

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

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

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA



August 2022

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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	110,833	132,721	21,888
Total Shared Services (Incurred)	0	0	0
Total O&M	110,833	132,721	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 \$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 their regional ReliabilityOne award for sixteen consecutive years.¹ In addition, SDG&E also

¹ 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/>.

received the PA Consulting Group’s national ReliabilityOne award in 2014, 2018, and 2021,² 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 (31.6%) and Electric Regional Operations (30.7%). 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 my testimony as Appendix C is SDG&E’s Grid Modernization Plan pursuant to Decision (D.) 18-03-023.³

² 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/>.

³ 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.

**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	4,058	4,045	-13
C. Electric System Operations	31,073	41,947	10,875
D. Kearny Operations Services	2,236	2,179	-57
E. ET&D: Substation C&O	10,361	9,519	-845
F. Distribution Design and Project Management	820	1,304	485
G. Electric Regional Operations	35,360	40,768	5,408
H. Skills & Compliance Training	2,839	3,829	990
I. Service Order Team (SOT)	4,061	4,069	8
J. Electric Engineering	2,083	2,504	420
K. Troubleshooting	9,634	9,633	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	132,721	21,888

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 \$132,721,000 for Electric Distribution O&M expenses, set forth in this chapter. For matters related to

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

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

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

26 | **Costs that Scale with Capital Construction**

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

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

6 **Shortages of Skilled Electric Distribution Labor**

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

17 **New Compliance Program**

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

22 **Increased Distribution System Automation**

23 There has been a large increase in the use of supervisory control and data acquisition
24 (SCADA)⁴ technology on SDG&E's electric system, especially for purposes related to wildfire
25 mitigation. SCADA service restorers are utilized to minimize public safety power shutoff
26 (PSPS) events, enable sensitive relay protection to detect and isolate downed power lines, and to
27 provide more visibility to the system. There are approximately 2,386 SCADA field sites
28 installed and the Company is forecasting an eight percent average annual increase based on a

⁴ 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.

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

9 **B. Support To and From Other Witnesses**

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

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

- 1 ○ Electric Engineering (Section IV.J.3) – Basis for O&M estimates
- 2 • Arthur Alvarez (Exhibit SDG&E-22: Fleet Services)
- 3 ○ Construction Management (Section IV.B.3) – Fleet vehicle needs
- 4 ○ Substation C&O (Section IV.E.3) – Fleet vehicle needs
- 5 ○ Distribution System Control & Protection (Section IV.E.1.3) –
- 6 Fleet vehicle needs
- 7 ○ Electric Regional Operations (Section IV.G.3) – Fleet vehicle
- 8 needs
- 9 ○ Portfolio & Project Management (Section IV.M.3) – Fleet vehicle
- 10 needs
- 11 • William J. Exon (Exhibit SDG&E -25 Chapter 2: Information Technology
- 12 ○ Reliability & Capacity (Section IV.A.3) – Explanation of need for
- 13 the distribution interconnection information system (DIIS)
- 14 information technology (IT) capital projects
- 15 ○ Electric System Operations (Section IV.C.3) – Explanation of need
- 16 for the Reliability and Operational Safety Enhancements (ROSE),
- 17 Smart Grid Operations, Distributed Energy Resource Management
- 18 (DERMS), Electric Load Curtailment, and Grid Operations Small
- 19 Cap IT capital projects.
- 20 ○ Distribution Design & Project Management Section IV.F.3) –
- 21 Reference to Builder Services Portal and Automated Utility Design
- 22 project cost
- 23 ○ Compliance Management (Section IV.M.3) – Explanation of need
- 24 for the Cross-Functional Work Management Enhancement and
- 25 Telecom Attachment Management System (TAMS) IT Capital
- 26 Projects.
- 27 • Kenneth J. Deremer (Exhibit SDG&E-31: Safety, Risk and Asset
- 28 Management Systems)
- 29 ○ Sustainability, Climate Policy, and Safety Culture (Section III.B) -
- 30 Reference to Safety and Risk Management System (SMS)
- 31 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 (ICLNBMMA) 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

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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.⁵ 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

⁵ D.18-03-023, Ordering Paragraph 4 at 34-35.

1 **II. RISK ASSESSMENT MITIGATION PHASE INTEGRATION**

2 Certain costs supported in my testimony are driven by activities described in SoCalGas
 3 and SDG&E’s respective 2021 RAMP Reports (the 2021 RAMP Reports).⁶ The 2021 RAMP
 4 Reports presented an assessment of the key safety risks for SoCalGas and SDG&E and proposed
 5 plans for mitigating those risks. As discussed in the testimony of the RAMP to GRC Integration
 6 witnesses R. Scott Pearson and Gregory S. Flores (Ex. SCG-03/SDG&E-03, Chapter 2), the costs
 7 of risk mitigation projects and programs were translated from the 2021 RAMP Reports into the
 8 individual witness areas.

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

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

16

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

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

⁶ 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.

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, <i>e.g.</i> , 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.

1
2 These activities are discussed further below in Section IV.B through Section IV.E,
3 Sections IV.G and H, and Sections IV.J and K, as well as in my workpapers. For additional
4 information and a roadmap, please refer to Appendix B, which contains a table identifying by
5 workpaper the TY 2024 forecast dollars associated with activities in the 2021 RAMP Report that
6 are discussed in this testimony.

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

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

17 **C. Changes from RAMP Report**

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

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

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

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

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

15 **III. SUSTAINABILITY AND SAFETY CULTURE**

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

24 **A. Sustainability**

25 As described in the Sustainability Policy testimony of Estela de Llanos (Ex. SDGE-02),
26 SDG&E's adoption of DER is an important component for reducing reliance on harmful GHG
27 emitting technology. Additionally, SDG&E has a strategic focus on replacing sulfur
28 hexafluoride (SF6) containing equipment from its system. SF6 is a GHG with approximately
29 22,000 times the environmental impact of carbon dioxide.

1 **1. Enabling DER Technology**

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

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

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

22 **2. SF6 Emission Tracking**

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

1 **B. Safety Culture**

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

5 A comprehensive approach is essential to keeping field workers safe and building a
6 strong safety culture within the electric distribution operations and maintenance teams.

7 SDG&E’s approach includes identification of risks as they emerge or before incidents occur and
8 designed solutions to mitigate those risks identified. This combination allows for an adaptable
9 program that continually refocuses on the greatest threats to the safety of the public, SDG&E’s
10 employees, and contractors. Additionally, building designed solutions may encompass many
11 programs, all of which are captured in the Safety Management System (SMS). Launched in
12 2020, the SMS aligns and integrates safety management, risk management, asset management,
13 and emergency management across the entire organization. The SMS takes a holistic approach
14 to “safety” and expands beyond traditional occupational safety principles to include public
15 safety, asset safety, system safety, cyber safety, and psychological safety for improved safety
16 performance and culture. SDG&E’s SMS is a systematic, enterprise-wide framework to
17 collectively manage and reduce risk and promote continuous improvement in safety performance
18 through deliberate, routine, and intentional processes. SDG&E adopted a de-centralized SMS
19 organizational structure where risk and accountability is retained at the operational level. The
20 SMS Executive-level and Director-level teams bring cross-functional leaders together to share
21 safety best practices, lessons learned and opportunities for improvement. The Director – Electric
22 Regional Operations serves as a SMS Governance Team member and has identified operational
23 support across the districts and departments within the organization to operationalize the SMS
24 processes. For more information on the SMS, please see Safety, Risk & Asset Management
25 Systems testimony of Kenneth J. Deremer (Ex. SDG&E-31).

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

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

14 Creating focused mitigation programs that efficiently target risk areas are essential to the
15 success of SDG&E's safety culture and safety performance. There are several programs driving
16 costs within my testimony that target safety risk to the public, employee, and contractors. First
17 and foremost is training resources needed to maintain core safe job skills within SDG&E's field
18 workforce. This includes industrial trainers who teach the importance of field employees
19 maintaining physical fitness as a means to prevent instances of sprains and strains, which are the
20 most frequent type of employee injury. Additionally, SDG&E is introducing a new Municipality
21 Electric Hazard Awareness program, which will create engagement with local jurisdictions to
22 promote safe behaviors within those entities. The SDG&E electric distribution workforce is also
23 trained to respond to any and all emergencies related to its electric distribution systems. This
24 includes managing programs designed to mitigate the frequency and impact of fires during a
25 Santa Ana wind event. During emergencies, SDG&E electric operations team utilizes the
26 Incident Command Structure (ICS) to unify priorities and resource management under a single
27 command. This allows a faster response, efficient prioritization of resources to public safety
28 issues, and improving communication and support to employees and contractors responding to
29 the event. For more information on SDG&E's ICS structure, see the Wildfire Mitigation and
30 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.⁸ 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	4,058	4,045	-13
C. Electric System Operations	30,150	41,025	10,875
C.1 ESO: GIS	922	922	0
D. ET&D: Operations Services	2,236	2,179	-57
E. ET&D: Substation C&O	6,785	5,810	-975
E.1 ET&D: Substation C&O: Relay & SCADA	3,576	3,709	133
F. Distribution Design and Project Management	820	1,304	484
G. Electric Regional Operations	35,360	40,769	5,409
H. Skills & Compliance Training	2,839	3,829	990
I. Service Order Team (SOT)	4,061	4,069	8

⁸ 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)
J. Electric Engineering	2,083	2,504	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	110,833	132,721	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

1 function covered under this workpaper is advising on generation interconnections submitted
2 through the Wholesale Distribution Access Tariff (WDAT) and Electric Rule 21.
3 Responsibilities include designing the electric distribution system to facilitate the construction of
4 electric facilities to connect new customers to SDG&E's system and ultimately increase the
5 capacity of the electric distribution system infrastructure to support both new load and/or DER
6 throughout the service territory. SDG&E is responsible for developing, implementing, and
7 guiding on all aspects correlated with distribution resources planning (DRP) processes at
8 SDG&E.⁹ These tasks consist of analysis, developing reports, developing new analytical tools,
9 providing comments to proposed decisions, adhering to final decisions, conducting detailed
10 presentations, and leading or collaborating in stakeholder-driven planning processes. Active
11 support is provided to O&M activities including staffing the Emergency Operations Center and
12 Construction and Operations districts during major events and storms. Other responsibilities
13 include reviewing and revising distribution planning design standards, reviewing fusing requests
14 and providing engineering input on planning worksheets, approving load studies, participating in
15 distributed generation and renewable resource studies, integrating advanced technologies,
16 designing utility owned interconnection facilities for DER, project management for specific
17 GRC-approved projects, responding to internal and external customer data requests, training, and
18 attending relevant technical committee meetings.

19 The Reliability Team is responsible for reviewing, coding, and auditing outage
20 information to enable correct classification, duration, customer counts, and indices. This team
21 leads root cause analysis for unplanned, primary outages to enable data integrity for metrics
22 related to reliability. The team also maintains the official data repository for outage data, known
23 as the Reliability Database, which is the foundation for data reporting to both internal and
24 external entities. Common metrics tracked include System Average Interruption Duration Index
25 (SAIDI), System Average Interruption Frequency Index (SAIFI), and Customer Average
26 Interruption Duration Index (CAIDI). Other responsibilities include responding to customer
27 inquiries related to outage information for their account(s) and supporting CPUC reporting
28 requirements. Some of these requirements are listed below:

⁹ See D.18-02-004 for a discussion on the distribution resources planning processes.

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

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

10 **Distribution Generation Statistics Memorandum Account (DGSMA)**

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

17 **2. Forecast Method**

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

28 **3. Cost Drivers**

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

1 **4. Other Drivers**

2 **a. IT Projects**

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

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

7 Aligning with Commission directives to the large IOUs to utilize Institute of Electrical
8 and Electronic Engineers (IEEE) 2030.5 communication standards within the interconnection
9 process,¹¹ DIIS 6.0 is a project to enhance SDGE’s current DIIS to enable the configuration files
10 of a planned new DER system to be integrated into the interconnection process. IEEE 2030.5
11 has been selected within the Rule 21, Section 5, proceeding to be the default method of
12 communication in California between smart inverters and the IOUs. Significant effort has been
13 made by all parties including utilities, DER service providers and manufacturers to create a “plug
14 and play” ecosystem for enabling all DER to participate as part of California’s planned high
15 DER future. This project is to develop and implement a tool to manage requirements of IEEE
16 2030.5.

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

18 This project will make enhancements to SDG&E’s interconnection portal as well as
19 incorporate recent CPUC mandates from various NEM and Rule 21 proceedings. The portal will
20 be expanded to include additional interconnection processes such as WDATs, back-up generator
21 applications, and pre-applications. Additionally, the portal will be updated to capture
22 information supporting IEEE 2030.5 based communications for telemetry and control purposes.
23 The improvements to be achieved with this second DIIS project also pertain to activities
24 discussed in Commission rulemaking¹² and will include Vehicle-to-Grid (V2G) projects.
25 Finally, these costs cover the need to integrate downstream systems such as GIS to incorporate
26 newly captured portal information.

¹¹ 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.

¹² *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	4,058	4,045	-13
Total	4,058	4,045	-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

1 **2. Forecast Method**

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

12 **3. Cost Drivers**

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

15 **4. Other Drivers**

16 **a. Fleet Vehicles**

17 Below, I speak to the fleet vehicle needs related to this workpaper. Costs for the fleet
18 vehicle additions are included in the Fleet Services testimony of Arthur Alvarez (Ex. SDG&E-
19 22).

20 **Construction Management Fleet Vehicle Needs**

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

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

3 **Technology**

4 The data systems in use and personnel in the Mission Control facility operate on a
5 24/7/365 schedule. Additionally, data systems that support SDG&E operations continue to
6 support increased workloads due to steady system growth, a high volume of replacements for
7 aging system infrastructure, requirements to comply with CPUC reporting, risk mitigation efforts
8 related to safety, reliability, and security, and increasing customer expectations for outage
9 information.

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

15 **Storeroom**

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

24 **2. Forecast Method**

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

1 **3. Cost Drivers**

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

5 **a. Storeroom Cost Pressures in Support of the Capital Plan**

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

16 **b. DSO Workforce Development**

17 The Electric Distribution Operations Control Center (EDOCC) is responsible for
18 operating the electric distribution system safely and reliably for planned and unplanned events
19 (e.g., outages). One of the main resources within the Center are the DSOs. This group supports
20 24/7 operations management and oversight to enable field workers to have the proper safety
21 authorizations when making system changes to the electric distribution system. The DSOs are
22 also responsible for directing unplanned outage restoration activities on the electric distribution
23 system, having a direct impact on the reliability of the system and impacts SDG&E’s customers
24 see. The DSOs are also critical to implementing wildfire mitigation measures during the
25 heightened fire risk season. These measures include but are not limited to enabling sensitive
26 relaying, removing reclosing functions, enforcing visual patrol requirements prior to re-
27 energizing overhead lines, and safely performing PSPS events.

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

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

7 **c. Reliability and Safety**

8 **Advanced Distribution Management System (ADMS) Support**

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

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

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

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

22 **Supervisory Control and Data Acquisition (SCADA) Workforce Development**

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

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

4 **4. Other Drivers**

5 **a. IT Projects**

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

9 **Reliability and Operations Safety Enhancements (ROSE) and Smart Grid** 10 **Operations (SGO) – IT CAPITAL**

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

14 **Distributed Energy Resource Management System (DERMS) – IT CAPITAL**

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

- 26 1) Build direct dispatch capabilities for large capacity (1MW and above) energy
27 storage
- 28 2) Engage with commissioner staff, customers, DER developer, aggregators, and
29 other key stakeholders in establishing key use cases for smart inverter
30 operationalization.

- 1 3) Facilitate appropriate level of procurement efforts and collaborate with vendors to
2 develop, pilot, and implement the needed functionalities to support the use cases
3 on a technological level.

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

- 5 • Dynamic limit management
- 6 • Aggregator Communication
- 7 • Direct DER Communication
- 8 • DER Communication Management
- 9 • DER Monitoring, control, and data exchange with ADMS
- 10 • 2030.5 Integration

11 **Emergency Load Curtailment IT Tool – IT CAPITAL**

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

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

25 **Grid Small Cap – IT CAPITAL**

26 The IT Electric Grid Ops Small Capital budget code is needed to fund replacement of
27 electric transmission legacy hardware required for the Transmission SCADA system. This
28 budget code supports purchasing replacements for defective, broken, or expired components,
29 including legacy equipment that is prone to failure and no longer supported by the vendor.
30 Reliable operation of the Transmission SCADA system is critical to monitor generation
31 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

1 verify the connectivity model to validate proper safe isolation points for field and public safety.
 2 GIS is also utilized during emergency events due to the use of real-time fire data, such as fire
 3 parameters, weather data, and crew locations it provides. Incorrect record keeping within GIS
 4 can lead to improper communication, during planned and unplanned outages with customers
 5 affecting SDG&E’s longstanding commitment to public and customer safety

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

9 **TABLE TS-14: RAMP Activity O&M Forecasts by Workpaper**
 10 **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

11 * An RSE value was not calculated for this activity

12 **2. Forecast Method**

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

17 **3. Cost Drivers**

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

20 **4. Other Drivers**

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

1 electrical ratings and physical condition for rubber gloves and live line tools assigned to
2 SDG&E’s electrical workers, at mandated intervals.

3 **Business Controls and Training**

4 This group provides several support functions to ET&D: Operations Services and ET&D:
5 Substation C&O. This group is responsible for the oversight of internal ET&D control
6 procedures and policies to enable compliance and develop process improvements. The group
7 also facilitates both compliance and job skill training for ET&D employees, ensuring compliance
8 with internal and external guidelines and regulations, and curating and developing new training
9 content to meet demand.

10 **a. Description of RAMP Mitigations**

11 RAMP-related costs for ET&D: Operations Services include costs for (1) Occupational
12 Safety and Health Administration (OSHA) Voluntary Protection Program (VPP), and (2) PPE.
13 As described in Table TS-6 above: (1) The OSHA Voluntary Protection Program includes
14 implementation of effective health and safety management systems to prevent fatalities, injuries,
15 and illnesses of employees. Several programs and processes are being employed as part of VPP
16 to promote safe activities and improve safety performance, including Hazard Identification Cards
17 and the Safety Incentive Program. Hazard Identification Cards are used as a proactive measure
18 for employees to report and resolve hazards in the workplace. Each card is collected withing a
19 tracking system and increases awareness of the hazard among the workforce. The Hazard
20 Identification Card empowers the employee in the resolution process of correcting the hazard by
21 giving the employee the ability to resolve the hazard on their own, if possible, or work with
22 additional departments for assistance and guidance on resolving the hazard. A workflow process
23 is established for standardizing how each Hazard Identification Card is processed and reviewed.
24 The Safety Incentive Program is a reward-based program focused on leading safety indicators,
25 promoting workplace safety through positive reinforcement of observed safe behaviors and
26 voluntary participation in various safety and risk reduction programs. Employees can receive
27 incentive points, which can then be redeemed for rewards, by submitting Near Miss Reports,
28 submitting Hazard Identification Cards, making safety recommendations, taking the lead on
29 resolving known safety issues, participating in safety subcommittees and analysis of safety
30 issues, or by demonstrating additional safety-related behaviors. These activities and other
31 employee time dedicated to fostering an enhanced safety environment are key components of the

1 overall VPP; (2) PPE protect employees from the risk of injury by creating a barrier against
 2 workplace hazards. PPE includes clothing and equipment designed to protect employees while
 3 performing their job (e.g., flame resistant clothing, gloves, protective eyewear). All employees
 4 who are required to use PPE are trained on when PPE is necessary, which PPE is necessary, how
 5 to properly don/remove/adjust/wear PPE, limitations of PPE and the proper
 6 care/maintenance/life/disposal of PPE. In addition, the ET&D: Operations Services group
 7 performs inspections and tests of PPE which is used by SDG&E employees. PPE which is
 8 inspected and tested by the ET&D: Operations Services group includes, but is not limited to,
 9 rubber gloves, rubber blankets, rubber sleeves, rubber line hose, and live line tools. The PPE
 10 maintained by the ET&D: Operations Services group is used by multiple working groups at
 11 SDG&E, including Electric Regional Operations, ET&D: Substation C&O, Troubleshooting,
 12 Skills and Compliance Training, and others.

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

16 **TABLE TS-16: RAMP Activity O&M Forecasts by Workpaper**
 17 **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*

18 * An RSE value is not calculated for this activity

19 **2. Forecast Method**

20 The forecast method developed for this cost category is three-year average. This method,
 21 along with including incremental adjustments as discussed in the Cost Driver section below, is
 22 most appropriate for both labor and non-labor because the workload for this group is driven by
 23 factors that vary from year-to-year, such as the quantity of equipment removed from service that
 24 can be tested and repaired versus safely disposed of. In addition, tools and rubber goods are

1 inspected and tested based upon time-based cycles, so although the quantity and associated costs
 2 can vary year-to-year, an average provides the best forecast for a typical year. Sustained
 3 increases in workload and rising union labor rates for the employees who perform the inspection,
 4 testing, and repair activities occurred in 2019 making the three-year average the most appropriate
 5 forecast.

6 **3. Cost Drivers**

7 The cost driver behind this forecast is workforce development.

8 **a. Workforce Development**

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

18 **4. Other Drivers**

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

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

21 **TABLE TS-17**
 22 **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	6,785	5,810	-975
Total	6,785	5,810	-975

23 **1. Description of Costs and Underlying Activities**

24 Electric Transmission & Distribution: Substation C&O and associated support
 25 organizations are responsible for the installation, inspection, and maintenance of approximately
 26

1 135 distribution substations on the SDG&E system. Substation equipment maintained includes
2 approximately 304 distribution power transformers and their associated load tap changers or
3 voltage regulators, and approximately 1,672 circuit breakers including oil, air, and vacuum
4 classifications, and their associated line and bus disconnect switches. Substation equipment also
5 includes inspection and maintenance for all substation equipment including batteries, buses,
6 support structures, capacitor banks, reactors, grounding systems, fire suppression systems, and
7 perimeter fences and gates. The substation inspection and resulting corrective maintenance
8 program managed by this group is established in compliance with GO 174, CAISO maintenance
9 requirements, and SDG&E's maintenance standards. This program is critical to the safe
10 operation and reliability of all electric distribution substation facilities.

11 **a. Description of RAMP Mitigations**

12 RAMP-related costs for Electric Transmission & Distribution: Substation C&O include
13 costs for (1) Substation Inspection and Repair GO 174, (2) OSHA Voluntary Protection
14 Program, and (3) PPE. As described in Table TS-6 above: (1) SDG&E's Substation Inspection
15 and Repair Program adheres to GO 174 while promoting safety for SDG&E personnel and
16 contractors by providing a safe operating and construction environment, within the substation
17 fence. Goals for this program include: meeting all of the requirements of GO 174, achieving a
18 level of station availability satisfactory to SDG&E's health and safety programs and maintenance
19 standards, and assuring compliance with all sections of the CAISO TCA. The program involves
20 routine inspections at reoccurring cycles. A security check is also performed once per week, and
21 a more detailed inspection is planned monthly or bimonthly, which takes a visual look at
22 equipment and attempts to identify any problems, like environmental hazards caused by
23 equipment oil leaks; (2) The OSHA Voluntary Protection Program includes implementation of
24 effective health and safety management systems to prevent fatalities, injuries, and illnesses of
25 employees. Several programs and processes are being employed as part of VPP to promote safe
26 activities and improve safety performance, including Hazard Identification Cards and the Safety
27 Incentive Program. Hazard Identification Cards are used as a proactive measure for employees
28 to report and resolve hazards in the workplace. Each card is collected withing a tracking system
29 and increases awareness of the hazard among the workforce. The Hazard Identification Card
30 empowers the employee in the resolution process of correcting the hazard by giving the
31 employee the ability to resolve the hazard on their own, if possible, or work with additional

1 departments for assistance and guidance on resolving the hazard. A workflow process is
 2 established for standardizing how each Hazard Identification Card is processed and reviewed.
 3 The Safety Incentive Program is a reward-based program focused on leading safety indicators,
 4 promoting workplace safety through positive reinforcement of observed safe behaviors and
 5 voluntary participation in various safety and risk reduction programs. Employees can receive
 6 incentive points, which can then be redeemed for rewards, by submitting Near Miss Reports,
 7 submitting Hazard Identification Cards, making safety recommendations, taking the lead on
 8 resolving known safety issues, participating in safety subcommittees and analysis of safety
 9 issues, or by demonstrating additional safety-related behaviors. These activities and other
 10 employee time dedicated to fostering an enhanced safety environment are key components of the
 11 overall VPP; (3) PPE protect employees from the risk of injury by creating a barrier against
 12 workplace hazards. PPE includes clothing and equipment designed to protect employees while
 13 performing their job (e.g., flame resistant clothing, gloves, protective eyewear). All employees
 14 who are required to use PPE are trained on when PPE is necessary, which PPE is necessary, how
 15 to properly don/remove/adjust/wear PPE, limitations of PPE and the proper
 16 care/maintenance/life/disposal of PPE.

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

20 **TABLE TS-18: RAMP Activity O&M Forecasts by Workpaper**
 21 **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*

22 * An RSE value is not calculated for this activity

1 **2. Forecast Method**

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

11 **3. Cost Drivers**

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

14 **a. Workforce Development**

15 **Substation Electricians**

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

25 **Substation Condition Based Maintenance**

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

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	3,709	133
Total	3,576	3,709	133

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

1 increasing complexities of the job. Given the additional regulatory requirements and the skilled
 2 workforce necessary, SDG&E is planning on hiring additional employees for this work group.
 3 SDG&E plans on hiring five Relay Technicians to perform maintenance of substation relay and
 4 control systems. There are also plans to hire five SCADA Technicians to install, operate,
 5 maintain, and test distribution circuit equipment including but not limited to power circuit
 6 breakers, service restorers, regulators, transformers, relays, motors, batteries, battery chargers
 7 and distribution SCADA controls. Two RTU Technicians will be hired to perform construction
 8 and maintenance of substation and field distribution metering and control equipment.

9 **4. Other Drivers**

10 **a. Fleet Vehicles**

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

13 **Distribution System Control & Protection Fleet Vehicle Needs**

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

17 **H. Distribution Design and Project Management (1ED007)**

18 **TABLE TS-21**
 19 **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	1,304	484
Total	820	1,304	484

20 **1. Description of Costs and Underlying Activities**

21 Design and Project Management (DPM)'s responsibilities vary widely, but all relate to
 22 the preparation of construction orders. Department personnel perform the design and
 23 engineering necessary to develop comprehensive construction orders, from which additions and
 24 modifications to electric distribution systems are constructed. Such construction orders range
 25 from simple services for individual customers to new installations and modifications to large
 26

1 complex distribution systems that serve subdivisions, commercial centers, and high-rise towers.
2 Also included are construction orders for converting electric overhead lines to underground
3 through various government programs and relocating existing facilities to accommodate both
4 private party requestors and government agencies. The construction order development process
5 includes meeting with customers, government agencies, and other utilities in planning and
6 coordinating additions and modifications to the electric distribution system. Department
7 personnel perform a variety of engineering calculations, analytical assessments, secure and
8 execute contracts, and special agreements. In addition, Project Management personnel prepare
9 and assemble the construction order job packages for distribution to customers, contractors, other
10 utilities, and all participating departments within SDG&E. All new project managers and
11 planners go through a series of training courses to learn the roles, tools, and responsibilities to
12 efficiently complete these tasks.

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

19 **2. Forecast Method**

20 The forecast method developed for this cost category is Base Year Recorded. This
21 method is appropriate because it most closely represents the annual O&M costs that is roughly
22 2% of Project Management's total budget. The rest of the budget is comprised of capital
23 expenses. The base year recorded was used as opposed to averages to specifically account for an
24 increased FTEs count in 2021 needed to support increased workload due to increased meter sets
25 for new business, more aggressive undergrounding, and additional response for improvements
26 for municipal customers.

27 **3. Cost Drivers**

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

1 **a. Distribution Designer Workforce Development**

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

17 **b. Software**

18 **Builder Services Portal**

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

23 **Automated Utility Design**

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

28 **Design Software Licensing**

29 There are two drivers associated with design software licensing. First, the licensing,
30 maintenance, and support service costs of a Portable Document Format markup and editing
31 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	35,360	40,769	5,409
Total	35,360	40,769	5,409

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,

1 Electric Distribution Engineering, Fleet, Environmental, as well as various governmental
2 agencies (the CPUC, Occupational Safety and Health Administration (OSHA), State of
3 California). The ERO workforce also reviews and updates standards and practices to address
4 operational incident patterns.

5 The primary job functions include:

6 **Inspection and maintenance of the electric distribution system**

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

11 **Restoration of service after outages**

12 ERO crews, made up of a working foreman, lineman, apprentices, and line assistants
13 respond to, repair, and restore primary and secondary electric outages in both the underground
14 and overhead systems based on internal Company service level policies and reliability targets.
15 Crews leverage the safety training that they have received to implement public and employee
16 safety protocols while conducting all restoration activities.

17 **Repairing service problems and addressing other customer issues**

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

21 **Constructing new electric infrastructure**

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

25 **Scheduling and Forecasting**

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

1 **a. Description of RAMP Mitigations**

2 RAMP-related costs for Electric Regional Operations include costs for (1) Mandatory
3 Employee Health and Safety Training Programs and Standardized Policies, (2) Employee
4 Behavioral Accident Prevention Process Program, and (3) PPE. As described in Table TS-6
5 above: (1) The Mandatory Employee Health and Safety Training Programs and Standardized
6 Policies includes employee health and safety training programs that Construction Management
7 personnel attend to promote mitigating the risk of an incident involving SDG&E employees; (2)
8 The Employee Behavioral Accident Prevention Process (BAPP) Program is a partnership
9 between management, volunteers, and front-line employees (employee led and management
10 supported) that provides a structured process for continuous safety improvements specific to the
11 high-risk tasks and situations faced by front-line employees. The BAPP volunteers rely on
12 hazard and risk assessment checklists, developed from historical injury analytics, to perform
13 observations focused on key areas of critical risk. These volunteers also conduct on the spot
14 accountability conversations, defining Safe and At Risk behaviors, and also collect safety data.
15 This collected data is further analyzed and utilized to identify and further act on undiagnosed risk
16 exposure. The BAPP teams work with leadership to drive hazard and risk removal and
17 mitigation efforts; (3) PPE protect employees from the risk of injury by creating a barrier against
18 workplace hazards. PPE includes clothing and equipment designed to protect employees while
19 performing their job (e.g., flame resistant clothing, gloves, protective eyewear). All employees
20 who are required to use PPE are trained on when PPE is necessary, which PPE is necessary, how
21 to properly don/remove/adjust/wear PPE, limitations of PPE and the proper
22 care/maintenance/life/disposal of PPE.

23 Table TS-23 below provides the RAMP activities, their respective cost forecasts, and the
24 RSEs for this workpaper. For additional details on these RAMP activities, please refer to my
25 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

1 perform the core electric regional operations activities of inspection and maintenance, emergency
2 and outage response, and infrastructure repair and replacement. The training process to develop
3 a line assistant into a lineman takes an average of four to five years and the risk of a reduction in
4 skilled utility labor could lead to losing our capability to deliver safe reliable power to our
5 customers. Additional resources including skilled trainers, management and administrative
6 support are also needed to support the hiring and development process of these lineman. Please
7 refer to my Skills & Compliance Training testimony set forth in section H, for additional
8 information regarding these requests.

9 **b. Corrosion Zone Enhancements**

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

16 **c. Intelligent Image Processing**

17 The cost driver behind this non-labor incremental cost is for electric infrastructure data
18 collection via car mounted cameras for ERO utilization of imagery and model predictions for
19 emergencies, outages, construction fielding, and other ad hoc (non-compliance related) uses.
20 The scope of this program includes car mounted camera imagery data collection and acquisition,
21 QA review and processing by a subject matter expert and cloud consumption costs related to
22 intelligent image processing utilized for model predictions and machine learning to support
23 ERO. The ultimate goal of this program is to increase the quality of SDG&E's inspection
24 programs by leveraging and validating the capabilities of machine learning and drive down cost
25 long term. Data validation and iterative testing of the technology will continue past 2024.
26 Acquiring the necessary equipment and the collection and validation of the initial imagery data
27 and will likely take five years. Leveraging the full machine learning to drive down costs of
28 inspections is estimated to be in the five-seven year range.

1 **4. Other Drivers**

2 **a. Fleet Vehicles**

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

5 **Electric Regional Operations Fleet Vehicle Needs**

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

12 **J. Skills & Compliance Training (1ED009)**

13 **TABLE TS-24**
14 **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	2,888	990
2. Skills & Compliance Training (TNG)	941	941	0
Total	2,839	3,829	990

15 **1. Description of Costs and Underlying Activities**

16 The Skills and Compliance Training (SCT) organization is responsible for the
17 development and training of the electric distribution workforce. The workforce consists of
18 electric field personnel, non-electrical support personnel, and first line supervision. Subject
19 matter experts (SMEs) borrowed from the field comprise eighty percent of the instructor
20 workforce. Using SMEs from the field promotes a skilled and expert workforce capable of
21 utilizing safe work practices, new technology, best work practices and operating procedures, and
22 building to construction standards. Skills and Compliance Training programs support a
23 workforce with the required skills to safely and reliably maintain and operate the electric
24 distribution and transmission system in compliance with GOs 95, 128, 165, as well as SDG&E’s
25

1 standards, work methods and operating procedures. Core training consists of the programs
2 described below.

3 **Training Facilities**

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

9 **Compliance Training**

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

15 **Equipotential Zone (EPZ) / Personal Protective Grounding Training**

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

28 **Electric Linemen Development**

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

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

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

10 **Equipment Operations and Commercial Drivers' Training**

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

13 **Additional Ancillary Training & Services**

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

28 **Specialized Task-Specific Development and Training Programs**

29 These programs are conducted for Relief Electric Troubleshooters, Relief Fault Finding
30 Specialists, Electric Meter Test Electricians, and lead cable splicers. Relief Electric
31 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	495	19
1ED009	SDG&E-Risk-8-C10	Personal Protective Equipment	113	113	0	0*

* An RSE value was not calculated for this activity

1 **a. Service upgrade demand**

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

11 **4. Other Drivers**

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

13 **L. Electric Engineering (1ED012)**

14 **TABLE TS-27**
15 **Summary of Workpaper Costs**

ELECTRIC DISTRIBUTION (In 2021 \$)			
J. Electric Engineering	2021 Adjusted-Recorded (000s)	TY2024 Estimated (000s)	Change (000s)
1. Electric Engineering	2,016	2,437 ¹³	420
2. Electric Engineering (TNG)	67	67	0
Total	2,083	2,504	420

16 **1. Description of Costs and Underlying Activities**

17 The Electric Engineering group is responsible for all equipment pertaining to the
18 distribution network. Responsibilities include the development and maintenance of overhead
19 and underground equipment specifications, risk analysis and mitigation, as well as the
20 development of construction standards and work methods to enable safe and reliable customer
21 service throughout the 4kV and 12kV electric distribution system. The specification
22 requirements include all service standards for customer facilities as well as design manual
23

¹³ 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 corresponding correction to testimony and workpapers at the next available opportunity.

1 standards for all of our project management design teams. Creation of new codes to estimate the
2 required material, labor, and equipment for construction as well as maintenance of existing codes
3 to support the design teams. Real-time support for operations and constructions teams are also
4 daily requirements. New and revised construction standards and material specifications are
5 designed to provide community safety and system reliability while keeping pace with technology
6 advancements in areas such as fire-preparedness, communication technology improvements, and
7 renewable integration. The electric standard practices developed by the team establish uniform
8 and safe work methods and procedures and inspection requirements to enable regulatory
9 compliance with all governing agencies. Construction standards and standard practices are used
10 by Company and contractor construction forces throughout the SDG&E electric distribution
11 system.

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

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

29 Within Electric Engineering, there is an Associate Engineer program. The Associate
30 Engineer program is an ongoing training program that is a key component of the effort to
31 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

1 engineering and design needed for SDG&E's electric system hardening program. Electric
2 Engineering supports these primarily capital projects, which increased significantly in 2020 and
3 2021, and will continue at the higher level for the foreseeable future. These projects have
4 associated O&M expenditure. When factoring this in, base year 2021 recorded data with
5 incremental adjustments is the most appropriate forecasting methodology for this work paper.

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

8 **3. Cost Drivers**

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

12 **a. Engineering Capabilities**

13 All overhead and underground work requires engineering support as well as additional
14 engineering resources needed to support the increasing electric capital and wildfire related
15 workloads. Another driver is an increasing work scope updating and expanding standards related
16 to hardening the distribution system. There is also an increasing level of effort required to
17 remain compliant with the need to review and give guidance on pole loading calculations
18 throughout the Company's service territory. The costs for these engineers will be allocated
19 approximately 98% capital and 2% O&M.¹⁴ This 2% upward O&M pressure is a result of the
20 capital program demands listed above. Please see the Electric Distribution Capital testimony of
21 Oliva Reyes (Ex. SDG&E-11) and the Wildfire Mitigation and Vegetation Management
22 testimony of Jonathan Woldemariam (Ex. SDG&E-13) for further details of the capital programs
23 driving these costs.

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

¹⁴ 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.

1 **4. Other Drivers**

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

3 **M. Troubleshooting (1ED013)**

4 **TABLE TS-29**
5 **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

6 **1. Description of Costs and Underlying Activities**

7 The Operations & Engineering (O&E) workgroup covers six districts and two satellite
8 locations within SDG&E’s service territory. The O&E workgroups for each of the six districts
9 consist of Electric Troubleshooters, engineers, technical assistants, and management supervision.
10 The O&E workgroup is responsible for engineering and system troubleshooting to enable
11 reliable and safe electric service to SDG&E customers. Electric Troubleshooters are a key
12 resource, acting as SDG&E’s first responders. The Electric Troubleshooters have the specific
13 skills necessary to timely restore electric service during emergencies and unplanned interruptions
14 while protecting public and employee safety. During service interruptions, Electric
15 Troubleshooters are tasked with isolating affected areas of SDG&E’s distribution system and
16 implementing restoration efforts that will minimize the impact of any service interruptions to
17 SDG&E customers. During emergencies, Electric Troubleshooters work closely with emergency
18 response agencies to protect the public and SDG&E’s employees from potentially hazardous
19 conditions. Electric Troubleshooters act as the primary interface with customers who are
20 experiencing service problems. Electric Troubleshooters perform a variety of additional tasks
21 including substation and field switching, substation security checks, and routine safety patrols
22 related to SDG&E’s inspection and maintenance CMP. The remainder of the O&E workgroup
23 provides necessary engineering, compliance administration, and supervisory support, all essential
24 to providing safe and reliable service.
25

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.

1 **3. Cost Drivers**

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

4 **4. Other Drivers**

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

6 **N. Portfolio & Project Management (1ED014)**

7 **TABLE TS-31**
8 **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

9 **1. Description of Costs and Underlying Activities**

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

15 In addition, Portfolio & Project Management is responsible for managing the entire
16 electric portfolio and providing project services and controls, including capital project
17 accounting support, document control management, project scheduling, and quality
18 assurance/quality control. Portfolio management is responsible for aligning all capital projects to
19 the Company vision, strategy, and priorities. They work to unify business units across SDG&E
20 by focusing on budget and resource utilization while promoting accountability and efficiency.¹⁵
21 Project accounting supports the Company in compliance with internal and external financial
22 policies and requirements through contract invoice review, audit support, monthly accruals, and
23

¹⁵ 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.

1 SOX compliance. Document control and project scheduling is provided to maintain project
2 timelines and meet schedule goals while verifying that all documents for projects are labeled and
3 safely stored for the required document retention timeline as required. QA/QC support is
4 provided to validate quality in design, construction, and manufacturer fabrication. This is
5 accomplished through design reviews, post construction checks, manufacturer audits, special
6 inspections, pole inspections, and vendor reviews. Additionally, this department is responsible
7 for testing and qualifying electric distribution design resources. This verifies that all work is
8 built to SDG&E Design and Safety Standards and is in accordance with GO 95 and GO 128
9 design and construction specifications.

10 **2. Forecast Method**

11 The forecast method developed for this cost category is base year. This method, along
12 with including incremental adjustments as discussed in the Cost Driver section below, was
13 selected as current staffing and activity levels are most representative of the costs moving
14 forward, as they include the addition of the portfolio management functional roles and the
15 expansion of the quality assurance/quality control team. These roles support efficient processing
16 of work to enable greater, more streamlined capacity and reduce cycle times for all electric
17 system projects and validate quality in design, construction, and manufacturer fabrication

18 **3. Cost Drivers**

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

21 **a. Enterprise Project Management Standardization**

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

27 New Project Management roles are also needed to provide support for new battery
28 storage projects and to further support electric system hardening initiatives. A specialized
29 QA/QC team is responsible for the review and analysis of projects including a constructability
30 review, validation of the engineering and design information, and post-construction verification
31 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.¹⁶ Additional team members are planned to provide specialized support for document management and scheduling software, allowing project managers to focus on project delivery.

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

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

1 **1. Description of Costs and Underlying Activities**

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

8 **Compliance Management Group**

9 Compliance Management Group (CMG) has the responsibility to manage regulatory
10 compliance to GOs 95, 128, 165 and 166. The group carries out its function through audits,
11 statistical analysis, reporting, and training of field personnel. It also maintains the relationship
12 with the CPUC’s Safety Policy Division to comply with CPUC requests regarding the electric
13 distribution system. CMG also maintains responsibility for all joint utility processes related to
14 CIP attachments, assuring compliance with CPUC D.98-10-058, SDG&E’s structural licensing
15 process. CIP attachment management includes QA/QC of new applications, oversight of CIP
16 attachment transfers/buddy poles (*i.e.*, joint utility communication forms), and pole data record-
17 management (related to regulatory requirements and joint attachments).

18 **Program Management Group**

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

27 **2. Forecast Method**

28 Labor and non-labor forecasts for Compliance Management are based on the 2021 base
29 year data. This forecast methodology, along with including incremental adjustments as
30 discussed in the Cost Driver section below, best represents workload forecasts due to CMP
31 cycles and structures which fall outside of the HFTD, which vary over a ten-year cycle making a

1 three or five year average ineffective. The base year best represents expected costs during this
2 GRC cycle.

3 **3. Cost Drivers**

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

7 **a. Pole Attachment Data Points**

8 The CPUC issued D.21-10-019 on October 26, 2021 requiring pole owners to provide 20
9 data points such as asset information on attachments, the status of attachment requests,
10 attachment design information, and structural loading information.¹⁷ The data will be managed
11 through a database to be developed and operated by the pole owners.

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

21 Although SDG&E seeks recovery for this program in this GRC, absent a memorandum
22 account to track the incremental Track 2 costs, SDG&E would not have reasonable opportunity
23 to recover the costs associated with implementing the new requirements directed in the Track 2
24 Decision prior to the effective date of its next GRC application. A Track 2 cost memorandum
25 account (T2CMA) will be needed to provide a cost-recovery mechanism for SDG&E's
26 compliance costs for 2022-2023. For further explanation related to the regulatory accounting
27 treatment, please refer to the Regulatory Accounts testimony of Jason Kupfersmid (Ex. SDG&E-
28 43).

¹⁷ D.21-10-019, Ordering Paragraph 1 at 125, and Attachment A.

1 **3. Cost Drivers**

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

4 **4. Other Drivers**

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

6 **Q. Regional Public Affairs (1ED017)**

7 **TABLE TS-34**
8 **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

9 **1. Description of Costs and Underlying Activities**

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

18 **2. Forecast Method**

19 Labor and non-labor forecasts for Regional Public Affairs are based on the base year
20 2021 recorded data. The base year methodology, along with including incremental adjustments
21 as discussed in the Cost Driver section below, best represents the outlook going forward to
22 support increased relations with various municipalities and our increase in capital project
23 programs.
24

and funding request for this Category nor the forecast and funding request for any other witness, as such the error was not corrected.

1 **3. Cost Drivers**

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

4 **a. City of San Diego Franchise Commitments**

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

8 **4. Other Drivers**

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

10 **V. CONCLUSION**

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

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

1 **VI. WITNESS QUALIFICATIONS**

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

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

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

19 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

APPENDIX C

SDG&E'S GRID MODERNIZATION PLAN

Appendix C

Grid Modernization Plan

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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

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.

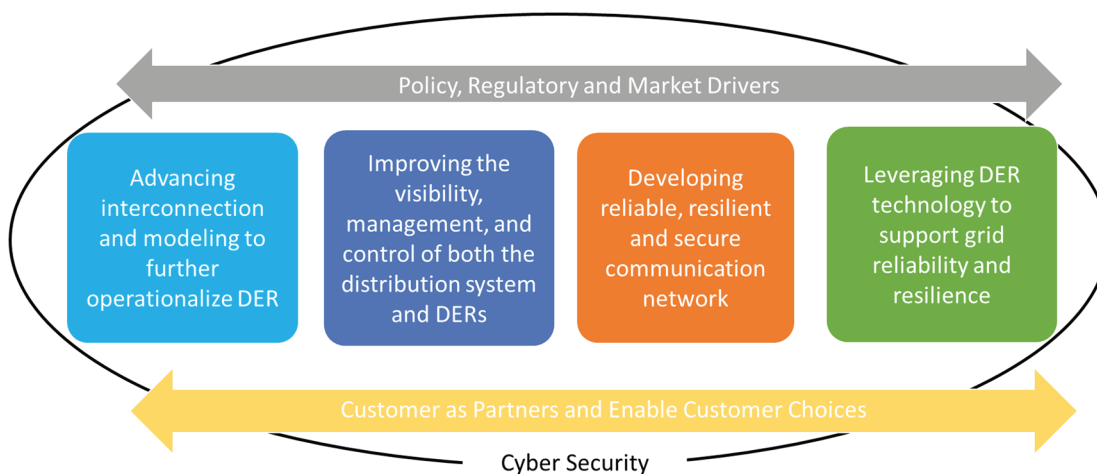


Figure 1- Grid Modernization Plan Key Themes

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.

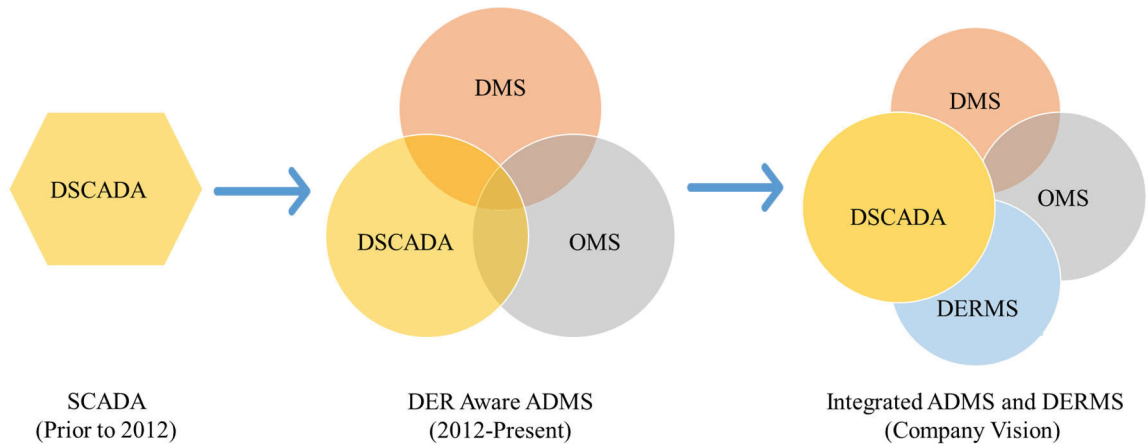


Figure 2 – Control System Evolution at SDG&E

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 metrics.

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 by leveraging sensors and relays to quickly 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.

Fiber Development

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 2030.5² 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 Plan 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.

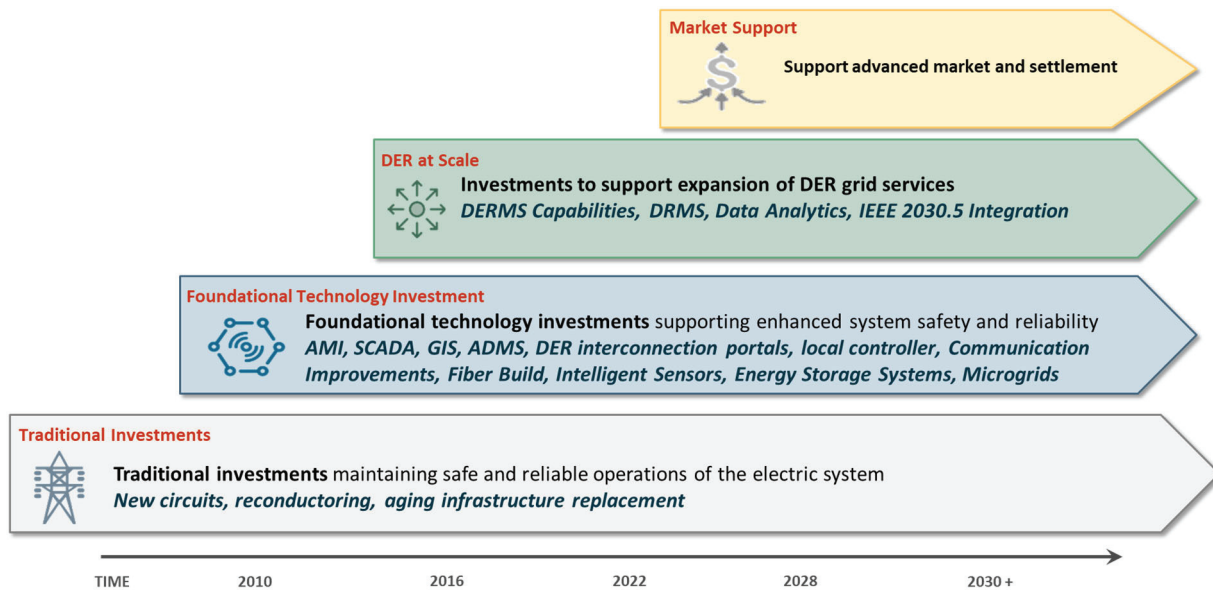


Figure 3- Grid Modernization Investment Phased Roadmap

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-term 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	
<i>Related Grid Modernization Categories</i>	6. Interconnection Processing Tool
<i>System integration challenges the technology supports</i>	The DIIS enables an integral process for customer to integrate DER, it does not specifically address any system integration challenges ⁶ .
<i>Grid services the technology enables</i>	The DIIS enables a user-friendly process for customer to integrate DER, it does not specifically enable any grid services.
<i>Supporting Technology</i>	Data Portals Planning Tools
<i>Technology Maturity</i>	SDG&E DIIS has been implemented since 2013 and is a mature and existing technology.
<i>Expected Useful Life of Equipment</i>	>5 years
<i>Equipment capacities, ratings, and other specifications</i>	Not applicable
<i>Which DERs does the Technology Integrate</i>	PV, Wind Generator, EV, Energy Storage (ES)
<i>Proposed method and result for assessment of cost reasonableness</i>	DIIS is a home-grown application designed and developed by SDG&E.
<i>Locational Investment and Deployment Plan</i>	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	
<i>Related Grid Modernization Categories</i>	19. Microgrid Interface
<i>System integration challenges the technology supports</i>	Item 1-6 of list of challenges
<i>Grid services the technology enables</i>	Reliability and Resilience
<i>Supporting Technology</i>	SCADA, ADMS, DERMS
<i>Technology Maturity</i>	SDG&E LADC is an innovative solution to control resources within microgrid. The technology is built upon existing control system and data platform
<i>Expected Useful Life of Equipment</i>	>10 years
<i>Equipment capacities, ratings, and other specifications</i>	Not Applicable
<i>Which DERs does the Technology Integrate</i>	ES and PV, but has the potential to integrate other DERs
<i>Proposed method and result for assessment of cost reasonableness</i>	Lowest cost approach SDG&E utilized the Request for Proposal (“RFP”) process to select the vendor for LADC.
<i>Locational Investment and Deployment Plan</i>	SDG&E is deploying LADC in accordance with the deployment of the microgrid systems.

SDG&E – 25 – 00900C – Demand Response Management Systems (“DRMS”) Replacement	
<i>Related Grid Modernization Categories</i>	2. Grid Management System
<i>System integration challenges the technology supports</i>	Item 6, 10 of list of challenges
<i>Grid services the technology enables</i>	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.
<i>Supporting Technology</i>	Not applicable
<i>Technology Maturity</i>	DRMS has been widely deployed in the industry and is a mature and existing technology.
<i>Expected Useful Life of Equipment</i>	>5 years
<i>Equipment capacities, ratings, and other specifications</i>	Not Applicable
<i>Which DERs does the Technology Integrate</i>	Demand Response
<i>Proposed method and result for assessment of cost reasonableness</i>	Lowest Cost Approach SDG&E selects DRMS vendor through RFP process.
<i>Locational Investment and Deployment Plan</i>	Not a locational investment

SDG&E – 25 – 00920BA – Enterprise Distributed Energy Resource Management System (DERMS)	
<i>Related Grid Modernization Categories</i>	2. Grid Management System
<i>System integration challenges the technology supports</i>	Item 1-7 of list of challenges
<i>Grid services the technology enables</i>	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.
<i>Supporting Technology</i>	SCADA, ADMS, WAN, FAN
<i>Technology Maturity</i>	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.
<i>Expected Useful Life of Equipment</i>	The DERMS project involves integration across multiple software systems. Useful life of software ranges from 10-15 years.
<i>Equipment capacities, ratings, and other specifications</i>	Not applicable
<i>Which DERs does the Technology Integrate</i>	Potentially all DERs
<i>Proposed method and result for assessment of cost reasonableness</i>	SDG&E plans to utilize the “lowest cost approach” to evaluate the technologies.
<i>Locational Investment and Deployment Plan</i>	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:

<p>EPIC-1 Project 1. Smart Grid Architecture Demonstrations</p>	<p>This project investigated emerging communication architecture standards for power system modernization, with focus the IEC 61850 standards.</p>
<p>EPIC-1 Project 2. Visualization and Situational Awareness Demonstration</p>	<p>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.</p>
<p>EPIC-1 Project 3. Distributed Control for Smart Grids</p>	<p>This project investigated the structure for hierarchical control of distribution systems as they become more complex with adoption DER and other emerging component types.</p>
<p>EPIC-1 Project 4. Demonstration of Grid Support Functions of Distributed Energy Resources</p>	<p>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.</p>
<p>EPIC-1 Project 5. Smart Grid Circuit Demonstrations</p>	<p>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.</p>

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:

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

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. DER-Specific Integration Challenges

- 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 compromised 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
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	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 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	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)	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

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
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

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
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

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
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)

SDG&E 2024 GRC Testimony Revision Log – August 2022

Exhibit	Witness	Page	Line or Table	Revision Detail
<i>SDG&E-12</i>	<i>Tyson Swetek</i>	<i>TS-vi</i>	<i>Summary Table</i>	<i>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</i>
<i>SDG&E-12</i>	<i>Tyson Swetek</i>	<i>TS-vi</i>		<i>Updated text to reflect change to Compliance Management category New: “...forecast of \$132,721,000...” Old: “...forecast of \$139,296,000...”</i>
<i>SDG&E-12</i>	<i>Tyson Swetek</i>	<i>TS-vii</i>		<i>Updated text to reflect changes New: (62.3%), (31.6%), (30.7%) Old: (58.7%), (29.4%), (29.3%)</i>
				<i>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</i>
<i>SDG&E-12</i>	<i>Tyson Swetek</i>	<i>TS-1</i>	<i>Table TS-1</i>	<i>Updated text to reflect change New: “...forecast of \$132,721,000...” Old: “...forecast of \$139,296,000...”</i>
<i>SDG&E-12</i>	<i>Tyson Swetek</i>	<i>TS-1</i>	<i>Line 18</i>	<i>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</i>
<i>SDG&E-12</i>	<i>Tyson Swetek</i>	<i>TS-16</i>	<i>Table TS-8</i>	<i>Corrected RSE value for SDG&E-Risk-8-C08 to 196 from 84</i>

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		Added footnote 13 informing of an identified error that was not corrected
SDG&E-12	Tyson Swetek	TS-61		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		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