Company: San Diego Gas & Electric Company (U 902 M)
Proceeding: 2024 General Rate Case
Application: A.22-05-______
Exhibit: SDG&E-15

PREPARED DIRECT TESTIMONY OF

FERNANDO VALERO

(CLEAN ENERGY INNOVATIONS)

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

MAY 2022

TABLE OF CONTENTS

APPENDICES

SUMMARY

CLEAN ENERGY INNOVATIONS (In 2021 $)			
	2021 Adjusted-Recorded (000s)	**TY2024 Estimated (000s)**	**Change (000s)**
Total Non-Shared Services	3,896	9,985	6,089
Total Shared Services (Incurred)	0	0	0
Total O&M	**3,896**	**9,985**	**6,089**

CLEAN ENERGY INNOVATIONS (In 2021 $)			
	Estimated 2022 (000s)	**Estimated 2023 (000s)**	**Estimated 2024 (000s)**
NON-COLLECTIBLE (NC)	20,520	24,684	26,333
COLLECTIBLE (CO)	2,504	290	0
Total CAPITAL	**23,024**	**24,974**	**26,333**

Summary of Requests

San Diego Gas & Electric Company (SDG&E or Company) is requesting the California Public Utility Commission (CPUC or Commission) adopt its Test Year 2024 (TY 2024) General Rate Case (GRC) forecast of $9.985 million for SDG&E's Clean Energy Innovations' operations and maintenance (O&M) expenses. SDG&E also requests the Commission adopt its forecast for SDG&E's Clean Energy Innovation's capital expenditures in 2022, 2023, and 2024 of $20.520 million, $24.684 million, and $26.333 million, respectively. These O&M and capital requests are reasonable and fully justified in that the activities:

1. Support the Company's current and future efforts to promote and achieve the State's goal of decarbonizing the electric grid by deploying clean energy technologies.
2. Support the Company's current and future efforts to provide grid resiliency and operational flexibility to its customers utilizing clean energy alternatives and proactive testing and analysis.
3. Support a Research, Development and Demonstration (RD&D) program which seeks to advance clean energy alternatives, provide advanced system controls and provide customer end-use solutions for transportation electrification.

PREPARED DIRECT TESTIMONY OF FERNANDO VALERO (CLEAN ENERGY INNOVATIONS)

I. INTRODUCTION

A. Summary of Clean Energy Innovations Costs and Activities

My testimony supports the TY 2024 GRC forecasts for O&M costs for non-shared services, and capital costs for the forecast years 2022, 2023, and 2024, associated with the Clean Energy Innovations activities for SDG&E. Clean Energy Innovations at SDG&E supports the delivery and use of clean energy throughout SDG&E's service territory. As described in my testimony, this includes the evaluation, testing and deployment of infrastructure and technologies needed to achieve both SDG&E's and California's goal of decarbonization, resiliency, and operational flexibility, supporting customers' adoption of clean energy technologies, and re-establishing an RD&D program at SDG&E.[1] Table FV-1 summarizes my sponsored costs.

TABLE FV-1
Test Year 2024 Summary of Total Costs[2]

CLEAN ENERGY INNOVATIONS NON-SHARED SERVICES O&M (In 2021 $)			
	2021 Adjusted-Recorded (000s)	**TY2024 Estimated (000s)**	**Change (000s)**
Hydrogen Strategy and Implementation Department	1,221	1,376	155
Advanced Clean Technology Department	617	1,011	394
Innovation Technology Development	0	5,000	5,000
Sustainable Communities	180	282	102
Distributed Energy Resource Engineering Department	1,878	2,316	438
Total O&M	**3,896**	**9,985**	**6,089**

1 SDG&E's 2008 GRC (D.08-07-046) and 2012 GRC (D.13-05-010) authorized SDG&E for a RD&D program.

2 Totals in tables may include rounding differences.

CLEAN ENERGY INNOVATIONS CAPITAL (In 2021 $)			
	Estimated 2022 (000s)	**Estimated 2023 (000s)**	**Estimated 2024 (000s)**
A. Advanced Energy Storage	13,258	16,448	22,582
B. Microgrid and Controls	4,217	(188)	0
C. Sustainable Communities	969	407	439
D. Mobile Energy Storage	2,076	2,076	2,076
E. Hydrogen	0	5,941	1,236
Total CAPITAL	**20,520**	**24,684**	**26,333**

I am responsible for supporting the costs associated with the Advanced Clean Technology (ACT), Hydrogen Strategy and Implementation, and Distributed Energy Resources (DER) Engineering O&M budgets, and the capital costs associated with deploying investments to deliver clean energy for customers. With an additional focus at the CPUC on activities such as the integration of high amounts of DER,[3] programs to support customer adoption of clean energy technologies,[4] and post-implementation evaluation of clean energy programs,[5] this has resulted in incremental regulatory activities requiring additional staff to support the Commission in their objectives. Similarly, additional staff is needed to support increased distribution system infrastructure investments to ensure integration of DERs and delivery of energy produced by the DERs.

B. Support To and From Other Witnesses

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

- Estela de Llanos (Exhibit SDG&E-02, Sustainability Policy)
- Tyson Swetek (Exhibit SDG&E-12, Electric Distribution O&M)
- Daniel S. Baerman (Exhibit SDG&E-14, Electric Generation)

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3 *See* R.21-06-017 (High DER Order Instituting Rulemaking [OIR]).

4 *See* R.20-05-012 (Self-Generation Incentive Program [SGIP] OIR); R.20-08-022 (Clean Energy Financing OIR; R.19-09-009 (Microgrid OIR).

5 For example, D.13-10-040 requires the Commission to conduct a comprehensive evaluation of the Commission's Energy Storage Framework and energy storage procurement in compliance with Assembly Bill 2514. The Commission has retained Lumen to support this effort. *See* https://lumenenergystrategy.com/energystorage.html.

- William J. Exon (Exhibit SDG&E-25, Chapter 2, Information Technology)
- Arthur Alvarez (Exhibit SDG&E-22, Fleet Services)

C. Organization of Testimony

My testimony is organized as follows:

- Introduction
- Discussion on Sustainability and Safety Culture initiatives with references to the appropriate workpapers
- Testimony on five Non-Shared Cost Categories, broken down into three sections each:
  - Description of Costs & Underlying Activities
  - Forecast methodology
  - Cost Drivers
- Testimony on nine Capital Costs, broken down into three sections each:
  - Description of Costs & Underlying Activities
  - Forecast methodology
  - Cost Drivers
- Support to other witnesses
- Conclusion

II. SUSTAINABILITY AND SAFETY CULTURE

As discussed by Ms. De Llanos (Ex. SDG&E-02), the integration and deployment of clean energy technologies is crucial to reaching California's decarbonization goal. SDG&E has been a leader in adoption of energy storage since 2013,[6] with approximately 74 megawatts (MW) of utility-owned energy storage, 93 MW of customer-owned energy storage paired with solar, and 36 MW of customer-owned stand-alone energy storage interconnected and operational as part of SDG&E's electric system as of December 31, 2021. SDG&E's energy storage portfolio is utilized for a variety of use cases, including but not limited to power quality, microgrid islanding, and participating in the California Independent System Operator (CAISO) wholesale marketplace, showcasing the many benefits that energy storage offers to the electric system.

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[6] *See* D.13-05-010 at 226 (approving SDG&E's first energy storage systems as part of the Energy Storage project under the Smart Grid category.)

SDG&E's utility-owned energy storage portfolio consists of various different technology types of energy storage systems, including two lithium-ion chemistries - nickel manganese cobalt and lithium iron phosphate, vanadium redox flow, and an iron salt flow. Owning, operating, and maintaining these assets has enabled SDG&E to increase its understanding of the various operational aspects of energy storage technologies and the many benefits that energy storage technologies can offer to the electric system. Applying this gained operational experience to such a diverse portfolio of energy storage technologies allows SDG&E to deploy the right technology in the most appropriate situation and maximize the benefits that energy storage can offer the electric systems and SDG&E's customers. These operational learnings have also allowed SDG&E to provide technical assistance to its customers when integrating their own energy storage technologies.

Supporting customers and their desire to adopt clean energy technologies will require investment in electric system infrastructure in order to maximize the benefits these technologies are able to offer to reduce overall emissions in SDG&E's service territory. SDG&E's projects and associated funding requests will help more than just the electric sector decarbonize – the investments will also support the residential, commercial and transportation sectors in adopting clean technologies.

III. NON-SHARED O&M COSTS

"Non-Shared Services" are activities that are performed by a utility solely for its own benefit.[7] Corporate Center provides certain services to the utilities and to other subsidiaries. For purposes of this GRC, 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 FV-2 summarizes the total non-shared O&M forecasts for the listed cost categories.

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

TABLE FV-2
Non-Shared O&M Summary of Costs

CLEAN ENERGY INNOVATIONS NON-SHARED SERVICES O&M (In 2021 $)			
	2021 Adjusted-Recorded (000s)	**TY2024 Estimated (000s)**	**Change (000s)**
Hydrogen Strategy and Implementation Department	617	1,011	394
Advanced Clean Technology Department	1,221	1,376	155
Innovation Technology Development	0	5,000	5,000
Sustainable Communities	180	282	102
Distributed Energy Resource Engineering Department	1,878	2,316	438
Total O&M	**3,897**	**9,985**	**6,088**

A. 1DD001 Hydrogen Strategy and Implementation Department O&M

TABLE FV-3
Hydrogen Strategy and Implementation Department

CLEAN ENERGY INNOVATIONS NON-SHARED SERVICES O&M (In 2021 $)			
	2021 Adjusted-Recorded (000s)	**TY2024 Estimated (000s)**	**Change (000s)**
Hydrogen Strategy and Implementation Department	617	1,011	394
Total O&M	**617**	**1,092**	**475**

1. Description of Costs and Underlying Activities

The production, storage, transportation, and use of clean hydrogen is a relatively new and growing area of interest for SDG&E to support California's and the Company's climate and sustainability goal in order to decarbonize its customer's energy, in addition to helping decarbonize SDG&E's own internal operations.

The Hydrogen Strategy and Implementation (HSI) department is responsible for understanding, developing, incorporating, and promoting the integration of clean hydrogen projects into the Company's electric, gas, and internal operations to help prepare the Company and its customers for an equitable, low carbon future, in which clean hydrogen is likely to play an important role. The O&M expenses include labor costs for department staff and the non-labor costs for performing critical modeling, analysis, and customer engagement to inform future hydrogen investments.

SDG&E has two unique and first-of-their-kind clean hydrogen projects already underway[8] with plans to expand its hydrogen project portfolio by adding clean microgrids with long duration hydrogen energy storage, evaluating novel hydrogen applications for low carbon dispatchable generation, and developing hydrogen fueling stations for SDG&E's growing fleet of hydrogen fuel cell electric vehicles (HFEV).[9] The HSI department supports company goals, manages regulatory activities relating to hydrogen eligibility and integration on the electric and gas infrastructure systems, manages hydrogen technology innovation and assessment, and manages applications for public funding such as the $9.5 billion dollars allocated toward hydrogen projects in recent federal legislation.[10] The HSI department is committed to applying for federal dollars to help offset the costs of hydrogen projects to SDG&E's customers.

In order to evaluate future investments that may be required to deploy hydrogen infrastructure on the electric generation and the gas distribution systems, SDG&E has identified modeling and technical analysis work that will be necessary to fully understand the current challenges and the associated costs of various hydrogen solutions. SDG&E is requesting Non-Labor costs for the use of contractor and consultant resources to cover the following issues that are not being examined in any other SDG&E application or by the California Energy Commission (CEC):

- **Desert Star H2 Conversion Study and Technical Analysis:** SDG&E is interested in understanding the usefulness, feasibility, and costs to implement hydrogen blending at the Desert Star 490 MW combined cycle natural gas plant located in Boulder City, Nevada. This is a very complex evaluation affecting nearly every system at the plant, necessitating SDG&E to bring in third-party technical and engineering experts to inform what will be required for a phased

8 SDG&E's Commitment to Sustainability: Hydrogen Innovation. *See* https://www.sdge.com/more-information/environment/sustainability-approach#hydrogen.

9 *See* SDG&E witness Arthur Alvarez's Direct Testimony (Exhibit SDG&E-22, Fleet Services) for more information on SDG&E's proposed HFEVs and SDG&E witness Dale Tattersall (Ex. SDG&E-23) for the proposed hydrogen fueling stations.

10 Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, 135 Stat. 429 (2021). *See* https://www.congress.gov/bill/117th-congress/house-bill/3684/text.

plan to convert Desert Star to using hydrogen as a source fuel and understand how SDG&E can produce and store the hydrogen onsite while reducing overall water consumption. This technical analysis will inform SDG&E's hydrogen and decarbonization strategy and enable the Company to make prudent capital investments for its customers in the future.

- **Cuyamaca Pre-Feasibility Study:** SDG&E plans to hire third-party technical and engineering experts to model the costs and feasibility of converting the Cuyamaca Energy Center 50 MW natural gas-powered black start peaker plant to be 100% hydrogen fuel. This facility is located in El Cajon, California.
- **Clean Gas Alternatives to Electrification Study:** SDG&E plans to contract for a study to aid its efforts to understand better the many implications of injecting hydrogen into the existing natural gas pipeline as a solution to achieving emission reduction goals. The study will involve comparing two pathways: a "Clean Fuels Scenario" that assumes a 20% hydrogen blend in the gas pipeline, and an "Early and Complete Electrification Scenario" that assumes 100% electric appliance sales by 2030. Developing these scenarios to occur in a representative community of 1,000 SDG&E service territory customers will allow SDG&E to better understand: (1) potential costs to the customers both individually for electrical service equipment upgrades, appliance upgrades, as well as through system costs and rate impacts, (2) overall Greenhouse Gas (GHG) reduction achieved, and (3) timing for appliance and system upgrades. The holistic nature of this analysis and its results will help inform how SDG&E, and perhaps California as a whole, can approach and design an equitable transition to a low carbon future for residential customers.
- **Hydrogen Perception and Acceptance Survey:** SDG&E's HSI department requests Non-Labor funding to contract for a first-of-its-kind market research survey regarding Hydrogen Perception and Acceptance. The goal of initiating the Hydrogen Perception and Acceptance Survey is to gain an understanding of the level of customer acceptance around hydrogen blending in a natural gas line, as well as to understand better their feelings and concerns about the clean energy transition that SDG&E will be helping usher our customers through. The results

of the survey will: (1) help inform SDG&E's strategy around residential clean energy transformation; (2) highlight where the Company may need to invest in hydrogen-related outreach and education to its customers; and (3) create better program designs that help its customers meet the energy transition challenges they face. SDG&E plans to partner with a local university to create data and learnings that can be made public.

2. Forecast Method

The forecast method developed for this cost category is base year. This method, along with including incremental adjustments as discussed in the Cost Driver section below, is most appropriate because it accurately represents the current state of the HSI department activities including capital projects proposed in this GRC and other proceedings. Furthermore, this method best reflects current and future operating requirements for the HSI department to support core business initiatives, including regulatory activities. This department was established in 2021, so forecasting is important without a deep history of operations.

3. Cost Drivers

The cost drivers behind the HSI department O&M forecast are driven by the growth in interest by industry, customers, regulators, and federal legislation in the deployment of hydrogen for multiple applications, including to support clean and firm dispatchable generation, decarbonization of the gas system, and zero-emission transportation.

Additional HSI department staff is required to properly engage in project development, pursue external (*i.e.,* federal and state) funding opportunities, manage regulatory requirements, negotiate contracts, and manage projects. Currently, the HSI team is small, with only four full-time equivalents (FTEs). SDG&E's requests include increasing the HSI team by an additional three FTEs, including a Business Analyst, Project Manager, and Business Development Manager. The existing team and additional staff will support modeling efforts for future hydrogen investments, support of future hydrogen capital projects, and the development of new business opportunities, including applications for external funding sources.

B. 1DD1002 Advanced Clean Technology Department

The mission of SDG&E's Advanced Clean Technology (ACT) team is to identify, advance and build innovative solutions that are necessary solutions on SDG&E's pathway for a clean energy transition. As discussed by Ms. de Llanos (Ex. SDG&E-02), SDG&E has set a goal to reach Net Zero GHG emissions by 2045 and adopted a Sustainability Strategy to support this goal. The role of SDG&E's ACT team is to identify and deploy projects that can deliver clean energy to align with the goal of reaching Net Zero by 2045.

TABLE FV-4
Advanced Clean Technology Department

CLEAN ENERGY INNOVATIONS NON-SHARED SERVICES O&M (In 2021 $)			
	2021 Adjusted-Recorded (000s)	**TY2024 Estimated (000s)**	**Change (000s)**
Advanced Clean Technology Department	1,221	1,376	155
Total O&M	**1,221**	**1,376**	**155**

1. Description of Costs and Underlying Activities

The ACT department is responsible for developing and deploying energy storage, microgrids, integration software and other clean energy technologies to provide electric stability and to help the Company continue to operate the system effectively, delivering clean energy in a safe, resilient, and efficient manner. The O&M expenses include labor costs for the department staff and the non-labor costs for training and staff development.

SDG&E designed, built, and now operates several microgrids that have the capability to leverage renewable resources to provide electric service continuity to communities during emergencies and outages in a safe and stable manner. The ACT department supports the development and deployment of energy storage systems and microgrids throughout SDG&E's service territory as a means to reinforce safety and resiliency for communities and critical facilities, reduce outage impacts as a result of public safety power shutoffs, and promote equity for disadvantaged and vulnerable communities. The ACT department also supports regulatory activities relating to DER integration, technology innovation and microgrid deployment. Members of the department actively engage in and contribute to statewide activities on high DER and clean energy technology adoption, and also facilitate internal activities on grid modernization-related investments.

2. Forecast Method

The forecast method developed for this cost category is base year. This method, along with including incremental adjustments as discussed in the Cost Driver section below, is most appropriate because it best reflects current and future operating requirements for the ACT department to support core business initiatives including regulatory activities such as the Microgrid OIR,[11] the High DER OIR,[12] and in the Electric Program Investment Charge (EPIC) OIR.[13] The ACT department is also responsible for the development of microgrids under the Wildfire Mitigation Plan, identification and development of utility-owned energy storage, asset management of utility-owned energy storage resources, coordination of support for external grant and funding opportunities, and business development partnerships to support the adoption of clean energy technologies.

3. Cost Drivers

The cost drivers behind this forecast are:

- Distributed Energy Resources (DER): risk of safety and electric system stability incidents due to the high penetration of DERs on SDG&E's system;
- Sustainability: support customer adoption of clean energy technologies and delivery of clean energy throughout SDG&E's system; and
- Environmental and Regulatory Compliance: support SDG&E's involvement in regulatory proceedings, advice letter filings, compliance requirements, and other directives from the Commission.

SDG&E has and continues to design, develop, and deploy energy storage systems and microgrids that help maintain the safety and stability of the electric system. Additional ACT department staff is required to properly engage in contract negotiations, procurement, development, and project management of these projects.

Additional ACT department staffing is also needed to keep pace with the rapid development in grid technology, customer technology, and associated integration standards. This additional staff is also needed to develop and implement a research and development program to vet and test technologies before commercial deployment, as discussed further below in Section IV.

The ACT department also needs an additional technology advisor to participate in and support activities associated with the increasing demand initiated by State regulatory and

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[11] R.19-09-009.

[12] R.21-06-017.

[13] R.19-10-005.

legislative activities, including but not limited to the Microgrid OIR and the High DER OIR proceedings.

C. 1DD003 Innovation Technology Development O&M

TABLE FV-5
Innovation Technology Development

CLEAN ENERGY INNOVATIONS NON-SHARED SERVICES O&M (In 2021 $)			
	2021 Adjusted-Recorded (000s)	**TY2024 Estimated (000s)**	**Change (000s)**
Innovation Technology Development	0	5,000	5,000
Total O&M	**0**	**5,000**	**5,000**

1. Description of Costs and Underlying Activities

SDG&E's RD&D program, called the Innovation Technology Development program, will identify and support new technologies and research activities that benefit SDG&E's customers and are consistent with California's and the Company's climate and sustainability goals which include lower GHG emissions and operational efficiencies. SDG&E's RD&D program does not include any pre-commercial demonstrations, which SDG&E is separately authorized to conduct as part of the EPIC program. California Public Utilities Code Section 740.1 provides authority for utility RD&D activities that benefit ratepayers through improved reliability, safety, environmental benefits, and operational efficiencies provided that efforts are not duplicative of other research funding entities. The TY 2024 request of $5.0 million supports the Company's sustainability goal for a decarbonized future. As discussed in the Regulatory Accounts testimony of Jason Kupfersmid (Ex. SDG&E-43), SDG&E concurrently requests authority to open a one-way balancing account to track the costs associated with this RD&D program.[14]

[14] The request for a one-way balancing account is consistent with prior authorization for regulatory account treatment for RD&D funding. *See* SDG&E's 2008 GRC (D.08-07-046) and 2012 GRC (D.13-05-010).

2. Forecast Method

The forecast method developed for this cost category is zero-based. This method is most appropriate because specific RD&D needs and activities evolve as technology progresses and new public policies and goals are established.

3. Cost Drivers

RD&D costs will support the State's climate goal as well as SDG&E's sustainability goal. In order to reach SDG&E's sustainability goal of net zero emissions by 2045, as discussed by Ms. de Llanos (Ex. SDG&E-02), SDG&E needs to consider innovative and rapid deployment of new technologies necessary to lower GHG emissions. The RD&D costs will also be able to help support SDG&E's participation in projects eligible for other funding sources, such as grant funding from the California Energy Commission.

4. Proposed Innovation Technology Development Program Funding Details

Table FV-6
Estimated Innovation Technology Development Funding Categories ($000)[15]

Program	Sub-Program	Forecast
System Advancements	Planning, Control & Power Optimization	1,400
Clean Energy	Carbon Sequestration	1,300
Customer End-Use	Electrification Transformation	1,000
External Engagement	Consortia Subscription Fees, Stakeholder Workshops, Conferences, etc.	425
Program Management	SDG&E Program Administration & Project Management	875
Total		**5,000**

a. System Advancements

This program will sponsor sub-programs that focus on emerging system technology advancements and support future decision-making on which emerging technologies may be worth adopting on a commercial basis. It may also be used to support the development of

[15] Funding split between programs is estimated and will be refined once the program is approved and RD&D initiatives are established.

industry standards, such as those promulgated by the International Electrotechnical Commission and Institute of Electrical and Electronics Engineers. General areas of prospective activity are:

- Testing novel technologies for monitoring, control, visualization, and situational awareness in distribution system operations. Examples include new power electronic equipment, sensors, monitoring devices, safety systems, data systems, and software visualization platforms.
- Testing of novel communications, protection, and control technology. This work can include new hardware, software, protocols, and emerging industry standards.

b. Clean Energy

This program and its sub-program will support the evaluation and study of new solutions for carbon sequestration and/or clean generation enhancements on a small scale to determine whether to adopt them commercially on a larger scale. Includes identifying types of sites that may be suitable for commercial adoption.

c. Customer End-Use

As part of SDG&E's efforts to support its customers through an electrification transformation process, SDG&E has identified research areas under this program that will support that goal, including bi-directional vehicle-to-grid, emerging beachhead sectors, and technology demonstrations like wireless power transfer and dynamic in-motion charging.

d. External Engagement

In addition to the planned RD&D programs discussed above, the Innovation Technology Development program also intends to fund general research consortia memberships, program management, administration, stakeholder workshops, conferences, and project support from other SDG&E internal groups on the RD&D programs. The consortia membership cost category provides sponsorship of RD&D programs, including the Electric Power Research Institute (EPRI),[16] participation in industry standards committees, and consortia membership fees such as those associated with the Centre for Energy Advancement through Technological Innovation (CEATI) International.[17] The collaborative nature of these activities provides an opportunity to

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16 https://www.epri.com/

17 https://www.ceati.com/

leverage the use of RD&D funds and better inform RD&D activities for a more successful program at SDG&E.

e. Program Management

The program management, administration, and general project support of the RD&D programs are essential resources needed to provide program management, administrative support, and engineering and business knowledge to the RD&D programs. Lastly, as part of the Program Management category, approximately $0.3 million is related to SDG&E's subject matter experts supporting industry partners as the host utility in an approved Department of Energy (DOE) RD&D project, which is aimed at developing software to create a virtual air gap which allows for close to real-time load data without compromising cybersecurity and other proprietary concerns.

D. 1DD004 Sustainable Communities O&M

TABLE FV-7
Sustainable Communities O&M

CLEAN ENERGY INNOVATIONS NON-SHARED SERVICES O&M (In 2021 $)			
	2021 Adjusted-Recorded (000s)	**TY2024 Estimated (000s)**	**Change (000s)**
Sustainable Communities	180	282	102
Total O&M	**180**	**282**	**102**

1. Description of Costs and Underlying Activities

The Sustainable Communities Program (SCP) was created in response to SDG&E's 2004 Cost of Service Decision, D.04-12-015.[18] The requested funding herein is to support the ongoing operation and maintenance activities of the DERs installed as part of the program's community-based energy strategy. While the program is no longer available for new enrollments, SDG&E still has an obligation to maintain the existing assets. The costs requested here allow SDG&E to continue to maintain those assets. As the assets reach the later years in their useful life, additional maintenance activities are required to keep the resources operational, driving the need for increased costs compared to expenses incurred in 2021.

[18] D.04-12-015 at 35-37.

2. Forecast Method

The forecast method developed for this cost category is base year. This method, along with including incremental adjustments as discussed in the Cost Driver section below, is most appropriate because it best reflects the current and future operating expenses, which include expected lease payments necessary to support the SCP program and the over 30 customer sites, including any maintenance required to ensure operation of the assets.

3. Cost Drivers

The cost drivers behind this forecast are driven by the number of customer sites, projected lease payments to occur over the GRC cycle, and projected maintenance activities required to keep the resources functional.

E. 1DD005 Distributed Energy Resource Engineering Department O&M

SDG&E's DER Engineering department is responsible for the integration of renewables and distributed energy resources necessary to enhance electric reliability, operational flexibility, and public safety. The DER Engineering department consists of engineers, project managers, and project specialists who support the development and maintenance of microgrid engineering standards, environmental and safety compliance associated with SDG&E's utility-owned DERs, and providing technical assistance to customers regarding DERs and/or microgrid technology.

TABLE FV-8
Distributed Energy Resource Engineering Department

CLEAN ENERGY INNOVATIONS NON-SHARED SERVICES O&M (In 2021 $)			
	2021 Adjusted-Recorded (000s)	**TY2024 Estimated (000s)**	**Change (000s)**
Distributed Energy Resource Engineering Department	1,878	2,316	438
Total O&M	**1,878**	**2,316**	**438**

1. Description of Costs and Underlying Activities

The DER Engineering department leverages technology in order to accelerate the future of the electric industry through the use of microgrids, energy storage, advanced control systems and proactive engineering, testing, and demonstration. The DER Engineering department's work is directly contributing to the Company's and State's goal of decarbonizing the electric grid by integrating DERs into the system.

The DER Engineering department does critical work by proactively testing and analyzing technology and energy storage at the Integrated Test Facility (ITF). This facility allows SDG&E to perform various real operational scenarios in a safe and controlled test environment to better understand system characteristics and device behavior before the technologies are installed and operational on the electric system. The ITF serves as a platform to drive industry standards, promote collaboration, and develop institutional knowledge to operate the electric system more safely, reliably, and efficiently.

2. Forecast Method

The forecast method developed for this cost category is base year. This method, along with including incremental adjustments as discussed in the Cost Driver section below, is most appropriate because it best reflects the current and future operating expenses necessary to support the DER Engineering department's core business, including the integration of microgrids, energy storage and advanced systems controls.

3. Cost Drivers

The cost drivers behind this forecast are driven by the increased integration of DERs and microgrid operations. Additional engineering staff is needed to perform testing on new technologies, performing microgrid islanding studies, integration of microgrids into SDG&E's local area distribution controller (LADC), and performing other engineering studies related to the integration of DERs. Additional staff is also needed to support the increase in energy storage and clean technology capital projects, such as the Advanced Energy Storage program and the Mobile Battery Energy Storage Program.

IV. CAPITAL

SDG&E is committed to providing its customers, and California as a whole, lower emissions-sourced energy to facilitate the Company's and the State's decarbonization goal. In order to accomplish these very important goals, SDG&E proposes various capital projects necessary to advance SDG&E's energy sources, provide customers reliable service and be the catalyst for utilizing new, and clean, energy sources. The individual projects which SDG&E is proposing in this GRC are described in more detail below. Table FV-8 summarizes the total capital forecasts for 2022, 2023, and 2024.

TABLE FV-9
Capital Expenditures Summary of Costs by Category

Categories of Management	Estimated 2022 (000s)	Estimated 2023 (000s)	Estimated 2024 (000s)
A. Advanced Energy Storage Total	**13,258**	**16,448**	**22,582**
20278A Advanced Energy Storage	12,483	1,314	0
212690 Advanced Energy Storage 2.0	0	13,284	20,030
212710 Non-Lithium-Ion Energy Storage Technology	775	1,850	2,552
B. Microgrid and Controls Total	**4,217**	**(188)**	**0**
17246A Borrego 3.0 Microgrid	2,792	(188)	0
212660 ITF Expansion	1,425	0	0
C. Sustainable Communities Total	**969**	**407**	**439**
20281A Sustainable Communities Removal	969	407	439
D. Mobile Energy Storage Total	**2,076**	**2,076**	**2,076**
212610 Mobile Battery Energy Storage Program	2,076	2,076	2,076
E. Hydrogen Total	**0**	**5,941**	**1,236**
212680 Hydrogen Build Ready Infrastructure	0	770	1,155
212720 Hydrogen Energy Storage System Expansion	0	5,171	81
Total	**20,520**	**24,684**	**26,333**

A. 20278A Advanced Energy Storage

TABLE FV-10
Capital Expenditures Summary of Costs

A. Advanced Energy Storage	Estimated 2022 (000s)	Estimated 2023 (000s)	Estimated 2024 (000s)
20278A Advanced Energy Storage	12,483	1,314	0
Total	**12,483**	**1,314**	**0**

1. Description

The forecast for the Advanced Energy Storage (AES) project for 2022, 2023, and 2024 are $12.483 million, $1.314 million, and $0, respectively. SDG&E plans to build and place the Advanced Energy Storage project in service by 2023.

The forecasted costs for the AES project support the Company's goal of decarbonization, resiliency, and operational flexibility. The AES project continues the Company's strategic deployment of energy storage devices established in SDG&E's TY 2019 GRC, D.19-09-051,[19] on distribution circuits with an abundance of solar photovoltaic (PV) penetration to effectively manage the reliability of the grid. Benefits include leveraging excess renewable energy to charge the battery component of the microgrid during the day when the circuit is experiencing lighter load levels, discharging the battery component of the microgrid during times of higher loading, and mitigating electric service intermittency. The project also supports SDG&E's grid modernization efforts and is part of the Grid Modernization Plan (Exhibit SDG&E-12, Appendix C).

The forecasted costs for the AES project specifically support the completion of the last deployment of the AES project approved in SDG&E's 2019 GRC[20] and are comprised of a forecast of only non-labor costs. 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 PV at the Borrego Spring Microgrid. Pursuant to the requirement set forth in D.19-09-051, SDG&E provides an initial report on the AES project in my Confidential Workpaper titled "SDG&E's Initial Report on the Advanced Energy Storage (AES) Project Pursuant to D.19-09-051," which includes projected total project costs and specific procurement costs to-date for procuring the energy storage systems.[21] The AES systems at the Borrego Springs Microgrid are currently under-construction and forecasted to reach operational status in the second half of 2023. Thereafter, SDG&E will supplement the report to provide the remaining information on specific benefits to SDG&E customers as required in D.19-09-051 once the AES systems at Borrego Springs Microgrid are complete and operational.

The specific details regarding the Advanced Energy Storage project are found in my capital workpapers. *See* SDG&E-15-CWP 20278A

[19] D.19-09-051 at 293-294.

[20] *Id*.

[21] *Id.*

2. Forecast Method

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

3. Cost Drivers

The underlying cost driver for this capital project relates to the energy storage system needed to capture the significant amount of PV DER near the energy storage site. Documentation of these cost drivers is included as supplemental capital workpapers. See SDG&E-15-CWP 20278A.

B. 212690 Advanced Energy Storage 2.0

TABLE FV-11
Capital Expenditures Summary of Costs

A. Advanced Energy Storage	Estimated 2022 (000s)	Estimated 2023 (000s)	Estimated 2024 (000s)
212690 Advanced Energy Storage 2.0	0	13,284	20,030
Total	**0**	**13,284**	**20,030**

1. Description

The forecast for the Advanced Energy Storage 2.0 for 2022, 2023, and 2024 are $0, $13.284 million, and $20.030 million, respectively. This project is a continuation of the prior AES project (workpaper 20278A) and will consist of three energy storage systems each approximately 7 MW/14 MWh in size. As described above, SDG&E intends to identify additional circuits with high concentrations of DERs. SDG&E plans to build and place the Advanced Energy Storage 2.0 program in service by 2024.

This cost supports the company’s goal of providing resilient services to the customers through the delivery of clean energy. The Advanced Energy Storage 2.0 project is the second phase of the previous AES project approved in SDG&E's TY 2019 GRC.[22] This project continues to advance the company's strategic deployments of energy storage devices on distribution circuits with an abundance of PV penetration (which has grown significantly since SDG&E's first phase of this project) to effectively manage the reliability of the grid. Benefits include leveraging excess renewable energy to charge during the day when the circuit is experiencing lighter load levels, discharging during times of higher loading, and mitigating intermittency. The project also supports SDG&E's grid modernization efforts and is part of the Grid Modernization Plan (Ex. SDG&E-12, Appendix C). The specific details regarding the Advanced Energy Storage 2.0 project are found in my capital workpapers. *See* SDG&E-15-CWP 212690.

2. Forecast Method

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

3. Cost Drivers

The underlying cost driver for this capital project relates to the three proposed energy storage systems and the purchase price for each system necessary to leverage the growing penetration of renewable energy and PV DER on the electric system. Impacts of current market demand and supply chain constraints are reflected in the forecast. As these projects have not yet begun construction, SDG&E intends to conduct a competitive solicitation process requesting proposals to identify the optimal product and vendor for the specific locations. Given SDG&E's extensive experience with various energy storage systems, the costs reflected here incorporate an average of different energy storage chemistries as SDG&E cannot predict what storage chemistry will be the optimal solution for future requests for proposals. Documentation of these cost drivers are included as supplemental capital workpapers. *See* SDG&E-15-CWP 212690.

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[22] D.19-09-051 at 293-294.

C. 212710 Non-Lithium-Ion Energy Storage Technology

TABLE FV-12
Capital Expenditures Summary of Costs

A. Advanced Energy Storage	Estimated 2022 (000s)	Estimated 2023 (000s)	Estimated 2024 (000s)
212710 Non-Lithium-Ion Energy Storage Technology	775	1,850	2,552
Total	**775**	**1,850**	**2,552**

1. Description

The forecast for the Non-Lithium-Ion Energy Storage Technology project for 2022, 2023, and 2024 are $0.775 million, $1.850 million, and $2.552 million, respectively. SDG&E plans to design and implement the Non-Lithium-Ion Energy Storage Technology project by 2024.

The project will seek commercially available solutions for energy storage technologies that avoid issues associated with lithium-ion technologies and can offer additional benefits. It also targets deployment of alternative technologies on a small scale to develop familiarity with the technology and the application situations in which larger-scale deployments are merited. Similar to the authorization of SDG&E's energy storage projects under the Smart Grid program in SDG&E's TY 2012 GRC,[23] SDG&E intends to invest in non-lithium-ion technologies to continue to maintain and/or improve system performance and operational flexibility as the needs of the electric system have changed over the last decade. The Commission has indicated a need for long-duration storage,[24] defined as 8-hours to 12-hours, and the State's heavy reliance on lithium-ion technologies may pose risks by putting all of our eggs in one energy storage technology basket. SDG&E's program proposes to address these issues by aligning the technology with the use case to maximize value to customers. Examples of technologies that may be deployed are new commercially available battery chemistries and non-battery alternatives such as flywheels and gravity-based energy storage. The energy storage systems deployed would be commercially available technology and will remain in use consistent with the useful life of the technology.

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[23] D.13-05-010 at 226.

[24] Pursuant to D.20-03-028 at 106, the CPUC defines long-duration storage as 8-12 hours.

This cost supports the Company's goal of decarbonization without becoming overly dependent on one form of energy storage battery technology.

The specific details regarding Non-Lithium-Ion Energy Storage Technology are found in my capital workpapers. *See* SDG&E-15-CWP 212710.

2. Forecast Method

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

3. Cost Drivers

The underlying cost driver for this capital project relates to the equipment necessary to implement alternative energy storage technologies, as well as consulting expertise necessary to deploy this project for commercial use. Documentation of these cost drivers are included as supplemental capital workpapers. *See* SDG&E-15-CWP 212710.

D. 17246A Borrego 3.0 Microgrid

TABLE FV-13
Capital Expenditures Summary of Costs

CLEAN ENERGY INNOVATIONS (In 2021 $)			
B. Microgrid and Controls	**Estimated 2022 (000s)**	**Estimated 2023 (000s)**	**Estimated 2024 (000s)**
17246A Borrego 3.0 Microgrid (NC)	2,792	(188)	0
17246A Borrego 3.0 Microgrid (CO)	2,504	290	0
Total	**5,296**	**102**	**0**

1. Description

The forecast for Borrego 3.0 Microgrid for 2022, 2023, and 2024 are $2.792 million, $(0.188) million, and $0, respectively. SDG&E plans to build and place the Borrego 3.0 Microgrid project in service in 2023.

This capital project supports the company's goals of continuously improving safety and electric system stability. The Borrego 3.0 Microgrid project builds on existing infrastructure, assets, and control systems completed at the Borrego Springs microgrid, and provides enhanced stability, safety, and renewable energy utilization for the approximate 2,800 customers that reside in Borrego Springs. This project focuses on site preparation, including planning, design, and engineering to support the expansion of the current Borrego microgrid. The project also supports SDG&E's grid modernization efforts and is part of the Grid Modernization Plan (Ex. SDG&E-12, Appendix C). The capital dollar forecast includes capitalized labor and non-labor cost estimates.

The specific details regarding the Borrego 3.0 Microgrid project are found in my capital workpapers. *See* SDG&E-15-CWP 17246A.

2. Forecast Method

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

3. Cost Drivers

The underlying cost drivers for this capital project are related to site grading and installation of a new circuit necessary to integrate additional DER as part of the microgrid. Documentation of these cost drivers are included as supplemental capital workpapers. *See* SDG&E-15-CWP 17246A.

E. 212660 Integrated Test Facility (ITF) Expansion

TABLE FV-14
Capital Expenditures Summary of Costs

B. Microgrid and Controls	**Estimated 2022 (000s)**	**Estimated 2023 (000s)**	**Estimated 2024 (000s)**
212660 ITF Expansion	1,425	0	0
Total	**1,425**	**0**	**0**

1. Description

The forecast for the ITF Expansion project for 2022, 2023, and 2024 are $1.425 million, $0, and $0, respectively. SDG&E plans to implement the Integrated Test Facility (ITF) Expansion project in 2022.

This project supports the safe and reliable deployment of advanced technologies, which is driven by State policy and consumer adoption of DERs and other clean energy technologies. This expansion project includes the procurement of a real-time digital simulator and multiple Doble testing sets. The increasing complexity and usage of technologies such as microgrids and advanced system protection require modern real-time digital simulator systems to perform pre- and post-installation simulated electric system events testing of the hardware configuration(s) and software performance of the advanced control systems to verify those systems can perform safely and efficiently as designed. The Doble test sets will be used in a testing environment to validate control system configurations prior to in-service commissioning. The project also supports SDG&E's grid modernization efforts and is part of the Grid Modernization Plan (Exhibit SDG&E-12, Appendix C).

The specific details regarding the ITF Expansion are found in my capital workpapers. *See* SDG&E-15-CWP 212660.

2. Forecast Method

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

3. Cost Drivers

The underlying cost driver(s) for this capital project relate to the cost of the equipment being purchased. Documentation of these cost drivers are included as supplemental capital workpapers. *See* SDG&E-15-CWP 212660.

F. 20281A – Sustainable Communities Removal

TABLE FV-15
Capital Expenditures Summary of Costs

E. Sustainable Communities	Estimated 2022 (000s)	Estimated 2023 (000s)	Estimated 2024 (000s)
20281A Sustainable Communities Removal	969	407	439
Total	**969**	**407**	**439**

1. Description

The forecast for the Sustainable Communities Removal project for 2022, 2023, and 2024 are $0.969 million, $0.407 million, and $0.439 million respectively. SDG&E expects to remove SDG&E-owned solar PV arrays and small batteries on customer sites throughout San Diego County through 2024. The identified customer sites, mainly municipal buildings, schools, non-profit and commercial buildings, are scheduled for a potential lease renewal in the corresponding years, however it is unlikely that the customers will renew the lease and instead will exercise their right to remove the PV arrays.[25]

The specific details regarding the Sustainable Community Removal project are found in my capital workpapers. *See* SDG&E-15-CWP 20281A.

2. Forecast Method

The forecast method developed for this cost category is zero-based. The forecast is based on cost estimates that were developed based on the specific scope of work for the project. Specifically, the scope of work has been identified to consist of the following items for each site location: decommission and lockout of the PV system, removal of the PV panels and inverters, removal of PV related conduit systems as well as racking off the roof, capping of the AC feeder to the inverter, and the transportation of the discarded materials to a proper recycling facility.

3. Cost Drivers

The underlying cost drivers for this capital project relates to the number of customer sites that are identified for decommissioning at the end of their respective lease and the above-identified costs necessary to decommission each PV array. Documentation of these cost drivers are included as supplemental capital workpapers. *See* SDG&E-15-CWP 20281A.

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[25] D.04-12-015 at 35-37.

G. 212610 Mobile Battery Energy Storage Program

TABLE FV-16
Capital Expenditures Summary of Costs

D. Mobile Energy Storage	Estimated 2022 (000s)	Estimated 2023 (000s)	Estimated 2024 (000s)
212610 Mobile Battery Energy Storage Program	2,076	2,076	2,076
Total	**2,076**	**2,076**	**2,076**

1. Description

The forecast for the Mobile Battery Energy Storage Program for 2022, 2023, and 2024 are $2.076 million, $2.076 million, and $2.076 million, respectively. This program will consist of purchasing three mobile battery systems for each of the years 2022, 2023, and 2024 for a total of nine mobile battery systems. The intent is to have the mobile battery systems staged throughout SDG&E's service territory at either district operations & control centers or substations with available space for storage of the units to allow for quick and efficient deployment when needed.

This cost supports the Company's goal of decarbonization by decreasing the reliance on backup diesel generation through the alternative use of clean energy batteries which are not limited by physical location. SDG&E can leverage these mobile battery energy storage systems (MBESS) to increase grid resiliency and operational flexibility for the Company's customers during public safety power shut-off events by deploying these systems to at-risk electric systems experiencing things like system maintenance outages and adverse weather conditions. The MBESS can also be used during outages related to planned maintenance work or construction activities, reducing the use of backup diesel generators which are typically used to provide power continuity to customers and support construction activities, respectively.

SDG&E has successfully demonstrated multiple pre-commercial MBESS demonstration use cases within its EPIC-3 projects (EPIC-3, Project 7, Modules 1 and 2).[26] Through multiple demonstration sites, SDG&E was able to test the MBESS for use in functions such as demand shaving, emergency energy supply, voltage regulation, and frequency regulation. SDG&E will

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[26] EPIC-3, Project 7, Module 1 Final Report available at https://www.sdge.com/sites/default/files/EPIC-3 Project 7-Mobile Battery-Module 1 Final Project Report.pdf; and EPIC-3, Project 7, Module 2 Final Report, available at https://www.sdge.com/sites/default/files/EPIC-3%20Project%207-Mobile%20Battery-Module%202%20Final%20Project%20Report.pdf.

leverage those EPIC pre-commercial demonstrations and their successes to deploy the requested MBESS in this GRC to reduce SDG&E's GHG emission footprint while offering power continuity to customers and supporting construction activities.

The specific details regarding the Mobile Battery Energy Storage Program are found in my capital workpapers. *See* SDG&E-15-CWP 212610.

2. Forecast Method

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

3. Cost Drivers

The underlying cost driver for this capital project relates to the number of MBESS units SDG&E seeks to procure in order to reduce diesel fuel backup generation and lower SDG&E's GHG emissions. Documentation of these cost drivers are included as supplemental capital workpapers. *See* SDG&E-15-CWP 212610.

H. 212680 Hydrogen Build Ready Infrastructure

TABLE FV-17
Capital Expenditures Summary of Costs

E. Hydrogen	Estimated 2022 (000s)	Estimated 2023 (000s)	Estimated 2024 (000s)
212680 Hydrogen Build Ready Infrastructure	0	770	1,155
Total	**0**	**770**	**1,155**

1. Description

The forecast for the Hydrogen Build Ready Infrastructure project for 2022, 2023, and 2024 are $0, $0.770 million, and $1.155 million, respectively. SDG&E plans to design and implement this program by 2024.

To meet California's environmental goal and SDG&E's Sustainability Strategy, this project provides for the acceleration of electric system service infrastructure necessary to support customers' localized creation of hydrogen via electrolysis for the purpose of supporting clean, hydrogen-based transportation in SDG&E's service territory. By facilitating the development of this service infrastructure, the Hydrogen Build Ready Infrastructure program will allow qualifying customers to produce hydrogen for various use cases that will reduce GHGs.

This effort targets providing customers with an incentive by covering the interconnection costs incurred as it relates to the specific customer's installation of a hydrogen electrolyzer on SDG&E's electric grid. The program is designed to fund up to five customers and their associated interconnection-related costs as it pertains to their investment in an electrolyzer of no more than 2MW. An additional requirement includes an electrolyzer that must be paired with an onsite PV system that is anticipated to provide electricity to support at least 30% of the electrolyzer's nameplate capacity. SDG&E will target and prioritize these electrolyzer plus solar installations with a focus on serving public interest entities (e.g., public transit agencies, waste management agencies, port authorities or school districts). As discussed by Mr. Kupfersmid (Ex. SDG&E-43), SDG&E is concurrently requesting authority to open a two-way balancing account to track the costs associated with this program, and funds will only be spent when/if qualifying projects arise in SDG&E's service territory within this GRC cycle.

The specific details regarding the Hydrogen Build Ready Infrastructure project are found in my capital workpapers. *See* SDG&E-15-CWP 212680.

2. Forecast Method

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

3. Cost Drivers

The underlying cost driver for this capital project is based on an estimate of interconnection costs necessary to upgrade service at a customer's premise in order to deploy an electrolyzer under the proposed incentive program. Documentation of these cost drivers are included as supplemental capital workpapers. *See* SDG&E-15-CWP 212680.

I. 212720 Hydrogen Energy Storage System Expansion

TABLE FV-18
Capital Expenditures Summary of Costs

E. Hydrogen	Estimated 2022 (000s)	Estimated 2023 (000s)	Estimated 2024 (000s)
212720 Energy Storage System Expansion	0	5,171	81
Total	**0**	**5,171**	**81**

1. Description

The forecast for the Hydrogen Energy Storage System Expansion project for 2022, 2023, and 2024 are $0, $5.171 million, and $0.081 million, respectively. SDG&E plans to build and place the project in service by 2024.

To support the Borrego Springs community's electric resiliency and environmental goals, SDG&E plans to expand the hydrogen portion of the Advanced Energy Storage System at the Borrego Springs Microgrid.[27] The expansion includes increasing onsite hydrogen fuel cell capacity from 250 kilowatts (kW) to 1000 kW and doubling onsite hydrogen storage to support the increased fuel cell capacity. This expansion is critical to support islanding operation of the microgrid and helping better meet the community's high-solar penetration load after the sun has set. Additionally, the project includes purchasing an atmospheric water generation system[28] to relieve the water demand from the local water utility. The most low-cost electrolytic hydrogen utilizes low cost solar, usually located in the desert, where there is a lack of water. By deploying an atmospheric water generation system in the desert near low cost solar, the deployment will help lower the overall cost and improve the flexibility of the electrolytic hydrogen system for the Borrego Springs service region. The project also supports SDG&E's grid modernization efforts and is part of the Grid Modernization Plan (Ex. SDG&E-12, Appendix C).

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[27] D.19-09-051 at 293-294.

[28] An atmospheric water generator converts ambient water vapor in the air into liquid using solar energy.

The specific details regarding the Hydrogen Energy Storage System Expansion project are found in my capital workpapers. *See* SDG&E-15 212720.

2. Forecast Method

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

3. Cost Drivers

The underlying cost driver for this capital project relates to SDG&E's sustainability goal of decarbonizing the electric grid, transitioning to 100% renewable energy at the Borrego Springs Microgrid,[29] and reducing the amount of renewable energy curtailment. This project has the added benefit of relieving the State's strained aquafers by utilizing water vapor converted into liquid water. Documentation of these cost drivers are included as supplemental capital workpapers. *See* SDG&E-15-CWP 212720.

V. SUPPORT TO OTHER WITNESSES FOR COSTS

This section of my testimony provides the business justification for the costs of capital projects presented in other witness' testimony as referenced below.

A. Electric Generation Projects – Daniel S. Baerman (Exhibit SDG&E-14, Electric Generation)

Capital costs for the forecasted years 2022, 2023, and 2024 for Electric Generation projects that support the Palomar Hydrogen Systems and Hybrid at Miramar Energy Facility are sponsored by Mr. Daniel S. Baermann. The purpose for this section of my testimony is to provide the business justification for both the Palomar Hydrogen Systems and the Hybrid at

[29] During certain circumstances, for instance when customer load is at peak, the Borrego Springs Microgrid must utilize diesel generators to serve the customer load. Additional capacity of the hydrogen fuel cell will help reduce the reliance on the diesel generators to serve customer load in high demand scenarios.

Miramar Energy Facility capital project. Refer to Mr. Baermann's workpapers (Ex. SDG&E-14-CWP) for the basis of the costs.

1. 210390 - Palomar Hydrogen Systems

The Palomar Hydrogen Systems program is SDG&E's essential first pilot focused on demonstrating multiple use cases of electrolytically produced hydrogen to support decarbonizing natural gas-powered plant operations. SDG&E believes that clean hydrogen will play a vital role in helping to decarbonize California's electric grid by ultimately becoming a key source of clean, firm, and dispatchable power that can support the electric system at times of low renewable production and high demand and as such has taken the necessary steps to begin understanding the many unique aspects of this resource, starting first with a small scale pilot at Palomar Energy Center (Palomar). Areas of increased knowledge and understanding regarding the production, storage, and operational aspects of hydrogen that SDG&E is learning from the Company's pilot at Palomar include hydrogen's behavior and impact on SDG&E's turbines; the impact on various emissions; how to design, operate, and maintain hydrogen equipment; and how to reduce the unit cost of hydrogen. By understanding best practices for hydrogen project design, development, equipment selection and sizing, storage, and maintenance and operation of key hydrogen equipment, SDG&E expects to learn valuable information which SDG&E can then apply in the future to reduce cost and help achieve the DOE's Hydrogen Shot goal of producing hydrogen at $1/kilogram by 2030.[30]

Hydrogen will be produced onsite at the Palomar Energy Center via electrolysis powered by renewable energy. This electrolytic hydrogen will be available for multiple onsite applications, including power generation, generator cooling, and as a clean transportation fuel. The hydrogen production system at Palomar includes a dedicated solar PV system to provide renewable sourced electricity to a hydrogen electrolyzer. A dedicated SDG&E fleet HFEV fueling pump will also be located at Palomar to fuel light-duty HFEVs used by plant operation personnel to visit remote generation sites managed out of Palomar, including SDG&E's numerous remote battery installations and microgrids.[31] The HFEVs will replace the

30 *See* https://www.energy.gov/eere/fuelcells/hydrogen-shot.

31 As listed in Mr. Baerman's testimony (Ex. SDG&E-14) remote sites managed from Palomar include Escondido BESS, El Cajon BESS, Kearny BESS, Miguel Vanadium BESS, Top Gun BESS, Ramona Solar Energy Project, Borrego Springs Microgrid, Butterfield Ranch Microgrid, Cameron Corners

conventional gasoline-powered vehicles operations personnel currently use and will also contribute towards SDG&E's success in achieving targeted vehicle emission reductions as discussed by Ms. de Llanos (Ex. SDG&E-02) and the Fleet Services testimony of Arthur Alvarez (Ex. SDG&E-22).

While SDG&E already uses hydrogen at the Palomar Energy Center for generator cooling, this hydrogen is classified as gray hydrogen produced from fossil fuel feedstocks; it is procured from third parties and traditionally delivered via gas or diesel-fueled trucks about once a month. Replacing current gray hydrogen that must be trucked to site with clean hydrogen produced onsite is an important step towards reducing plant-related emissions.

The pilot will also include a hydrogen blending system that will allow the onsite 588 MW gas-fired combined-cycle electric generation facility to accept hydrogen gas as a blended feedstock with natural gas. The volumetric blending ratio of hydrogen to natural gas at this facility is currently relatively low at up to two percent but has the possibility to increase and scale over time. SDG&E looks forward to significant learning on hydrogen blending for power generation, GHG emissions, and other factors through this unique and first-of-its-kind pilot.

2. 000080 – Hybrid at Miramar Energy Facility

The Hybrid at Miramar Energy Facility project involves installing a 10 MW/10 MWh BESS at each of the two existing gas turbines (total of 20 MW BESS). Additionally, this project will install new operational controls logic to optimize operational efficiency, reduce GHG emissions and water use between the combined use of both the existing gas turbines as well as the proposed battery energy storage units.

This project would result in reduced GHG emissions and reduced water use by leveraging the proposed battery storage units in order to reduce the operating hours of the existing gas turbines. The proposed battery storage units would also allow the facility to operate in a quicker response time compared to starting the gas turbines when the facility is called upon for reliability needs. Finally, the proposed hybrid logic allows the battery storage units to operate for shorter duration and reduces the need to start the gas turbines for meeting shorter duration net peak grid needs. Together, the new BESS and controls logic at Miramar Energy Facility will support SDG&E's sustainability strategy, as discussed by Ms. de Llanos (Ex. SDG&E-020, to

Microgrid, Fallbrook BESS, Melrose BESS, Pala-Gomez Creek BESS, Shelter Valley Microgrid, and Westside Canal BESS.

decarbonize and reduce our climate impact through the deduction in GHG emissions and water usage.

B. Information Technology (IT) Projects – William J. Exon (Exhibit SDG&E 25, IT Capital)

Capital Costs for the forecasted years 2022, 2023, and 2024 for IT projects that support the LADC are sponsored by Mr. William J. Exon. This section of my testimony provides the business justification for the LADC projects. Refer to Mr. Exon's workpapers (Ex. SDG&E-25 CWP) for the basis of the costs.

LADC is a software and hardware solution that enables the distribution grid operator to monitor, manage and control the component resources of a microgrid. The LADC is a key component of the successful deployments of microgrids operated by SDG&E. This distributed microgrid controller is necessary to augment and interoperate with SDG&E's existing advanced distribution management system and supervisory control and data acquisition system. The LADC will coordinate the control of DERs and conventional grid management devices (*e.g.*, capacitors, switches) to ensure reliable operation during both island and grid-connected scenarios.

The LADC is deployed locally at a microgrid location with communication networks enabled to support remote control, visibility and supervisory operation to all microgrids from SDG&E's distribution control center. This centralized ability to manage and control all microgrids is critical for the timely, safe and reliable operations of a microgrid connected on the distribution system.

The LADC will have the capability to control multiple DERs to provide resiliency through black-start (via grid-forming DER), minimal-impact island transition, and load-shedding. When implemented, the LADC has the ability to automatically detect grid outages and automatically switch to island mode without the need to black start the feeder loads. The controller can be set up to shed noncritical loads as necessary to maintain the critical loads. The system has the capability to automatically reconnect to the main grid when the main grid power returns and stabilizes. The LADC is critical to the success of microgrids due to the need for fast-acting decisions and controls, which are required to maintain voltage and frequency within appropriate limits while in island-mode.

The LADC deployment planned from 2022 – 2024 are expected to add approximately 60 MW of controllable load under LADC management and enables nine microgrid sites to operate safely and reliably while providing resiliency support to the communities.

1. 00920AU – Local Area Distribution Controller (LADC)

The funding request for the LADC project will cover the remaining costs to deploy the LADC at microgrid sites, Cameron Corners, Ramona, and Borrego Springs, for a total of roughly 7 MW of controllable load across three distinct microgrid sites. As stated above, the LADC provides necessary visibility and controls to support the safe and reliable operation of microgrids.

2. 00920Y– Local Area Distribution Controller 2022 - 2023

The funding request for the LADC 2022-2023 project will cover the costs necessary to deploy the LADC at four future microgrid sites that are awaiting final Commission approval to begin development.[32] In addition, the funding request also supports integrating the AES system into the LADC once it is commissioned at the Borrego Springs Microgrid. This funding request will add approximately 46.9 MW of controllable load under LADC management. As discussed above, the LADC provides necessary electric grid support and flexibilities.

3. 00920L – Local Area Distribution Controller 2023 - 2024

The funding request for the LADC 2023-2024 project will cover the costs necessary to deploy the LADC at two future microgrid sites that are currently under development.[33] This funding request will add roughly 5.8 MW of controllable load under LADC management. As discussed above, the LADC provides necessary electric grid support and flexibilities.

C. Fleet Vehicle Request - Vehicle Additions - Arthur Alvarez (Exhibit SDG&E 22, Fleet Services)

O&M costs for the forecasted years 2022, 2023, and 2024 for Fleet Services that support additional fleet vehicles sponsored by Mr. Arthur Alvarez. The purpose for this section of my testimony is to provide the business justification for the additional fleet vehicles. Refer to Mr. Arthur Alvarez's workpapers (Ex. SDG&E-22 CWP) for the basis of the costs.

[32] Clairemont, Paradise, Boulevard and Elliot microgrids are currently awaiting Commission approval pursuant to D.21-12-004 at 58-59 (Ordering Paragraph 9).

[33] Butterfield Ranch and Shelter Valley microgrids are currently under development.

SDG&E's DER Engineer and ACT department staff manage multiple projects throughout SDG&E's service territory. The use of a company fleet vehicle, especially if multiple staff can carpool, is more efficient and can reduce GHG emissions. Additionally, SDG&E's capital projects are increasing in volume which increases the need for staff to be onsite to oversee interconnection-, engineering- or construction-related activities. As such, the DER Engineering department is requesting one fleet vehicle in 2022, and the ACT department is requesting one fleet vehicle in 2022 and 2023.

VI. CONCLUSION

SDG&E requests the Commission adopt its TY 2024 forecast for the Clean Energy Innovations O&M expenses related to the ACT department, the DER Engineering department, the HSI department, the Sustainable Communities program, and the Innovation Technology Development program as presented in Section III. This request is supported by the increased regulatory proceedings and capital projects which all three departments support in order to contribute to SDG&E's sustainability goal of decarbonizing the electric grid.

SDG&E further requests the Commission adopt its forecast for capital expenditures described in this testimony in Section IV. SDG&E's proposed capital projects presented herein are necessary to decarbonize the electric grid, lower the Company's dependency on diesel backup fuel, minimize renewable curtailment, and provide SDG&E's customers with resiliency.

Finally, SDG&E requests the Commission adopt the O&M and capital projects presented in this testimony in support of other witnesses funding requests, as presented above in Section V.

This concludes my prepared direct testimony.

VII. WITNESS QUALIFICATIONS

My name is Fernando Valero. My business address is 8690 Balboa Avenue, San Diego, California 92123. I hold a Bachelor of Science in Biology from the University of Arkansas, a Juris Doctor from the Thomas Jefferson School of Law, and a Master of Business Administration from San Diego State University. I am also a member of the State Bar of California.

I am employed by San Diego Gas & Electric as Director – Advanced Clean Technology. Prior to my current position, I was the Commercial Development Manager in Growth and Technologies, as well as the Partnerships and Programs Manager in Electric and Fuel Procurement at SDG&E. Prior to SDG&E, I worked at Sempra Energy as a regulatory attorney. I have been employed with Sempra Energy or SDG&E since 2008.

I have not previously testified before the California Public Utilities Commission.

APPENDIX A

Glossary of Terms

ACT	Advanced Clean Technology
AES	Advanced Energy Storage
BESS	Battery Energy Storage System
CAISO	California Independent System Operator
CEATI	Centre for Energy Advancement through Technological Innovation
CEC	California Energy Commission
CO	Collectible
CPUC	California Public Utility Commission
CWP	Capital Work Paper
DER	Distributed Energy Resources
DOE	Department of Energy
EPIC	Electric Program Investment Charge
EPRI	Electric Power Research Institute
Ex	Exhibit
FTE	Full Time Equivalent
GHG	Greenhouse Gas
GRC	General Rate Case
H2	Hydrogen
HESS	Hydrogen Energy Storage System
HFEV	Hydrogen Fuel Cell Electric Vehicle
HSI	Hydrogen Strategy and Implementation
IT	Information Technology
ITF	Integrated Test Facility
kW	Kilowatt
LADC	Local Area Distribution Controller
MBESS	Mobile Battery Energy Storage Systems
MW	Megawatt
MWh	Megawatt-hour
NC	Non-Collectible
O&M	Operations and Maintenance
OIR	Order Instituting Rulemaking
PV	Photovoltaic
RD&D	Research, Development and Demonstration
SCP	Sustainable Communities Program
SDG&E	San Diego Gas & Electric
TY	Test Year