliable and accelerates decarbonization – all while delivering value and choice for all customers. This vision reinforces SDG&E as the operator, planner, and integrator for the distribution system, while being supportive of state goals regarding DER adoption, transportation electrification, and decarbonization.

As a framework for expanding SDG&E's technical capabilities to realize such a vision, SDG&E has established four key themes to ground the investments needed to advance the grid, as shown in Figure 1.

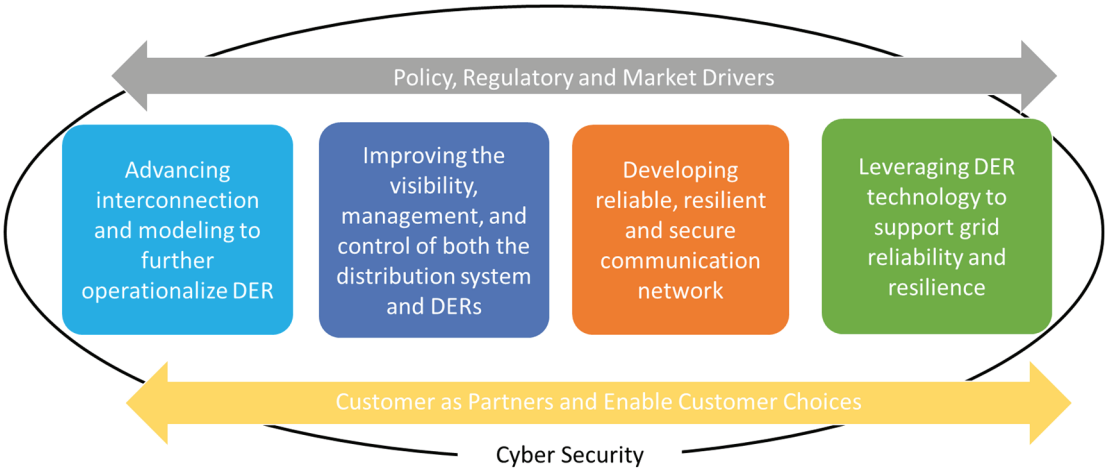

Figure 1- Grid Modernization Plan Key Themes

In addition, aside from these key themes, SDG&E continues carrying out its customer-centric vision and places a high priority on implementing technologies that empower customers in ways they personally value. This overarching vision is embedded and expands across all technological investments. Investments made in upgrading the infrastructure, enhancing visibility, management, and control of the distribution system, along with building resilient, robust, and secure networks are all aimed at delivering best-in-class clean, safe, and reliable electrical service to SDG&E's customers. In 2021, for the 16th consecutive year, SDG&E again received the ReliabilityOne Award for "Outstanding Reliability Performance" among utilities in the West.

With more and more customer energy solutions available, SDG&E strives to continue supporting customers' energy choices and is equipped to enable customer participation in wholesale markets. Customer facing programs like Demand Response ("DR") programs and the Power Your Drive ("PYD") Program will evolve to be more integrated with grid management

for them to be more effective. Customer facing tools like Distribution Interconnection Information System ("DIIS") and Distribution Resource Portals have provided greater ease and flexibility to customers adopting DER technologies and will continue to be enhanced to further support DER integration into the distribution system. In addition, as SDG&E is planning to build out its next generation of Advanced Metering Infrastructure ("AMI") technology, the Company believes it is a key foundational technology that aligns with all four grid modernization themes while providing an enhanced customer experience.

Similarly, SDG&E aligns its grid modernization plan with key regulatory drivers and state policies, and continuously updating components of its planned roadmap as needed. SDG&E also fully expects market drivers and technological evolution to impact the planned roadmap. Examples of ongoing regulatory proceeding and state governed activities that have influenced technology investments in fostering DER integration include the High DER Grid Planning OIR (R.21-06-017), Rule 21 Interconnection OIR (R.17-07-007), and other rulemaking proceedings within the umbrella of the Commission's DER Action Plan 2.0.

Regardless of the investments and across any technological theme, cybersecurity must be carefully evaluated, designed, and implemented as part of the technology deployment. Relying on highly decentralized resources and distributed power supply infrastructure for real-time operation represents a fundamentally new operating environment with new risks and challenges for grid operators and system reliability.

Grid Modernization Upgrades Initiated and/or Completed to Date

As mentioned previously, SDG&E utilizes the four themes as guiding principles in making its investments and upgrades, including grid modernization upgrades. Grid modernization related upgrades initiated and/or completed to date are discussed below under each theme, with description of its scope, DER integration relevance, and current status.

Theme 1: Advancing interconnection and modeling to further operationalize DER

Since the establishment of Net Energy Metering ("NEM"), SDG&E has been adapting and further developing software to streamline the interconnection process, how that software communicates through public portals to customers, and how it communicates to SDG&E's operations group. Additionally, process improvements support SDG&E's modeling of the

distribution system into long-term planning. Interconnection and modeling of the DERs are the foundation to operationalize DER.

In 2013, SDG&E launched an automated application process and online tool, DIIS for contractors and customers to manage interconnection projects. DIIS is a self-service portal which enables customers and contractors to fully manage the lifecycle of NEM projects. The tool allows users to create projects, receive real time status updates and notifications, and is available 24/7. As mentioned in the overview, SDG&E's DIIS has greatly facilitated its customers embracing DER adoption quickly and easily. As mentioned above, SDG&E has authorized over 240,000 DER interconnection requests advancing over 2,000 MW of generation. Moreover, DIIS allows fast track applications to be processed in an average of 3 days for residential applications.

DIIS is a one-stop shopping location for all NEM applications. Additionally, DIIS also supports other Rule 21 applications such as export, inadvertent export, and non-export applications. The automated interconnection and electric release process within DIIS reinforces SDG&E's key goals of implementing a transparent and efficient interconnection process. DIIS, along with other key planning tools, such as the distribution simulation tool (Synergi), planning forecasting tool (LoadSEER), and interconnection data portal collectively set the foundation for SDG&E to push the envelope on advancing interconnection and planning to further operationalize DER. SDG&E is continuing with necessary upgrades to DIIS (SDG&E – 25–00920AJ, SDG&E – 25–00920X) through its Test Year ("TY") 2024 General Rate Case ("GRC") to further its capabilities in facilitating customer DER interconnections.

Theme 2: Improved visibility, management, and control of the distribution system and DERs

In order for SDG&E to enable continued and expanded DER participation in wholesale markets, while maintaining utility voltage compliance, safety and system reliability, SDG&E needs the ability to view, maintain, and manage system configurations, protection settings, voltage and load levels and outage restorations reflecting the as-switched grid topology and direction of power flows. Thus, intelligent grid monitoring, data acquisition, and visualization and situational awareness systems that monitor system conditions and all resources, including DER, need to be in place for proper grid operation according to expected and sensed operating profiles as well as grid management commands.

SDG&E plans to embed the capabilities to monitor, manage and control DERs within its existing control systems architecture and to deploy enhanced capabilities in a progressive manner at carefully designed integration points. SDG&E's goal is always to design and deploy needed capabilities in the most practical manner. In the following section, SDG&E will discuss projects modernizing control systems and projects aiming to install distribution automation devices. The evolution of control system as shown in Figure 2 is what SDG&E has been undertaking and continue to carry forward in this current GRC cycle.

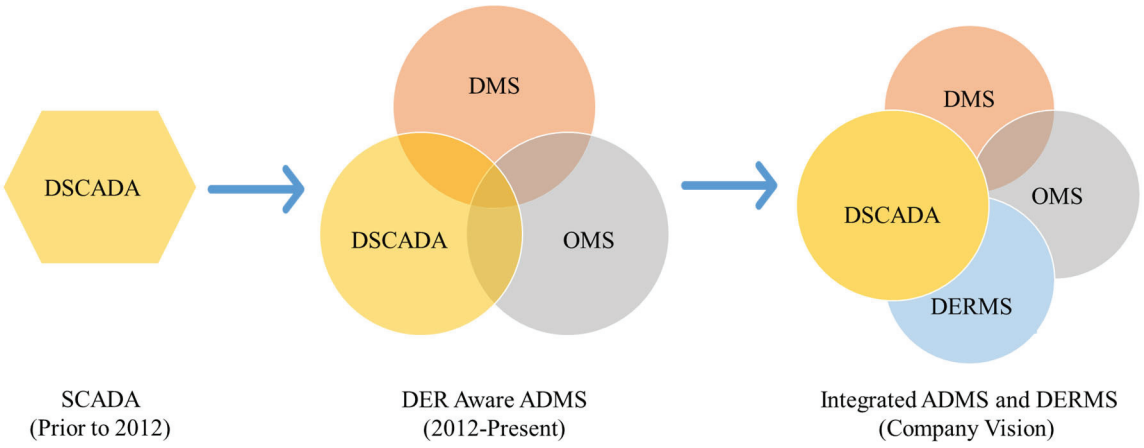

Figure 2 – Control System Evolution at SDG&E

Supervisory Control and Data Acquisition ("SCADA") Headend Replacement

SDG&E has long been using the SCADA system to monitor, control, and protect distribution assets. As the cornerstone of its operational platform, the implementation of the distribution SCADA ("DSCADA") system more than two decades ago initiated SDG&E's roadmap establishing system management capabilities within the distribution control center, as shown above in Figure 2. Over time, this legacy DSCADA system faced increasing challenges as more and more communication edge devices were deployed in the field.

In 2017, SDG&E engaged a consulting firm to perform a full evaluation of the DSCADA system. Upon evaluation, it was identified that the legacy DSCADA system did not meet SDG&E's technical roadmap requirements for grid modernization. Key issues included a lack of support for Internet Protocol ("IP") communications protocols as well as a limited capacity to send/receive DSCADA points associated with newer devices and general system scalability concerns. Moreover, given the DSCADA system was deployed more than 20 years ago with antiquated user interfaces, the development of DSCADA screens were very inefficient and time

consuming. The system did not have a reliable backup process and was heavily dependent on an aging hardware configuration, which created many challenges for operational support of the system.

Consistent with the final recommendation by the consulting firm, SDG&E decided to replace the legacy system with a new DSCADA Head-end system. As such, in 2020 SDG&E completed a full upgrade of DSCADA. The upgrade enabled the Company's DSCADA system to continue serving as the critical data aggregation system to integrate additional grid sensing, switching and protection equipment for the control center. In 2022 and as part of this TY 2024 GRC, SDG&E is looking to complete the Phase 2 of SCADA Head-end upgrade project (SDG&E – 12 – 162760) to further enhance the DSCADA system to have full testing capabilities.

Advanced Distribution Management System ("ADMS")

In September 2012, SDG&E deployed its initial ADMS which included an Outage Management System ("OMS") integrated with a Distribution Management System ("DMS"). To achieve SDG&E's desired operational vision, the ADMS was tightly integrated with other ancillary operational systems including Geographic Information System ("GIS"), SCADA, Customer Information System ("CIS"), and AMI systems. This initial ADMS deployment included a fully as switched model of the distribution system which provides granular system visibility and management capabilities for the operators. The OMS also enabled the full suite of digital switch plan management, including documentation, tagging, and authorization capabilities across emergency and planned work, with all SCADA switching executed remotely from the control center. The full ADMS platform also enables timely customer outage communications, integrated workflow management and real-time resource status management both integrating data from AMI and SCADA with the internal as switched grid model. ADMS has been a core enabling factor when it comes to SDG&E's superior safety and reliability metrices.

Moreover, ADMS is a key foundational system that anchors SDG&E's ability to operate and manage the distribution system in a high DER future. Its DER aware modeling, integrated network analysis and system reconfiguration applications paves the way for SDG&E to develop its growing capabilities around DER management and is a first step towards the fully integrated ADMS and DER Management System ("DERMS") platform, as depicted in Figure 2 above.

In its TY 2024 GRC, SDG&E proposes the Reliability and Operational Safety ("ROSE") project (SDG&E – 25 – 00920AX) and Smart Grid Operation ("SGO") projects (SDG&E – 25 – 00920B, SDG&E – 25 – 00920C) to ensure ADMS can be enhanced to address safety and reliability driven needs. These enhancements also provide a foundation for implementation of broader DER management capabilities, as proposed in the new Enterprise DERMS project. The scope of ROSE and SGO projects include enhanced customer communications during blue sky and Public Safety Power Shutoff ("PSPS") events, expanded visibility to DERs and advanced outage and reliability analytics. Additionally, SDG&E intends to improve its electric modeling, which is the foundation for all optimization applications within the ADMS. Accurate modeling not only improves switching accuracy, operating efficiency, but also provides an accurate baseline for planning and operating with DERs in the distribution system. The projects will also build upon existing architecture and platforms and further implement and refine advanced applications such as Volt/Var Optimization ("VVO"), Fault Isolation and Service Restoration ("FLISR"), Fault Location ("FL") and day ahead forecasting. Both the ROSE project and the SGO project are driven primarily by safety and reliability, but also provide a meaningful foundation for supporting DER integration.

Substation SCADA Expansion

SDG&E has been installing both protective relay and SCADA equipment within SDG&E's distribution substations as means of replacing aging infrastructure that has reached its end of useful life. The benefits of installing and upgrading SCADA equipment include faster faulted circuit identification, faster isolation of faulted electric distribution circuits, faster load restoration after system disturbances, and improved visibility as a telemetry point that can identify potential grid issues such as load imbalance, power factor, load factor, overloads, or voltage issues. In addition to the significant reliability benefits SCADA substation control provides, the additional data and controllable equipment enables more DER integration through improved visibility and control of the distribution system.

As of April 2022, SDG&E has SCADA fully enabled at over 90% of distribution substations and expects to have SCADA at all 12-kilovolt ("KV") substations within the next decade. The Substation SCADA Expansion project (SDG&E – 12 –152430) is ongoing and expected to continue through TY 2024. The Substation SCADA Expansion project is reliability driven, but it is also expected to provide ancillary benefits to DER integration.

Remote Terminal Unit ("RTU") Modernization

In parallel to the efforts within the substation fleet, SDG&E kicked off the RTU modernization project to perform critical functionality of migrating over to IP-based communication, replacing legacy systems, and upgrading RTUs for enhanced visibility. Not only are the IP-based RTU's faster and more reliable, but the legacy RTUs were at end of life and no longer supported by their vendors. This modernization effort of existing field devices, coupled with the SCADA Headend replacement, allows for faster and more reliable sectionalizing and establishing circuit tie connections in the field. This program combined with the SCADA expansion efforts, provides the foundation of enabling operational flexibility and allows operators to remotely operate and manage the distribution system. The need for this increasing control capability will grow in the high DER future, where the distribution system becomes more dynamic and complex. As of April 2022, SDG&E has approximately 2386 field RTU sites. SDG&E plans to continue the efforts of replacing legacy RTU within these sites through TY 2024. The RTU Modernization project (SDG&E – 12 –162770) is reliability-driven, but it is also expected to provide ancillary benefits to DER integration.

Wireless Fault Indicators

SDG&E has been installing wireless fault indicators ("WFI") sensors and necessary network communication systems for a decade. These integrated sensors improve reliability by allowing SDG&E to narrow down fault locations more quickly for faster sectionalizing of the faulted area, faster restorations for those customers outside the faulted areas, and faster identification of the outage cause and subsequent grid repair. Deployment of WFI has been prioritized in the high fire threat district ("HFTD") areas, with the goal of mitigating some of the reliability impacts of SDG&E's operational protocols designed to improve public safety by reducing the risk of wildfire. WFI installations not only enable faults to be identified quicker and more efficiently, but also assists SDG&E in identifying fault more accurately on highly DER penetrated circuits. As of April 2022, SDG&E has deployed 593 WFIs in HFTD areas and 5 WFI in non-HFTD areas.

Both the HFTD WFI project (SDG&E – 13 – 112530) and non-HFTD WFI project (SDG&E – 12 –202880) are ongoing and continuing through this TY 2024 GRC. Safety and reliability drive deployment of WFI, but WFI is also expected to provide ancillary benefits to DER integration.

SCADA Capacitors

SDG&E has been installing and replacing SCADA line capacitors to increase capacitor bank reliability, minimize downtime, and cut down the travel time needed for repair work. SCADA-controlled line capacitors will provide local and remote control and failure protection while reducing operating costs. Like the WFI program, SDG&E prioritized installing and replacing capacitors in HFTDs before expanding to wildlife-urban interface and locations outside the HFTD. SCADA capacitors reduce the risk of catastrophic failures that could lead ignitions be leveraging sensors and relays to quicky detect and isolate faulted or damaged capacitors, much faster than SDG&E's current fused protection system. In addition to this critical safety benefit, SCADA capacitors provide increased capacity and reliability, and also provide additional data and switchable points on the distribution system. In a high DER future, voltage management requires more data sensors and advanced control algorithm to coordinate voltage regulating equipment owned by the Utility, while balancing voltage impact from DERs and more dynamic load changes. Installation of SCADA capacitors enables SDG&E to dynamically adjust reactive power flow throughout the entirety of a distribution circuit efficiently and cost-effectively and plays a key role in the Company's voltage management strategy.

As of April 2022, SDG&E has installed and replaced 380 SCADA capacitors. Both the HFTD SCADA capacitor replacement project (SDG&E – 13 –202580) and the non-HFTD SCADA capacitor projects (SDG&E – 12 –11249) are on-going and are continuing through this TY 2024 GRC. Installation and replacement of SCADA line capacitors is safety and reliability driven, but it is also expected to provide ancillary benefits to DER integration.

Power Quality Program

SDG&E has been working on deploying and expanding substation power quality ("PQ") monitoring systems, field PQ monitoring to improve the visibility of the control system, and bring valuable asset health data to engineers, eliminating the need to perform site visits to download such information. With additional visibility provided by the power quality meters, SDG&E has increased situational awareness on the distribution system, which allows the Company to better analyze system events on circuits in a high DER future. As of April 2022, SDG&E has deployed 175 PQ meters. The PQ program (SDG&E – 12 – 942410) is ongoing and expected to continue through Test Year 2024. This program is primarily driven by safety and reliability, but it is also expected to provide ancillary benefits to DER integration.

Fault Isolation and Service Restoration ("FLISR") Implementation

Given that FLISR is an existing module within ADMS, SDG&E has been able to enable FLISR technology gradually as more upgraded SCADA line devices and updated substation relaying are becoming available. FLISR allows layered reliability benefits to be reached beyond the RTU modernization and substation SCADA expansion efforts, as it automatically isolates and restores electrical service to impacted and eligible customers during outages. SDG&E's efforts on FLISR have been ongoing. Within 2024 GRC, there is one project, "Substation Modification to support FLISR" (SDG&E – 12 – 17243), that specifically requests funding to implement FLISR at one of SDG&E's substations.

Local Area Distribution Controller ("LADC")

To support the controls associated with these renewable microgrids, SDG&E is working on developing and deploying a new microgrid controller, known as LADC. The LADC is designed as a fast local controller that is capable of rapidly controlling inverter-based resources while leveraging synchro-phasor data as control input. This fast control was deemed necessary based on experiences dealing with transient microgrid operating conditions in a low inertia environment. This is especially true for uncontrolled customer DER with legacy inverters without strong ride through capabilities where voltage or frequency excursions associated with these transients can cause them to trip offline in mass. LADC will first be deployed at SDG&E's Cameron Corner Microgrid in Summer 2022, with the goal to be established as the standard integration controller for microgrids. The deployment of LADC at current under-development and future microgrid sites will continue via multiple projects (SDG&E – 25 – 00920AU, SDG&E – 25 – 00920Y, SDG&E – 25 –00920L) requested in TY 2024 GRC. Finally, SDG&E expects to integrate all resources including those operated by third parties supporting microgrids with LADC in addition to utility assets. The LADC projects are primarily driven by DER Integration but are also necessary in order to ensure safe and reliable operation within the microgrids.

Besides the projects discussed above to increase visibility, management, and control of the distribution system, SDG&E has also been utilizing a combination of data, analytical method, engineering and operation knowledge, and various tools to build a data notification system, visualization dashboards to enable proactive, and targeted response to data changes and system events. Some of the use cases implemented include voltage monitoring and notification, phase

balancing, and overloading circuits watchlist. With more data available, including DER performance data, SDG&E expects to continue using analytics to further finetune its process to make more data driven planning and operational decisions. In addition, SDG&E also has ongoing grid technology deployment such as the Advanced Protection ("AP") technology to further extending branch circuit protection for improved reliability. (*See* SDG&E Wildfire Mitigation and Vegetation Management testimony witnessed by Jonathan T. Woldemariam (Exhibit SDG&E-13) for more information on this program.)

Theme 3: Reliable, Resilient, and Secure Communication Network

As the distribution network becomes more dependent on an increasing number of DER resources, telemetry, and control points to operate safely and reliably, the need for cyber security systems and standards to protect SDG&E's operational technology networks is also growing. Grid requirements envisioned for California's planned high DER future necessitate a communications network that is highly accessible, controllable, reliable, resilient, and secure. These communication network capabilities are becoming more foundational than ever to both grid operation and planning. Moreover, the end customer communicating and controlling DER present an unprecedented cybersecurity threat to grid stability that must be anticipated. It requires active monitoring, mitigation, and recovery procedures to be in place. Grid modernization upgrades SDG&E has completed and/or initiated are listed below.

To maintain and grow a reliable, resilient, and secure communication network, SDG&E must upgrade or replace aging infrastructure, such as projects to replace End of Support or End of Life devices within the Wide Area Network ("WAN"). In the Grid Modernization Plan, only projects aiming to enhance and extend the network to support the new assets integration, which are classified as DER integration relevant, are discussed and listed below.

<u>Fiber Development</u>

SDG&E's current backhaul fiber optic network is comprised of approximately 858 miles of fiber connecting over 60 transmission substations. SDG&E is about 60% complete with another approximately 622 miles to build towards completing a diverse fiber optic infrastructure network to all remaining substations. The fiber optic network not only provides a direct connection to substation equipment, but it also serves as backhaul and redundant pathways for Long-Term Evolution ("LTE") field area network technology and Microwave links that enables distribution automation devices to be interconnected to back-end control systems. In 2024 GRC, SDG&E is

continuing with the efforts of building fiber network through the Fiber Optic for Relay Protection & Telecommunications project (SDG&E – 12 – 71440), and the HFTD Transmission Fiber Optics project (SDG&E – 13 – 191340). Both projects are primarily driven by safety and reliability but provide the network foundation for supporting DER integration.

Private LTE

SDG&E is deploying a privately-owned LTE field area network using licensed radio frequency ("RF") spectrum by means of the Distribution Communications Reliability Improvements ("DCRI") program. The private LTE network and associated upgraded communication infrastructure will enhance the overall reliability of SDG&E's communication network, which is critical for enabling fire prevention and public safety programs. In the meantime, SDG&E envisions this network will also serve as a foundational network for DER integration efforts. Similar to the Fiber development projects, the private LTE Project (SDG&E – 13 – 198730) is also primarily driven by safety and reliability but provides the foundation for supporting DER integration. The project is an ongoing program and is expected to continue through the test year.

Cyber Security

In addition to the network expansion above, other efforts are being implemented to respond to the increasing cyber security risks and challenges. SDG&E has established a holistic Operational Technology ("OT") and Information Technology ("IT") cyber security strategy to protect its system and customers from cyber-attacks and potential catastrophic events. These integrated efforts are ongoing and continue to evolve as requirements and threats emerge. As part of the SCADA Headend upgrade project, SDG&E has validated and further improved its security layers guarding operational systems such as SCADA and ADMS. However, as discussed more below in the DER integration challenges, more analysis, testing and collaborated engagement from DER stakeholders are essential to build out a cyber secure high DER future. SDG&E expects to further investigate associated risks and evaluate new technology that can be adopted to mitigate these risks. SDG&E also plans to continue to actively engage in state initiatives working with broader stakeholders. Given that cybersecurity efforts are implemented systematically and cannot be isolated to just supporting grid modernization efforts. (*See* SDG&E Cybersecurity testimony witnessed by Lance R. Mueller (Exhibit SDG&E-26) for more information on SDG&E's cybersecurity strategy.)

Theme 4: Leveraging DER Technology to Support Grid Reliability and Resilience

Integrated Test Facility ("ITF")

SDG&E has been enhancing an innovative ITF over the past decade to support the implementation of various grid modernization and DER technology in a safe and controlled environment before commissioning and/or deployment in the field. Since the inception of the facility, the ITF has been integral to our fielding of systems and DER and provides the testing hub to model, simulate, test, and perform a complete demonstration. The lab has comprehensive capabilities in terms of coverage, which includes DER, traditional SCADA devices, systems, communications technology, and system/device security. The lab has been heavily utilized in our Electric Program Investment Charge ("EPIC") program, grant-funded programs, and field deployment projects. Some of the recent activities include the LADC, smart inverter testing, IEEE 2030.5[2] interoperability projects and wildfire mitigation projects. The facility currently consists of following integrated labs:

- Foundational Communication Lab
- Power Systems Lab
- DER Lab
- Smart Garage Lab
- System Protection lab
- Cyber Security Lab

Within this TY 2024 GRC, SDG&E proposes to expand the lab facility, and make equipment upgrades, enabling additional simulation capabilities to test and validate technology's grid integration behaviors to ensure safe and reliable operation of both the distribution system and the equipment. The ITF expansion project (SDG&E – 15 – 212660) is primarily driven by safety and reliability but provides direct benefits to DER integration as it equips SDG&E in understanding the operational behavior of DER technologies.

[2] Institute of Electrical and Electronics Engineers ("IEEE"), *IEEE Standard for Smart Energy Profile Application Protocol*, in IEEE Std 2030.5-2018 (Revision of IEEE Std 2030.5-2013), pp.1-361, (December 21, 2018). IEEE 2030.5 is a DER communications protocol.

SDG&E-Owned Energy Storage Systems

SDG&E has a long history of working with innovative partners to test battery chemistries in a variety of use cases to support needs of the grid. One key use case of utility energy storage is to smooth DER output, as defined within the grid modernization framework. Since 2012, SDG&E has been deploying utility-owned energy storage systems to address system reliability issues. In the 2019 GRC, SDG&E proposed the Advanced Energy Storage ("AES") project, which is currently being implemented at the Borrego Spring Microgrid.[3]

For the current phase of AES, SDG&E is in the process of installing and integrating a 7.3 MW/14.6 megawatt-hour ("MWh") Battery Energy Storage System ("BESS") and a 0.25 MW/4 MWh Hydrogen Energy Storage System ("HESS") to leverage excess photovoltaic ("PV") that is interconnected at the transmission and distribution system. These energy storage systems will also support microgrid operations at the Borrego Springs Microgrid. The AES implementation at Borrego Springs is expected to provide clean peaking power, reduce renewable curtailments, increase the microgrid capacity when in islanded operations and reduce the use and reliance on the conventional generators. In this TY 2024 GRC, SDG&E proposes to complete the current AES project (SDG&E – 15 – 212678A) in 2023 and continue with AES Phase 2 deployment (SDG&E – 15 – 212690) on additional circuits that have an abundance of DER penetration. This project is primarily driven by reliability, although it provides direct benefits to DER integration.

Resiliency-Focused Microgrids

In addition to deploying utility owned energy storage systems, SDG&E has also leveraged energy storage as part of several distinct microgrids in its territory to improve resiliency and reliability. During grid-connected mode, the energy storage systems installed as part of these microgrids provide load support, and in some cases are bid into the California Independent System Operator ("CAISO") market to maximize overall system benefits from deployed systems. All of the microgrids can operate in "island mode," meaning the microgrid assets provide energy to the local, isolated circuit(s) or circuit segment(s) in the event that the grid is unavailable—due to planned maintenance work, unplanned damage to the system, or as part of PSPS events.

[3] D.19-09-051.

SDG&E has been a pioneer in the development of community microgrids since 2012 with the initial development of the Borrego Springs Microgrid. For the past decade, SDG&E has continued its development of these solutions to incorporate multiple resources and controllable microgrid boundaries from a single circuit to an entire substation with dynamically configurable load pockets to manage both dynamic energy and power considerations. With this experience, SDG&E has undertaken the development of additional microgrids to support PSPS resiliency at a community level. As discussed in previous Wildfire Mitigation Plan ("WMP") updates, SDG&E has completed temporary configuration with conventional generators for four microgrids deployed in 2020. By TY 2024, SDG&E plans to place the permanent renewable solution in service, including Cameron Corners, Ramona Air Attack Base, Butterfield Ranch and Shelter Valley microgrids. The WMP microgrid projects (SDG&E – 13 – 192490) are primarily driven by safety, reliability, and resiliency.

A key aspect of these microgrid projects is that they are designed to be 100% renewable in nature based on solar and battery resources. SDG&E is currently working to upgrade the Borrego Springs Microgrid to operate with 100% renewable resources, benefitting from two local solar farms and ample customer rooftop systems. SDG&E proposes to continue with Borrego 3.0 Microgrid Project in this TY 2024 GRC. The Borrego 3.0 Microgrid Project (SDG&E – 15 – 17246A) is primarily driven by sustainability, resilience and operational flexibility.

Overview of Current GRC Grid Modernization Request

A. Proposed Grid Modernization Programs and Program Drivers for the 2024 GRC

As a continuation of all grid modernization upgrades discussed above, the grid modernization project list in Table 1 in Section B provides estimates of funding request necessary to meet SDG&E's grid modernization objectives within this TY 2024 GRC.

Narratives and program drivers for projects that continue as ongoing scope have been discussed in the above Section "Grid Modernization Upgrades Initiated and/or Completed to Date," while new projects proposed in this TY 2024 GRC under each grid modernization theme are further discussed below.

Theme 1: Advancing interconnection and modeling to further operationalize DER

Microgrid Portal (SDG&E – 25 - 00920A)

SDG&E is developing its Tribal/Local Government Portal ("TLGP") which is a separate, access-restricted data portal for local and tribal governments is a new project that will allow compliance with the CPUC Decision 20-06-017.[4] This project supports local and tribal efforts to promote community resiliency.

The proposed solution is to develop a separate access-restricted data portal for sharing information with local and tribal governments to support their resiliency planning efforts. The portal is a map application to display GIS data, including (a) planned grid investments, (b) high fire threat districts, (c) electrical infrastructure and (d) weather-related factors that led to the decision to de-energize from each prior PSPS events and resulting distribution and transmission line outages. The portal project is expected to be completed by the fourth quarter of 2023. Although this project is primarily driven by compliance and aims mostly at enhancing transparency for key stakeholders, it may also benefit DER integration.

Theme 2: Improved visibility, management, and control of the distribution system and DERs

Enterprise DERMS (SDG&E – 25 – 00920BA)

SDG&E views DERMS as providing the overarching capabilities within the operational domain to monitor, manage, and optimize DER. With the already solid foundation established by previous investments in SCADA Headend replacement, ADMS, and other network infrastructure, SDG&E believes it is important to carefully evaluate and design the capabilities needed to further enable DER integration in the operational domain and its existing systems portfolio. Instead of building out one enterprise application platform, SDG&E believes it can enhance its existing tools and build out scenario-driven capabilities as needed in a progressive manner.

Although SDG&E has not implemented an enterprise DERMS to date, it is one of the early adopters in expanding its grid management capabilities to embrace DER integration. SDG&E has a long history of working with national labs, vendors, research facilities, and universities via the avenue of state directed EPIC and other grant opportunities. However,

[4] R.19-09-009, *Decision Adopting Short-Term Actions to Accelerate Microgrid Deployment and Related Resiliency Solutions*, issued June 17, 2020. *See* SDG&E Advice Letter 3610-E, *San Diego Gas & Electric Plan to Develop a Work Pan to Develop a Separate, Access-Restricted Data Portal Pursuant to Decision 20-06-017*, made effective April 8, 2021.

additional capabilities and functionalities, along with consistent use cases are needed to develop and implement DERMS on the production level. Through this TY 2024 GRC, SDG&E proposes a DERMS project to implement the foundational communication and data architecture for monitoring and management of DER. Key DERMS requirements for this TY 2024 GRC include validating IEEE 2030.5 integration at both the device level and system level, expanding on aggregator communication, developing dynamic charging/discharging capabilities, and implementing forecasting capabilities. As DERMS is still an evolving technology and has dependence Commission policy guidance and approval, not all the functionalities can be implemented in full production scale, but SDG&E believes it is important to start testing, piloting and implementing the functionalities even at small scale in this GRC cycle. The DERMS project is primarily driven by DER integration, having a critical role in SDG&E's ability to integrate DER while continuing to operate the system in a safe and reliable way.

Demand Response Management System ("DRMS") Replacement (SDG&E – 25 – 00920C)

SDG&E has over two decades of experience in managing Demand Response ("DR") programs. The DRMS replacement project is targeted to implement a DRMS that meets the current and future needs of Demand Response ("DR") customers and the resulting DR programs. This platform will allow SDG&E's internal DR team to track and manage the various DR Programs and Pilots via one single platform. The DRMS replacement system is designed to be able to grow and expand, allowing SDG&E to have the capacity to manage and signal smart devices. The new platform will also allow the SDG&E's DR team to provide a better customer experience as many more customer purchased smart devices and equipment to be integrated into DR. The DRMS technology is primarily driven by DER integration, but the replacement project is primarily driven by aging IT infrastructure.

Theme 4: Leveraging DER Technology to Support Grid Reliability and Resilience

Hydrogen Energy Storage System Expansion (SDG&E – 15 – 212720)

To support the Borrego community's electric resiliency and environmental goals, SDG&E plans to expand the HESS at the Borrego Microgrid. The primary driver of the project is support SDG&E's sustainability goal of zero emissions by 2045 from all scope levels as well as gaining valuable experience operating longer duration storage systems, at least eight hours in duration, for system benefits. In the meantime, the additional HESS also supports the objective of the AES project and absorbs the abundance of solar generation during the non-net peak period

of day. The project is primarily driven by the Company's sustainability goals but also supports DER integration.

B. Cost Summary of Grid Modernization Plan: List of Total Amounts Requested

Table 1: Cost Summary of Grid Modernization Capital Projects in 2024 GRC (Dollars in 000)

Chapter	WP#	Project Name	Primarily DER Integration Driven	2022	2023	2024
SDG&E – 15 – Clean Energy Innovations	17246A	Borrego 3.0 Microgrid	N	$5,296	$102	$0
SDG&E – 15 – Clean Energy Innovations	212690	Advanced Energy Storage 2.0	N	$0	$13,284	$20,030
SDG&E – 15 – Clean Energy Innovations	20278A	Advanced Energy Storage	N	$12,483	$1,314	$0
SDG&E – 15 – Clean Energy Innovations	212660	ITF Expansion	N	$1,425	$0	$0
SDG&E – 15 – Clean Energy Innovations	212720	Hydrogen Energy Storage System Expansion	N	$0	$5,171	$81
SDG&E – 11 – Electric Distribution Capital	71440	Fiber Optic for Relay Protection & Telecommunications	N	$5,090	$7,122	$7,122
SDG&E – 11 – Electric Distribution Capital	162760	SCADA Head-End Replacement	N	$1,085	$0	$0
SDG&E –11 – Electric Distribution Capital	162770	Remote Terminal Unit (RTU) Modernization	N	$1,118	$622	632
SDG&E –11 – Electric Distribution Capital	152430	Substation SCADA Expansion - Distribution	N	$1201	2527	$1776
SDG&E –11 – Electric Distribution Capital	942410	Power Quality Program	N	$2300	$2300	$2300
SDG&E –11 – Electric Distribution Capital	172430	Substation Mod to Support FLISR	N	$887	$0	$0
SDG&E –11 – Electric Distribution Capital	202880	Non-HFTD Wireless Fault Indicators	N	$23	$1243	1243
SDG&E – 11 – Electric Distribution Capital	112490	SCADA Capacitors	N	$983	$984	984
SDG&E – 25 – Information Technology Capital	00920A	Microgrid Portal	N	$594	$389	$0
SDG&E – 25 – Information Technology Capital	00920AJ	Distribution Interconnection Info. System - Rule 21 and Net Energy Metering Enhancements - Phase 1	Y	$1,101	$0	$0
SDG&E – 25 – Information Technology Capital	00920X	Distribution Interconnection Info. System - Rule 21 and Net	Y	$224	$1,570	$1,409

Chapter	WP#	Project Name	Primarily DER Integration Driven	2022	2023	2024
		Energy Metering Enhancements - Phase 2				
SDG&E – 25 – Information Technology Capital	00920BA	Enterprise Distributed Energy Resource Management System (DERMS)	Y	$3,064	$2,810	$3,138
SDG&E – 25 – Information Technology Capital	00900C	Demand Response Management System (DRMS) Replacement	Y	$4,969	$4,368	$0
SDG&E – 25 – Information Technology Capital	00920AX	ROSE Phase 2	N	$1,558	$0	$0
SDG&E – 25 – Information Technology Capital	00920B	Smart Grid Operations 2022-2023	N	$2,619	$2,619	$0
SDG&E – 25 – Information Technology Capital	00920C	Smart Grid Operations 2024	N	$0	$0	$2,369
SDG&E – 25 – Information Technology Capital	00920AU	LADC	Y	$392	$0	$0
SDG&E – 25 – Information Technology Capital	00920Y	LADC 2022-2023	Y	$676	$2,039	$0
SDG&E – 25 – Information Technology Capital	00920L	LADC 2023-2024	Y	$0	$0	$897
SDG&E – 13 – Wildfire Mitigation and Vegetation Management	198730	WMP Private LTE	N	$79,569	$65,349	$70,179
SDG&E – 13 – Wildfire Mitigation and Vegetation Management	191340	HFTD Transmission Fiber Optics	N	$9,444	$7,700	$7,700
SDG&E – 13 – Wildfire Mitigation and Vegetation Management	112530	Wireless Fault Indicator	N	$666	$0	$1,064
SDG&E – 13 – Wildfire Mitigation and Vegetation Management	202580	HFTD SCADA Capacitor Replacement	N	$2,010	$1,378	$1,427
SDG&E – 13 – Wildfire Mitigation and Vegetation Management	192490	WMP Microgrids	N	$5,069	$36,229	$2,400
		Total		$143,846	$159,120	$124,751
		Total (2022-2024)		$427,717.00		

In summary, among the total approximately $124.8 million of requested dollars for grid modernization for TY2024, $5.4 million are costs primarily driven by DER integration. For the total approximately $427.7 million forecasted during 2022 to 2024, $26.7 million are costs primarily driven by DER integration.

C. Additional Operations and Management ("O&M") Expenses

In addition to the non-labor costs within the above funding request, SDG&E also forecasts the following incremental labor needs to support grid modernization programs within 2024 GRC, as shown below in Table 2.

Table 2: Cost Summary of additional Grid Modernization O&M Expenses in 2024 GRC

Testimony	Workpaper	Theme	Category	2024
SDG&E – 12	1ED001	Advancing interconnection and modeling to further operationalize DER	3,4,6	$406,502.00
SDG&E – 12	1ED003	Improved visibility, management, and control of the distribution system and DERs	1, 2, 9, 10	$519,000.00
SDG&E – 15	1DD005	Leveraging DER Technology to Support Grid Reliability and Resilience	2,18,19	$375,000.00
Total				$1,300,502.00

Grid Modernization 10 Year Lookout

To implement SDG&E's grid modernization vision and capabilities in a progressive manner, the Company has carefully crafted its investments in phases to foster DER integration in the near-term, mid-term and long-term, as shown in Figure 3 below. Each phase is thematic in nature, with the first phase dedicated to providing key basic infrastructure necessary to manage and orchestrate SDG&E's future electric grid and the resources that are interconnected to it. As with any plan and roadmap, SDG&E's approach is to be forward-looking but remain responsive and support the need for meeting priority grid challenges. All planned investment and activities are expected to evolve and be consistent with various state policies and regulatory proceedings. SDG&E believes this incremental approach is the practical way to achieve the Company's ultimate vision especially when compared against the alternative of an all-encompassing, "big bang" project.

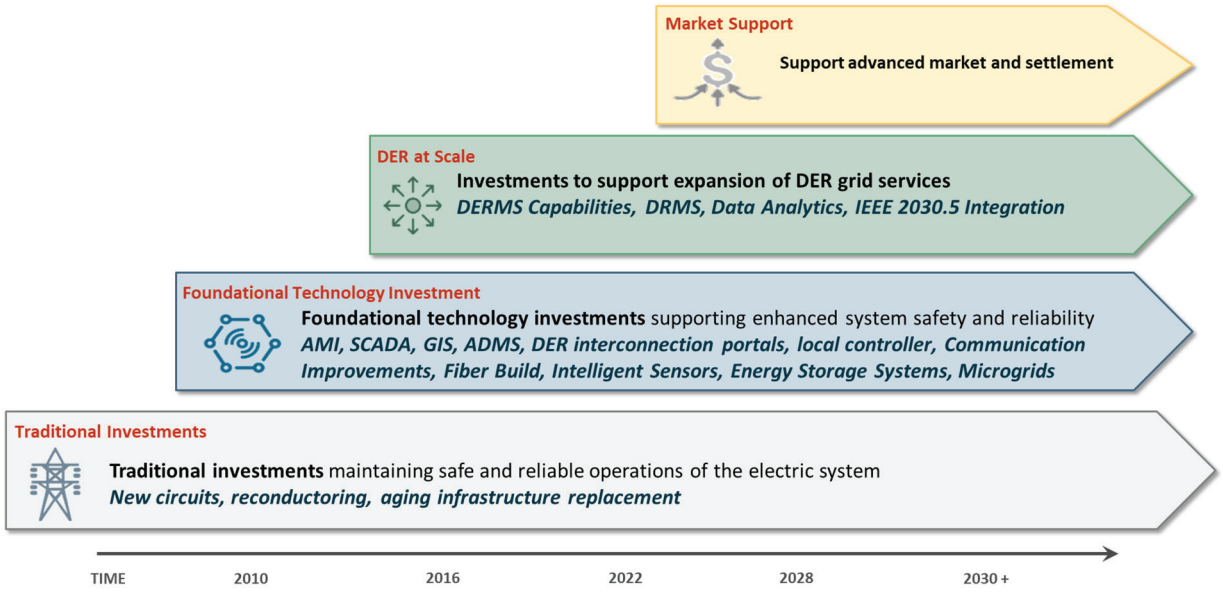

Figure 3- Grid Modernization Investment Phased Roadmap

Near-Term (2020 to 2024) – The first phase focuses on traditional and foundational technology investments SDG&E has already made in the past decades and will need to continue expanding in this TY 2024 GRC. These projects are discussed above in detail throughout the grid modernization plan in both upgrades to date and new projects proposed in this TY 2024 GRC. Although many projects are not primarily driven by DER integration, SDG&E believes all projects establish key components of the Company's vision to create a reliable, safe, and resilient

grid that naturally paves the way for DER integration to evolve. SDG&E additionally anticipates continued DER integration pilots to provide the experience for future phases.

Mid-Term (2025 to 2030) – The second phase includes planned investments that further advance the enablement of DER at scale to provide managed energy services by integrating resources into distribution operation and enabling customers as partners via enhanced programs and platforms. Investments in this phase are expected to evolve based on the foundational technology investments made in the past and in the near-team phase, along with changes and needs coming out of the on-going regulatory proceedings and state initiatives. In TY 2024 GRC, many projects would set the foundation for the technology to be further developed and enhanced. For example, the 2024 GRC scope for the Smart Meter 2.0 would set the foundation for grid modernization related use cases to be evaluated and implemented in the future. (*See* SDG&E Customer Service – Field Operations testimony witnessed by David H. Thai (Exhibit SDG&E-17) for more information on this program.)

Long-Term (Beyond 2030) – The third phase allows SDG&E to support future market structure that would allow for the increased participation of DER into the distribution system, where DER provide cost-effective grid services.

Grid Modernization Supplemental Information

As required,[5] SDG&E includes the following supplemental information for primarily DER integration driven projects relevant to the technology category within the grid modernization framework. For other information, such as capital budgets, O&M expense of maintaining grid modernization systems, investment drivers, and status of currently funded projects, are either discussed in the main Grid Modernization Plan above or in the relevant testimony justification and work papers.

[5] D.18-03-023, p.41.

SDG&E – 25 – 00920AJ – Distribution Interconnection Info. System – Rule 21 and Net Energy Metering Enhancements – Phase 1 SDG&E – 25 – 00920X – Distribution Interconnection Info. System – Rule 21 and Net Energy Metering Enhancements – Phase 2	
Related Grid Modernization Categories	6. Interconnection Processing Tool
System integration challenges the technology supports	The DIIS enables an integral process for customer to integrate DER, it does not specifically address any system integration challenges[6].
Grid services the technology enables	The DIIS enables a user-friendly process for customer to integrate DER, it does not specifically enable any grid services.
Supporting Technology	Data Portals Planning Tools
Technology Maturity	SDG&E DIIS has been implemented since 2013 and is a mature and existing technology.
Expected Useful Life of Equipment	>5 years
Equipment capacities, ratings, and other specifications	Not applicable
Which DERs does the Technology Integrate	PV, Wind Generator, EV, Energy Storage (ES)
Proposed method and result for assessment of cost reasonableness	DIIS is a home-grown application designed and developed by SDG&E.
Locational Investment and Deployment Plan	Not a locational investment

[6] DER Integration challenges were identified and approved in the classification tables within Resolution E-4982

SDG&E – 25 – 00920A – Local Area Distribution Controller SDG&E – 25 – 00920Y – Local Area Distribution Controller 2022-2023 SDG&E – 25 – 00920L – Local Area Distribution Controller 2023-2024	
Related Grid Modernization Categories	19. Microgrid Interface
System integration challenges the technology supports	Item 1-6 of list of challenges
Grid services the technology enables	Reliability and Resilience
Supporting Technology	SCADA, ADMS, DERMS
Technology Maturity	SDG&E LADC is an innovative solution to control resources within microgrid. The technology is built upon existing control system and data platform
Expected Useful Life of Equipment	>10 years
Equipment capacities, ratings, and other specifications	Not Applicable
Which DERs does the Technology Integrate	ES and PV, but has the potential to integrate other DERs
Proposed method and result for assessment of cost reasonableness	Lowest cost approach SDG&E utilized the Request for Proposal ("RFP") process to select the vendor for LADC.
Locational Investment and Deployment Plan	SDG&E is deploying LADC in accordance with the deployment of the microgrid systems.

SDG&E – 25 – 00900C – Demand Response Management Systems ("DRMS") Replacement	
Related Grid Modernization Categories	2. Grid Management System
System integration challenges the technology supports	Item 6, 10 of list of challenges
Grid services the technology enables	The DRMS enables SDG&E to implement and manage DR programs, it currently does not specifically enable any grid services but has the potential of doing so.
Supporting Technology	Not applicable
Technology Maturity	DRMS has been widely deployed in the industry and is a mature and existing technology.
Expected Useful Life of Equipment	>5 years
Equipment capacities, ratings, and other specifications	Not Applicable
Which DERs does the Technology Integrate	Demand Response
Proposed method and result for assessment of cost reasonableness	Lowest Cost Approach SDG&E selects DRMS vendor through RFP process.
Locational Investment and Deployment Plan	Not a locational investment

SDG&E – 25 – 00920BA – Enterprise Distributed Energy Resource Management System (DERMS)	
Related Grid Modernization Categories	2. Grid Management System
System integration challenges the technology supports	Item 1-7 of list of challenges
Grid services the technology enables	The DERMS enables SDG&E to build the foundation for operating the distribution system in a high DER future. It has the potential to enable grid services such as voltage support, capacity, reliability, and resilience if coupled with appropriate resources and policy.
Supporting Technology	SCADA, ADMS, WAN, FAN
Technology Maturity	The DERMS technology maturity has evolved in the past decade but in general is developing. SDG&E will take industry implementation and use case applicability into consideration during the process of selecting vendors.
Expected Useful Life of Equipment	The DERMS project involves integration across multiple software systems. Useful life of software ranges from 10-15 years.
Equipment capacities, ratings, and other specifications	Not applicable
Which DERs does the Technology Integrate	Potentially all DERs
Proposed method and result for assessment of cost reasonableness	SDG&E plans to utilize the "lowest cost approach" to evaluate the technologies.
Locational Investment and Deployment Plan	Not a locational investment

DER Integration Related EPIC Project Summary

The EPIC Program ran for nine years in three triennial cycles over the period 2012-2020 and the third cycle was extended into 2021. SDG&E performed the following projects related to DER integration in the EPIC program:

In the EPIC-1 cycle, an initiative consisting of five pre-commercial demonstration projects on advanced distribution system automation was funded. All five projects had content pertaining to DER integration. The following projects with DER integration relevance were funded and completed:

EPIC-1 Project 1. Smart Grid Architecture Demonstrations	This project investigated emerging communication architecture standards for power system modernization, with focus the IEC 61850 standards.
EPIC-1 Project 2. Visualization and Situational Awareness Demonstration	This project explored how data collected from sensors and devices in the distribution system can be processed, combined, and presented to system operator in a way the enhances grid monitoring and situational awareness.
EPIC-1 Project 3. Distributed Control for Smart Grids	This project investigated the structure for hierarchical control of distribution systems as they become more complex with adoption DER and other emerging component types.
EPIC-1 Project 4. Demonstration of Grid Support Functions of Distributed Energy Resources	This project investigated the value proposition for grid support functions of DER. It also included a demonstration of the emerging IEEE 2030.5 standard and a demonstration of DER hosting capacity analysis tools.
EPIC-1 Project 5. Smart Grid Circuit Demonstrations	This project had two major workstreams. The first workstream investigated advanced distribution circuit designs for assimilation of new technologies. The second module demonstrated methodologies and tools integration of energy storage technologies into advanced distribution systems.

In the EPIC-2 cycle, projects were funded in the initiative areas of renewables and distributed energy resource integration; grid modernization and optimization; customer focused products and services; and cross-cutting/foundational strategies and technologies. The following projects with DER integration relevance were funded and completed:

EPIC-2 Project 1. Modernization of Distribution System and Integration of Distributed Generation and Storage	This project focused on pre-commercial of an interoperable substation communication network based on the IEC 61850 communication standards.
EPIC-2 Project 2. Data Analytics in Support of Advanced Planning and System Operations	This project investigated the assimilation of several data streams into a central database to support advanced distribution system operations.
EPIC-2 Project 3. Monitoring, Communication, and Control Infrastructure for Power System Modernization	This project investigated an open field messaging bus concept for interoperability, peer-to-peer communication, and multiple protocol conversion.
EPIC-2 Project 4. System Operations Development and Advancement	This project investigated improving distribution system operations via use of regional aggregation monitoring and circuit optimizers and local resource aggregation and monitoring.
EPIC-2 Project 5. Integration of Customer Systems into Electric Utility Infrastructure	This project examined control and monitoring concepts based on data from phasor measurement units ("PMUs") in the context of advanced SCADA.
EPIC-2 Project 6. EPRI and Other Collaborative Programs	This project included a workstream on use of machine learning to identify important attributes driving adoption of photovoltaic systems at the zip code level for disadvantaged communities ("DAC") and other locations.

In the EPIC-3 cycle, projects were funded in the areas of grid modernization and optimization and customer services and enablement. The following projects with DER integration relevance were funded:

EPIC-3 Project 3. Application of Advanced Metering Infrastructure (AMI) Data to Advanced Utility System Operations	The two key areas of investigation are use of AMI data as a voltage sensor network and as a means for phase identification. Accurate phasing information is essential for optimal control and effective operation of the distribution system with ADMS and a DERMS. The project is currently in the final report stage.
EPIC-3 Project 4. Safety Training Simulators with Augmented Visualization	This project is divided into two workstreams. The first workstream is focused on a focused patrol simulator that uses multiple data sources to more rapidly locate faults in the distribution system. The second workstream is focused on a virtual reality simulator that can improve worker training to avoid voltage hazards, such as those that may be associated with an energized DER that has failed to cut out during a system outage. This project is currently in the final report stage.
EPIC-3 Project 7. Demonstration of Multiple-Purpose Mobile Battery for Port of San Diego and Other Applications	This project is determining the value proposition for stacked benefits that may be obtained by rotating a mobile battery to different locations with varying use cases. Two battery sizes are being tried in the demonstration work. Sites include a tenant of the Port of San Diego, an SDG&E microgrid, and two community resource centers ("CRCs"). Use cases include customer load smoothing, demand response, peak shaving, and emergency power supply.

The comprehensive final project reports for the EPIC-1, EPIC-2, and EPIC-3 cycles are posted on the EPIC public website at www.SDGE.com/epic. The only ongoing project within the EPIC-3 cycle is Module 3 of EPIC-3 Project 7, in which the project team is performing additional use cases including cases which focus on demonstration of battery operation using the IEEE 2030.5 communication standard. The project module will be completed in 2022.

DER Integration Related Questions

In addition to the main components of the Grid Modernization Plan above, SDG&E also includes answers to the DER integration related questions in the Decision.[7]

A. Foundational Technologies

i. Are there foundational planning and communications technologies that are critical for distribution system planning for DER integration that have not been installed?

[7] D.18-03-023, p.40.

ii. *And does the investment in these foundational technologies together with the capabilities they enable outweigh the "traditional" solution to provide the needed capability?*

As greater granularity of data is expected from the CPUC, stakeholders, and customers, it is incumbent on the investor-own utilities to adopt ever increasing and complex data structures to deliver meaningful results. Some examples of recent CPUC mandates include the granular identification of future forecast distribution grid needs through the DER Growth Scenarios, granular identification of distribution needs to be potentially deferred via DER through the Distribution Investment Deferral Framework ("DIDF"), and system rollout of the Integration Capacity Analysis ("ICA") calculation.

Meanwhile customers are connecting unprecedented amounts of distributed generation at record pace, due to lower costs of energy resources. These resources can have a variety of operating characteristics based on existing programs and market participation. Distribution System Planning engineers must consider demand datapoints at all hours to deliver meaningful results of where new distribution capacity is needed.

Greater enhancement to existing tools and creation of new data structures are needed to organize data into a meaningful result that can streamline analysis and provide accurate results. Future investment in this effort will lead to efficient deployment of new infrastructure. Enhanced hosting capacity information will deliver meaningful results to SDG&E's customers looking to interconnect new load and generation resources.

B. <u>DER-Specific Integration Challenges</u>

i. *For each type of DER, what types of integration challenges are anticipated occur?*

ii. *What type of distribution system upgrades are critical to mitigate each of these challenges?*

iii. *How, and to what degree, does the Grid Modernization Plan enable two-way flows of electricity?*

The challenges of integration are mostly common across all DERs. These integration challenges can be segmented into 3 functional areas: Distribution System Planning, Distribution Interconnection, and Distribution System Operation. Distribution system upgrades that are critical to mitigate each of these challenges are also described below.

1. Distribution System Planning

a. Ensure that system can provide the capability to support the interconnecting DER's planned mode of operation(s)

The planning system needs to be aligned with the operational system in terms of DER operation. Traditional planning systems have been implemented using an assumption of unmanaged DER. Additional assumptions were made with respect to the unidirectional flow of power and that telemetry from generating facilities sized under 1 MW was not available.[8] These assumptions have limited the capacity of DER that could be integrated to the grid. Making assumptions related to DER control and integrating these assumptions into planning systems provides an additional avenue can provide additional capacity to interconnect more DER without increasing physical infrastructure. This capacity can be created by making new assumptions regarding controllability of DERs ability to export and draw real and reactive power from the grid in accordance with grid conditions. SDG&E's existing system already has the capability of producing hour- and date-specific operating limits on a static basis. These capabilities can be extended to support more dynamic capabilities based on day-ahead and real-time system operating conditions.

Care must be taken to consider the differences in planning for DERs operating in an independent manner versus those participating in an aggregation. This will require increased investment to better forecast the behavior of distribution-level aggregations operating in concert in a portion of SDG&E's grid, where heretofore DERs were assumed to operate independently.

Another factor to consider is how the dependence of DER to provide grid services impact resource planning contingencies. SDG&E's planning processes need to be updated to incorporate planning assumptions related to DER availability to provide expected services. SDG&E anticipates the need to enhance the capability of planning systems to perform contingency and reserve margin analysis.

Finally, the reservation of long-term capacity needs to be considered. Traditional distribution investments have been made and funded under the assumption of planning for serving load. With DER, this traditional approach towards system investment requires update while preserving fairness. Unless distribution capacity is paid for directly, increasing DER

[8] SDG&E Electric Tariff Rule 21, Generating Facility Interconnection, at Section J.5, only requires telemetering if the nameplate rating of the Generating Facilities is 1 MW or greater.

levels without increasing physical capacity may change safe operating limits for previously installed units. The planning system must make assumptions as to the limits of previously installed DERs and whether they can be reduced due to changes. However, any reduction of operating flexibility to a previously agreed limit will likely be met with DER operator resistance. This topic is more related to policy and contracts rather than modeling.

b. Masked load/planning uncertainty

Masked load is created by not having access to DER operations and telemetry. Without access to real, measured DER performance data, SDG&E must make conservative planning and operational assumptions with respect to operations. With access to this DER telemetry data, SDG&E will be able to better understand DER performance and leverage this data to enhance both system planning as well as operational decisions. These improvements can lead to both enhanced interconnection capabilities and opportunities for better leveraging DERs in operations. Equally as important, SDG&E believes that having access to this DER telemetry provides an avenue for exploring whether DERs are generally operating in a manner consistent with California policy goals and are being dispatched in a manner consistent with grid needs. Finally, SDG&E expects that this performance data provides an opportunity for adjusting DER interconnection capacity limits based on reducing DER performance uncertainty leveraging system performance data.

2. Distribution Interconnection

a. A workflow and process to manage the planning for the additional DERs

SDG&E's interconnection system and portal has been designed largely to incorporate passive DERs. Smart Inverters and other control technologies require updates to SDG&E's interconnection system to capture new data and capabilities. For example, SDG&E's DIIS needs to be updated to collect communication information for new and existing DERs when communications are activated.

b. Compliance with relevant grid codes, interconnection agreements and DER device electrical standards

Additional work will be required to support the usage of DERs to provide grid services. This includes the development of new interconnection agreement terms for the activation of

communications. This should include the method of communication to the utility – direct or via an aggregator – and the needs for underlying DER owner responsibilities and obligations.

c. Provisioning of the DER into SDG&E's operational system planning

SDG&E has invested significant effort in managing the workflow and processes associated with DER. The interconnection portal management system can be further extended to meet the needs of a high DER future. In particular, SDG&E would like to capture communication information for DERs as they are brought onto the system. Additionally, once communications are activated, SDG&E believes it is possible to perform automated commissioning testing for these DERs provisioned via the portal. SDG&E would like to invest in automating the flow of DER constraint information from planning systems into asset management and operational systems like DERMS. Our investment in workflow to support both the needs of initial interconnection but also its full lifecycle to handle use cases such as a change inverter, communication path or enrollment with a service aggregator.

3. Distribution System Operation

a. Provisioning of the DER into SDG&E's operational systems automatically

As stated above, the ability to rapidly and automatically provision most DER into all operationally related systems for both planning and operations is an imperative to meet High DER future goals. To do anything else would contribute to excess time requirements for DER integration and excess workload. SDG&E anticipates that this provisioning will require increased integration between core SDG&E systems like GIS and our planning and operation management systems to ensure that DER once activated is incorporated into all aspects of grid management as DERs provide grid services both individually and as part of aggregations.

b. Activating and testing communication between SDG&E's control systems

Communications are an acknowledged key enabler that allow DERs to contribute to the grid and provide services. It is SDG&E's practice to test that all grid resources are communicating and operating normally before they are put into production. The CAISO has similar communication testing requirements for its resources that wish to participate in wholesale markets. The scale of DER deployment dictates that this end-to-end testing be performed in an

automated fashion as part of either the interconnection process or when communications are activated. This commissioning testing will ensure that the communications have been established correctly and can be depended upon to work correctly. As with the base provisioning of the DER itself, automated testing is required to minimize workload, cost and time for all parties including customers, installers, and DER providers. It is important to note that this commissioning testing is distinct from standards testing in that the focus is on ensuring that the end-to-end communication path is open and available and that no errors were made in configuring the DERs integration with the utility.

c. Ensuring compatible communications at the transport, protocol, and application level.

To actively manage DERs, communications pathways must be available. All differences between the DER and SDG&E's control system at the transport, protocol, and application level must be unified. For DER, these integration challenges are best met via extreme standardization efforts as has been initiated in the Rule 21 proceeding for Smart Inverter management.[9] To minimize costs for all parties, SDG&E recommends and supports the extension of the IEEE 2030.5 and Common Smart Inverter Profile ("CSIP") profile to be expanded to cover additional use cases. These use cases include management of energy storage, controllable loads, such as electric vehicles. Additional functionality will be necessary to incorporate aggregations providing services. An additional area of need will be in the communication of operating constraints, both day-ahead and real-time, to ensure that DER operations do not jeopardize grid safety and reliability as well as facilitating the interconnection of more DERs to SDG&E's system.

d. Cybersecurity monitoring of DER, aggregators and communication networks

DERs reflect a new challenge for the utility. Traditionally, all grid services at the distribution level have been provided exclusively through utility devices and communication networks. This environment has to date allowed SDG&E to both install and manage the cyber security of all devices and the networks that enable the flow of both telemetry and controls. DERs fundamentally change this environment as they interface with and provide services to the grid. The challenge gets even more acute when they provide the energy required to power

[9] Examples include Commission Resolutions E-4832, E-4898, and E-5000.

California and charge storage, while conventional generation resources are simultaneously retired. With third-party DERs, the utility no longer has insight into the cyber security status and controls of those systems and devices. This new DER environment requires the SDG&E to develop methods and systems to proactively detect whether the DER, aggregator, or energy management system representing DERs are acting as anticipated. This also requires the development of infrastructure to securely authenticate DERs and aggregators that communicate with SDG&E for the purposes of providing telemetry or grid services, while also detecting anomalies. This communication infrastructure must also make provisions for ensuring all communications between SDG&E and external systems are encrypted as well.

Lastly but not the least important, two-way power flow caused by DER has caused challenges in all aspects. SDG&E envisions updating its planning, management, control, and protection systems to better enable two-way power flow. For example, control and protection systems require alternate settings when the direction of electricity changes. These demands also require a much more sophisticated sensing and coordination scheme than previously required by a simple unidirectional flow of energy. When coupled with switching for grid reconfiguration, a real time demand emerges for more dynamic calculation of control and protection settings in real time. Distribution relay and communication upgrades that will provide more granular and visualization of two-way power flows coupled with control algorithm reprogramming to support reverse power flow across the substation transformer, would provide SDG&E's distribution system the foundational capability to enable two-way flows of electricity.

C. DERs as Grid Services

When cost effective, DER can provide the four services as outlined and adopted in D.16-12-036: capacity, voltage support, reliability, and resiliency. Typically, one single DER technology may not be able to fully function as alternative to grid infrastructure due to the variable nature of most DER. Thus, coordinated planning, design, deployment, and management of DERs is crucial for them to provide safe and reliable grid services.

Additional technology upgrades and regulatory framework are needed to enable DERs to provide grid services including but not limited to following:

a. Advanced notification to Wholesale Distribution Access Tariff ("WDAT") customers of planned and unplanned (*i.e.*, emergency) outages to better coordinate scheduled availability in CAISO marketplace

b. Determination of suitable distribution charge capacity rates for WDAT generators utilizing distribution capacity to minimize ratepayer cost-shift

c. Day-ahead and real-time forecasting of system needs to inform DER dispatch

In addition, mass fleets of DERs reflect a new and unique cybersecurity challenge to all grid operators. The fleets of small inverters already reflect the largest generation source on SDG&E grids. Specific investments needed include:

a. Systems to efficiently, provision, test and automatically connect DER to utility communications networks in a secure manner

b. Capability to detect comprised inverters behaviorally without direct access

c. Ability to isolate large fleets of compromised inverters at scale via utility managed isolation solutions

d. The development of highly standardized interfaces supporting required applications such that plug-and-play interoperability is realized

e. Fielding of communication systems and DER management systems that conform to industry standards

f. Ensuring that sufficient reliability exists within the DER to perform the commands

D. Role of Existing and Customer Technologies in Achieving Objectives

Smart Inverters: It is SDG&E's plan to integrate smart inverters, while practical leveraging the work of the Commission's Smart Inverter Working Group ("SIWG") and Smart Inverter Operationalization Working Group ("SIOWG") process, including communication standards. SDG&E looks forward to continuing work to extend the IEEE 2030.5 / CSIP standard to achieve additional use cases such as DER providing energy resources to PSPS microgrids.

AMI Infrastructure: SDG&E's existing AMI infrastructure was designed primarily as billing and customer support system. While load data collected by the AMI meters has also been leveraged to support engineering and planning analysis, the existing system architecture is not suitable for use at scale in real time grid management nor control. SDG&E looks to the future as it considers end of life of its first-generation system with the replacement of both meters and communications networks with a more capable solution.

It is SDG&E's vision that the utility meter has the potential to become the primary device for all telemetry and become an active control device from which to manage DER customers via standard interfaces. Further, SDG&E believes with the advent of more capable metering solutions, enhanced demand response and data analytics can be achieved. Finally, SDG&E believes there is opportunity to use the future AMI system as part of an integrated cybersecurity solution to mitigate the cyber threats on the system.

Third Party Communication Network: SDG&E fully expects to leverage third party communication networks to certain DERs managed by aggregators. An emerging challenge exists when customers are enrolled with multiple aggregators, each of which provides differing services all located behind a common point of interconnection. It is SDG&E's expectation via investments made in enhancing the network, architecture, and cyber security capabilities, it can continue to act as the "aggregator or aggregators" to ensure customer resources across the board operate in a consistent and supportive manner for the integrated grid.

Appendix C1 – Grid Modernization Classification Table

The table below reflects the Grid Modernization Classification Table as submitted in Advice Letter 3366-E, with Column I updated to reflect relevant projects in the 2024 GRC.

Please note, for "ITF Expansion" project, SDG&E is unable to categorize specific sets of technology category, as the facility provides a test bed for many grid modernization technologies. The project is included in the cost summary table in Table 1 above, but not listed in the Grid Modernization Classification Table below.

A. Technology Category	B. Use Cases	C. Function	D. System wide or Local Deployment	E. Distribution System Management Activities and Responsibilities	F. System/ Integration Challenges Addressed	G. Relevant DERs	H. Applicable Grid Mod Technologies Related to DER Integration	I. 2024 GRC Application Volume and Category
1. Grid Connectivity	HDA, S&R, GDS	Circuit modeling, Data Used for Forecasting and DER Value and Solution Analysis	System wide	Distribution Planning, Grid Operations, Market Operations	Items 1 - 8 of list of challenges	EV, DG, ES, EE, DR	Base data layer for ICA, Load and DER forecasting, state estimation, ArcGIS, EDGIS	SDG&E-25-00920B-Smart Grid Operations 2022-2023 SDG&E-25-00920C-Smart Grid Operations 2024 SDG&E-25-00920BA-Enterprise Distributed Energy Resource Management System (DERMS)
2. Grid Management Systems (GMS)	HDA, GDS, S&R	All functions in the definitions, except for DER Value and Solutions Analysis	System wide	Distribution Grid Operations	All items	PEV, DG, ES, DR	Distributed Energy Resource Management System (DERMS), Advanced Distribution Management System (ADMS), Demand Response	SDG&E-11-162760-SCADA Head-end Replacement SDG&E-25-00920BA-Enterprise Distributed Energy Resource Management System (DERMS)

A. Technology Category	B. Use Cases	C. Function	D. System wide or Local Deployment	E. Distribution System Management Activities and Responsibilities	F. System/ Integration Challenges Addressed	G. Relevant DERs	H. Applicable Grid Mod Technologies Related to DER Integration	I. 2024 GRC Application Volume and Category
							Management System (DRMS), DER Head-End, and VVO	SDG&E-25-00920AX-Reliability and Operational Safety (ROSE) - Phase 2 SDG&E-25-00920B-Smart Grid Operations 2022-2023 SDG&E-25-00920C-Smart Grid Operations 2024
3. Long and Short-term Planning Tools	HDA, S&R, GDS	DER Forecasting, DER Valuation Solution Analysis, Circuit Modeling	System wide	Distribution Planning	Thermal, Operational Limitations	EE, DR, EV, DG, ES	Integrated Load and DER forecasting, solution analysis for capacity/reliability, LoadSEER, Power flow modeling and analysis of distribution feeders (CYME) System Modeling Toolset (SMT); Long- Term Planning Tools (LTPT;) Integration Capacity Analysis (ICA), Locational Net Benefit Analysis Tool (LNBA)	N/A
4. Data Sharing Portals	HDA, S&R, GDS	DER Valuation, Solution Analysis, Circuit Modeling	System wide	Distribution Planning	Sustained voltage violations, thermal, protection	EE, DR, EV, DG, ES	Data Sharing Portal (web interface) to publish Distribution Resources Plan data; Distribution	SDG&E-25-00920A- Microgrid Portal

A. Technology Category	B. Use Cases	C. Function	D. System wide or Local Deployment	E. Distribution System Management Activities and Responsibilities	F. System/ Integration Challenges Addressed	G. Relevant DERs	H. Applicable Grid Mod Technologies Related to DER Integration	I. 2024 GRC Application Volume and Category
5. Grid Analytics Application	HDA, S&R, GDS	Circuit/System Modeling	System wide	Distribution Planning Grid Operations	Sustained voltage violations, thermal, protection, asset management	EV, DG, ES, DR	Asset management, sensing and measurement (data), improves quality of asset data to improve distribution planning inputs and operational decisions	N/A
6. Interconnection Processing Tool	HDA, S&R, GDS	Application Assessment and Processing	System wide	Service Planning and Customer Engagement	Indirect impact on sustain voltage violations, thermal, protection interconnection process)	EV, DG, ES	Customer facing application to support streamlining the interconnection process, improve distribution planning, Integration Capacity Analysis (ICA)	SDG&E - 25-00920AJ - Distribution Interconnection Info. System - Rule 21 and Net Energy Metering Enhancements - Phase 1 SDG&E -25-00920X - Distribution Interconnection Info. System - Rule 21 and Net Energy Metering Enhancements - Phase 2
7. Adaptive Protection System	S&R, HDA, GDS	Sensing & Measurement, Data & Device Communications, Control & Feedback Systems, Reliability Management,	Local & System wide	Grid Operations	Protection	All	This is typically incorporated as part of the Common Substation Platform (CSP) at the substation level. In the future, it may be incorporated into ADMS. (Capability in GMS for SCE)	N/A

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8. Substation Automation and Common Substation Platform (CSP)	HDA, S&R, GDS	Sensing & Measurement, Data & Device Communications, Control & Feedback Systems, Reliability Management, Cybersecurity	Local & System Wide	Distribution Planning, Grid Operations, Market Operations	Items 1 - 10 of list of challenges	EV, DG, ES	SCADA, coordinated distribution device control with DERs, protection, cybersecurity	SDG&E -11 - 152430 - Distribution Substation SCADA Expansion
9. Volt/Var Optimization	HDA, S&R, GDS	Sensing & Measurement, Data & Device, Communications Control & Feedback Systems	Local	Distribution Planning, Grid Operations, Market Operations	Voltage fluctuation, sustained voltage violations, Low (Secondary) Voltage Controllers, Conservation Voltage Reduction	EV, DG, ES, DR	Substation Load Tap Changers, Voltage Regulators, Automated programmable capacitor controls, integration with GMS and/or DMS and EMS, future integration with smart inverters	SDG&E-11- 112490 - SCADA Capacitors SDG&E-13-202580 -HFTD SCADA Capacitor Replacement
10. Fault Location, Isolation and Service Restoration (FLISR)	HDA, S&R, GDS	Sensing & Measurement, Data & Device Communications, Control & Feedback Systems, Reliability Management	Local	Distribution Planning, Grid Operations, Market Operations	Thermal, Operational Limitations, Fault Location & Service Restoration, Cybersecurity	EV, DG, ES, DR	Remote Intelligent Switches, Augmented Remote Control Switches, Automatic Reclosers, RCS retrofits	SDG&E - 11-172430 - Substation Modification To Support FLISR SDG&E- 11 - 162770-RTU Modernization
11. Remote Fault Indicators	S&R, HDA, GDS	Sensing & Measurement, Data & Device Comms.	Local	Distribution Planning, Grid Operations, Market Operations	Thermal, Operational Limitations, Cybersecurity	EV, DG, ES	Wireless bidirectional fault indicators, providing real time power flow characteristics	SDG&E - 11-202880- Non-HFTD Wireless Fault Indicator SDG&E -13 - 112530 -0 Wireless Fault Indicator

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12. Field Area Network	S&R, HDA, GDS	Sensing and Measurement, Data & Device Communications, Cybersecurity	Large Local Areas, eventually system wide	Distribution Planning, Grid Operations, Market Operations	Items 1 - 10 of list of challenges	EV, DG, ES	Wireless radios, Routers	SDG&E - 13 - 198730- WMP Private LTE
13. Wide Area Network	S&R, HDA, GDS	Sensing and Measurement, Data & Device Communications, Cybersecurity	Large Local Areas, eventually system wide	Distribution Planning, Grid Operations, Market Operations	Items 1 - 10 of list of challenges	EV, DG, ES	Fiber optic and IP connectivity	SDG&E - 11- 71440 - Fiber Optic for Relay Protection & Telecommunications SDG&E - 13 - 191340 - HFTD Transmission Fiber Optics
14. Grid Sensors	HDA, S&R, GDS	Sensing & Measurement, Data & Device Comms.	Local	Distribution Planning, Grid Operations, Market Operations	Thermal, Operational Limitations, Fault Location & Service Restoration, Cybersecurity	EV, DG, ES	Typically, incorporated with other devices/systems such as SCADA reclosers, and FLISR schemes. Telemetry included with the RFIs, RCS retrofits and RISs. This could also include Phasor Measurement Units (PMUs)	SDG&E - 11 - 942410 - Power Quality Program SDG&E - 11- 202880- Non-HFTD Wireless Fault Indicator SDG&E -13 - 112530 -HFTD Wireless Fault Indicator
15. Remote Controlled Switches	HDA, S&R	Control & Feedback Systems	Local	Distribution Planning, Grid Operations,	Operational Limitations	All	Typically, incorporated with other devices/ systems such as SCADA reclosers, and FLISR schemes.	N/A

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16. DER Hosting Capacity Reinforcement	HDA, GDS, S&R	Control & Feedback Systems	Local	Grid Operations	Thermal	All	Installing new manual switches, upgrading sections of cable/ conductor, extending feeder lines to create new ties	N/A
17. Relay Replacement	HDA, S&R	Control & Feedback Systems	Local	System Planning, Grid Operations	Protection	All	Upgrading legacy protection relays on as-needed basis	SDG&E -11 - 152430 - Distribution Substation SCADA Expansion
18. Utility-Owned Storage	HDA, S&R	Sensing & Measurement, Control & Feedback, Reliability Management	Local	System Planning and Grid Operations	Voltage Violations, Thermal, Operational Limitations, DER Aggregation Impacts	DR, EV, DG, ES	Energy storage systems installed on the distribution systems to buffer DER output and load (PEV)	SDG&E - 13 - 192490 - WMP Microgrids SDG&E - 15 - 17246A - Borrego 3.0 Microgrid SDG&E - 15 - 20278A - Advanced Energy Storage SDG&E - 15 - 212690 - Advanced Energy Storage 2.0 SDG&E - 15 - 212720 – Hydrogen Energy Storage System Expansion

A. Technology Category	B. Use Cases	C. Function	D. System wide or Local Deployment	E. Distribution System Management Activities and Responsibilities	F. System/ Integration Challenges Addressed	G. Relevant DERs	H. Applicable Grid Mod Technologies Related to DER Integration	I. 2024 GRC Application Volume and Category
19. Microgrid Interfaces	HDA, S&R	Sensing & Measurement, Control & Feedback, Reliability Management	Local	System Planning and Grid Operations	Voltage Violations, Thermal, Operational Limitations, DER Aggregation Impacts	DR, EV, DG, ES	"Trayer" switches and other hardware and software which allow DER powered microgrids	SDG&E - 25 - 00920AU - Local Area Distribution Controller (LADC) SDG&E - 25 - 00920Y - LADC 2022 - 2023 SDG&E - 25 - 00920L - LADC 2023 - 2024

Appendix C2 - Acronym Table

SDG&E	San Diego Gas and Electric Company
DER	Distributed Energy Resource
MW	Megawatts
CPUC	California Public Utilities Commission
EV	Electric Vehicles
GHG	Greenhouse Gas
DR	Demand Response
DIIS	Distribution Interconnection Information System
DRP	Distributed Resource Planning
NEM	Net Energy Metering
TY	Test Year
GRC	General Rate Case
SCADA	Supervisory Control and Data Acquisition
ES	Energy Storage
ADMS	Advanced Distribution Management System
OMS	Outage Management System
DMS	Distribution Management System
GIS	Geographic Information System
CIS	Customer Information System
AMI	Advanced Meter Infrastructure
DERMS	Distributed Energy Resource Management System
ROSE	Reliability and Operational Safety
SGO	Smart Grid Operation
PSPS	Public Safety Power Shutoff
VVO	Volt/Var Optimization
FLISR	Fault Isolation and Service Restoration
FL	Fault Location
RTU	Remote Terminal Unit
IP	Internet Protocol

WFI	Wireless Fault Indicators
HFTD	High Fire Threat District
PQ	Power Quality
LADC	Local Area Distribution Controller
AP	Advanced Protection
WAN	Wide Area Network
LTE	Long-Term Evolution
RF	Radio Frequency
DCRI	Distribution Communications Reliability Improvements
OT	Operational Technology
IT	Information Technology
ITF	Integrated Test Facility
EPIC	Electric Program Investment Charge
AES	Advanced Energy Storage
BESS	Battery Energy Storage System
HESS	Hydrogen Energy Storage System
CAISO	California Independent System Operator
WMP	Wildfire Mitigation Plan
OIR	Order Instituting Rulemaking
DRMS	Demand Response Management System
O&M	Operations and Management
PMU	Phasor Measurement Units
DAC	Disadvantaged Communities
CRC	Community Resource Centers
IOU	Investor-own Utilities
DIDF	Distribution Investment Deferral Framework
RFP	Request for Proposal
ICA	Integration Capacity Analysis
CSIP	Common Smart Inverter Profile
SIWG	Smart Inverter Working Group
WDAT	Wholesale Distribution Access Tariff
TLGP	Tribal/Local Government Portal

(END OF GRID MODERNIZATION PLAN)