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Witnesses: D. Thai and B. Baugh

PREPARED DIRECT TESTIMONY OF

DAVID H. THAI AND BRADLEY M. BAUGH

ON BEHALF OF SAN DIEGO GAS & ELECTRIC COMPANY

CHAPTER 3

(SMART METER 2.0 PROPOSAL AND OPTIONS EVALUATED)

(REDACTED PUBLIC VERSION)

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

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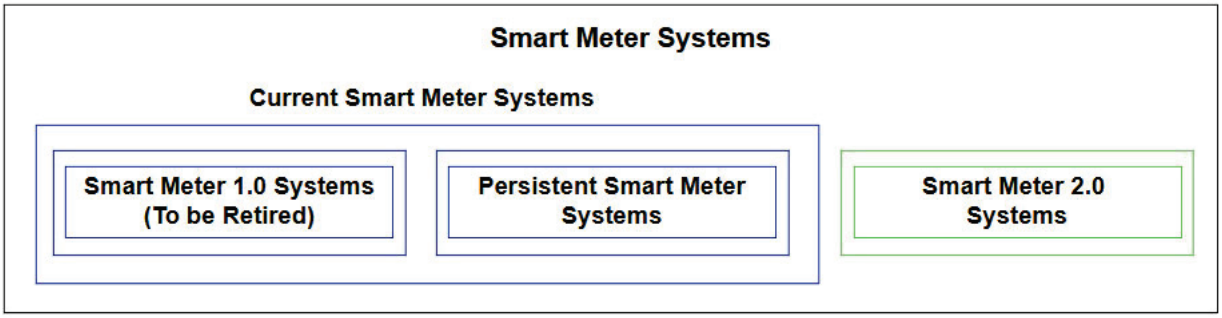
I. INTRODUCTION

This chapter outlines SDG&E's proposal for modernizing its aging Smart Meter (SM) 1.0 ecosystem to ensure that the next-generation solution meets current operational needs while positioning the utility for future innovation and grid advancements. This chapter also describes SDG&E's rigorous evaluation process for identifying alternatives to replace SM 1.0.

II. SDG&E'S PROPOSAL FOR TRANSITION TO SM 2.0

SDG&E proposes replacing its aging SM 1.0 infrastructure with SM 2.0, an updated platform designed to meet current operational challenges, maintain customer affordability, and support future advancements. SDG&E's SM 2.0 deployment strategy involves a significant degree of complexity. As discussed in greater detail in Chapter 5, upgrading SDG&E's Advanced Metering Infrastructure (AMI) functionality will involve modifications to (rather than full replacement of) SDG&E's current smart meter systems. Specifically, SDG&E will retire certain SM 1.0 systems (To-Be-Retired systems), while other existing smart meter systems will remain in place and will be incorporated into the SM 2.0 environment (Persistent systems). To implement SM 2.0, SDG&E will augment the Persistent SM 1.0 systems with new smart meter systems necessary to enable SM 2.0 functionality. Figure 3-1 below illustrates the relationship between the To-Be-Retired, Persistent, and new SM 2.0 systems involved in SDG&E's AMI Program.

Figure 3-1
Smart Meter Systems[1]

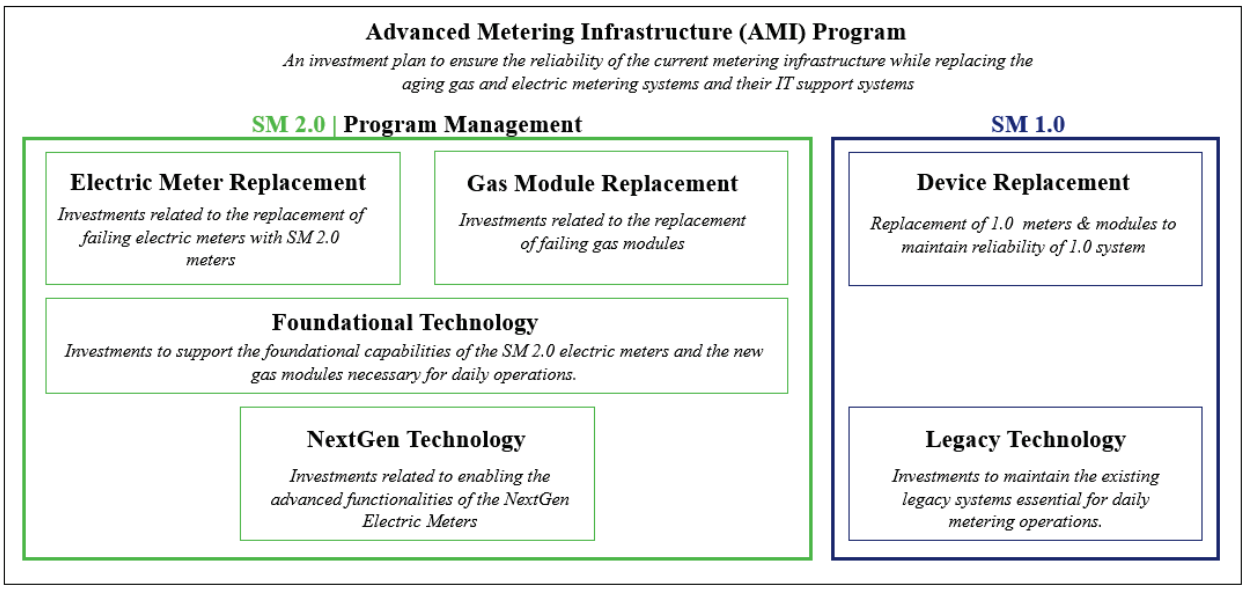


In addition to requiring modification of existing smart meter systems, transition to SM 2.0 will involve management of various groupings of technology components. First, SDG&E will implement technology that enables basic SM 2.0 capabilities and supports SM 2.0 electric meter and gas module replacements (Foundational Technology). In addition, SDG&E will implement technology to facilitate certain "Next Generation" SM 2.0 capabilities[2] that improve operational functionality and enhance the customer experience (NextGen Technology). Finally, it will be necessary during the transition from SM 1.0 to SM 2.0 to maintain the legacy SM 1.0 technology (including legacy electric meters and gas modules) for a period of time. As discussed later in this Chapter, SDG&E will seek to minimize the length of this transition period and limit further investment in SM 1.0 technology. Figure 3-2 illustrates the elements of the AMI Program, including implementation of SM 2.0 technology and devices and maintenance of the legacy SM 1.0 technology during an interim transition period, and they are discussed in more detail below.

[1] This illustration is also presented as Figure 5-1 in Chapter 5.

[2] NextGen enhanced electric capabilities are a suite of advanced metering, analytics, and grid modernization features designed to improve operational efficiency, reliability, and customer engagement.

Figure 3-2
AMI Program Structure[3]



It is critical that implementation of SM 2.0 begin as soon as is feasible given that SM 1.0 technology and devices are approaching end-of-life and that the failure rate of SM 1.0 devices is increasing. As discussed below, transition to SM 2.0 is necessary to maintain existing levels of operational functionality and customer service, and will deliver a critical upgrade that expands data capabilities, strengthens the network, enhance the customer experience, and lays the groundwork for advanced technologies such as meter-level visibility and compute intelligence (also known as edge computing or grid-edge computing).

A. SM 2.0 Implementation

SM 2.0 implementation focuses on the replacement and enhancement of metering systems. The main components include:

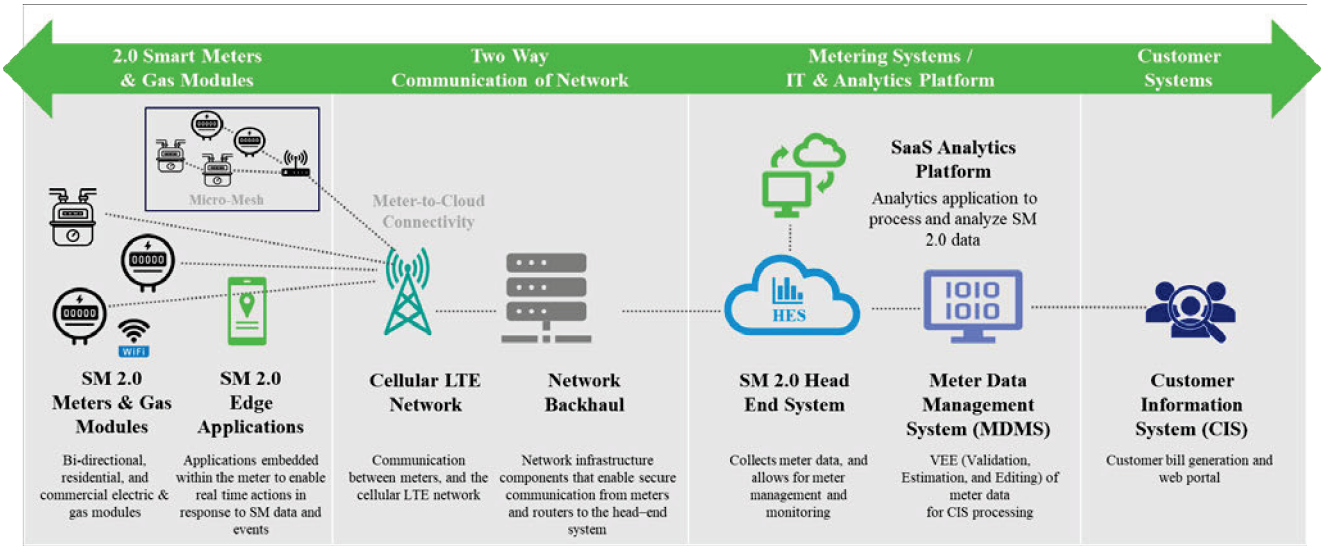
- Electric meter replacement to upgrade the existing failing infrastructure.
- Gas module replacement to ensure compatibility and improved functionality.

[3] This illustration is also presented as Figure 5-2 in Chapter 5.

- Implementation of Foundational Technology to support the transition and ongoing operation of SM 2.0.
- Implementation of NextGen Technology, introducing select advanced features for electric metering.
- Program Management – Overseeing and coordinating all aspects of the transition to Smart Meter 2.0 to ensure success.

Figure 3-3 details the components of the proposed Smart Meter 2.0 end-to-end infrastructure.

Figure 3-3[4]
SM 2.0 End-To-End Infrastructure



1. Electric Meters and Gas Modules

The approaching obsolescence and increasing failure rate of existing SM 1.0 electric meters threatens SDG&E's ability to perform basic utility functions. For example, as discussed in Chapter 2, increasing electric meter failure rates interferes with SDG&E's customer billing

[4] This illustration is also presented as Figure 5-6 in Chapter 5.

capabilities, resulting in greater reliance on estimated customer bills, and creates other negative customer and operational impacts. Thus, updating to SM 2.0 electric meters is necessary to maintain the basic level of functionality provided by SM 1.0 devices. In addition, SM 2.0 electric meters offer significant enhancements such as the ability to process and transmit data at much higher frequencies, enabling granular monitoring of electricity usage and grid performance. Unlike earlier models that provide only periodic readings, SM 2.0 electric meters can record thousands of measurements per second. This capability facilitates advanced analytics, including customer insights, which helps SDG&E better understand and manage demand across the grid.

An important innovation is the integration of meter-level visibility and compute intelligence (also known as edge computing or grid-edge computing) directly into the meter hardware. With local processing at the meter, delays and bandwidth burdens from centralized information transfers are minimized. This enables near real-time insights to grid events, such as outages or surges, and supports swift operational adjustments. Enhanced responsiveness streamlines operations and improves reliability for customers by allowing more proactive system management. Another benefit of the enhanced local processing is the ability to provide over-the-air upgrades for multiple functionalities, but also the delivery of updated applications, thus reducing the need for physical visits to update the meter for program changes.

Beyond immediate operational improvements, SM 2.0 electric meters offer a scalable platform for future enhancements. By incorporating adaptability into the system design, SDG&E can integrate emerging technologies such as advanced demand response programs, and evolving customer-facing applications. This approach supports SDG&E's commitment to providing

flexible, resilient, and innovative services that keep pace with changing market expectations and regulatory requirements.

[redacted]

Transitioning away from SM 1.0 battery-powered, Zigbee mesh-based gas modules to advanced SM 2.0 Long-Term Evolution (LTE)-enabled gas modules represents a significant technological and operational upgrade. Replacing the Zigbee communication protocol with the LTE cellular and micro-mesh networking platform will enable SM 2.0 gas modules to deliver improved security and seamless integration with the Head-End System (HES). [redacted]

2. SM 2.0 Foundational Technology

Implementation of SM 2.0 Foundational Technology is necessary to enable operation of SM 2.0 electric meters and gas modules. A detailed discussion of the SM 2.0 Foundational Technology and the back-office systems that must be installed or updated to support the new meter technology is presented in Chapter 5. This section provides a high-level summary of the key communication and related cyber-security/customer privacy aspects of the SM 2.0 Foundational Technology. It focuses on the back-office systems that must be installed or updated to support the new meter technology. Completing the foundational technology work is

critical to ensure the SM 2.0 devices operate properly and minimize customer impacts. To enable deployment of SM 2.0 devices in 2027, Foundational Technology must be implemented in 2027. Thus, SDG&E will initiate this technology development in 2026, even as this application proceeds through the regulatory process.

The SM 2.0 infrastructure will leverage an integrated two-way communications network connecting electric meters and gas modules directly to the cellular network. This network will utilize meter-to-cloud LTE connectivity through commercial cellular carriers (*e.g.*, Verizon, AT&T, T-Mobile). These SM 2.0 devices have carrier failover capabilities to maintain reliable connectivity if the primary carrier network experiences issues. For locations where LTE coverage is insufficient and cannot be extended, a micro-mesh router will be deployed to bridge the connection to the LTE network.

A new HES will be deployed using a new Software-as-a-Service (SaaS) /cloud hosting model, with the selected SM 2.0 vendor managing software and infrastructure through cloud providers. Like the current HES, the new system will enable two-way communication between smart meters, gas modules, and SDG&E's back-office systems. It will handle data exchange and remote actions such as connecting or disconnecting service to the meters, in addition to managing the deployment of NextGen applications embedded in electric meters. The HES will forward data to the existing Meter Data Management System (MDMS), which aggregates, validates, and prepares it for the existing Customer Information System (CIS). The CIS uses this data for billing, credit, collections, account management, and customer engagement.

A vital aspect of SM 2.0 Foundational Technology is the advanced cybersecurity features it offers. These upgraded cybersecurity measures are designed to protect customer information against ever-evolving threats and to ensure system integrity. The SM 2.0 platform supports

adoption of new National Institute of Standards and Technology (NIST)-approved security algorithms, enabling robust encryption for both integrations from the HES and meter-to-HES connectivity. As a SaaS-based solution, SM 2.0 benefits from frequent updates and rapid patching, allowing vulnerabilities to be addressed quickly without lengthy update cycles when systems are hosted on-premise. The SaaS environment is continuously monitored with near-real-time threat detection, allowing rapid response to emerging risks. Additionally, the implementation of cloud-to-cloud private network links strengthens data protection by reducing exposure to external threats. These combined measures ensure that customer usage data remain secure.

3. NextGen Technology to Support NextGen Enhanced Electric Capabilities

One of the most valuable features of the new SM 2.0 electric meters is their ability to selectively add new enhanced electric ("NextGen") capabilities through applications, similar to smartphone apps. This flexible platform allows SDG&E to easily update and replace applications over time to adapt to market demands, customer needs, and regulatory changes.

During the procurement process discussed later in this testimony, SDG&E evaluated NextGen capabilities currently offered in the market based on their value to customers, readiness, and implementation complexity. While several of the NextGen capabilities offered would provide material benefits and could potentially be implemented by SDG&E at a later time, SDG&E requests approval in this application to implement only a limited set of NextGen capabilities on top of the base solution. SDG&E's focus is on NextGen capabilities that will provide improved access to real-time energy data that will allow residential customers to gain unprecedented insights into their own consumption, while providing SDG&E with improved situational awareness and the ability to monitor and manage the local grid with greater precision.

Specifically, SDG&E proposes to include the following NextGen capabilities in its SM 2.0 implementation:

- **Customer Insights: Real-Time Energy Monitoring**: Provides customer visibility into behind the meter devices driving customer energy consumption. Real-time intelligence provides customers with knowledge – knowledge of an aged refrigerator needing replacement – knowledge that the electric water heater is running far too often due to a leak. This capability will be available to residential customers but would only be enabled for those customers who opt-in to activate this functionality in their account.
- **Transformer Health & Load Management Bundle (includes Transformer Health & Load Management, Meter Transformer Mapping and Phase Identification)**: Enhanced grid operation with smart sensors through the collection of advanced grid insights and analytics. Upstream, it improves planning and maintenance. Downstream, utility operations and customers benefit from improved identification of overload risks and customer power quality issues.

While SM 2.0 Foundational Technology is adequate to enable operation of SM 2.0 devices and to ensure basic operability, implementation of NextGen Technology is necessary to enable these enhanced NextGen capabilities. Specifically, the following supporting technology is necessary:

- **Grid Edge Applications**: These applications are software embedded in SM 2.0 electric meters that process data locally at the meter. They enable near real-time analysis of granular data, without waiting for back-office systems. These applications can be updated over the air and allow SDG&E to deploy new

capabilities without replacing hardware. Additional meter-to-cloud capacity will be required to handle incremental data being transmitted from these applications over the LTE cellular network to the SaaS analytics platform.

- **SaaS Analytics Platform**: This new platform is a cloud-based system provided by the SM 2.0 vendor that ingests data from grid edge applications and other sources. It performs advanced analytics, including forecasting, AI analytics, and machine learning, to support NextGen capabilities and operational processes.
- **Customer Enrollment Process**: In addition to enabling the third-party grid edge applications, a process for enrollment and unenrollment will need to be designed and developed allowing customers to enroll in the customer insights: real-time energy monitoring capability and ensuring customer data privacy when customers move locations.
- **Data Consolidation and Integration**: To enable the meter transformer mapping, phase identification, and transformer health & load management capabilities, Geographic Information System (GIS) and CIS data must be consolidated into the vendor's SaaS analytics platform to create a baseline connectivity model. Also, integrations will be built to pull corrected phase and transformer mapping data from the SaaS analytics platform into SDG&E back-office systems, including GIS, CIS, and the Outage Management System (OMS).
- **Testing and Validation:** After setup of the NextGen Technology and capabilities, extensive testing is needed to validate algorithms, fine-tune performance, and ensure security and privacy, so the implemented NextGen capabilities can be fully utilized.

As additional NextGen capabilities reach maturity, the SM 2.0 devices will provide a platform to enable their integration, if desired. This ability to implement NextGen capabilities on a selective basis at any time makes the SM 2.0 platform more flexible and adaptable than prior generations.

B. Smart Meter 1.0

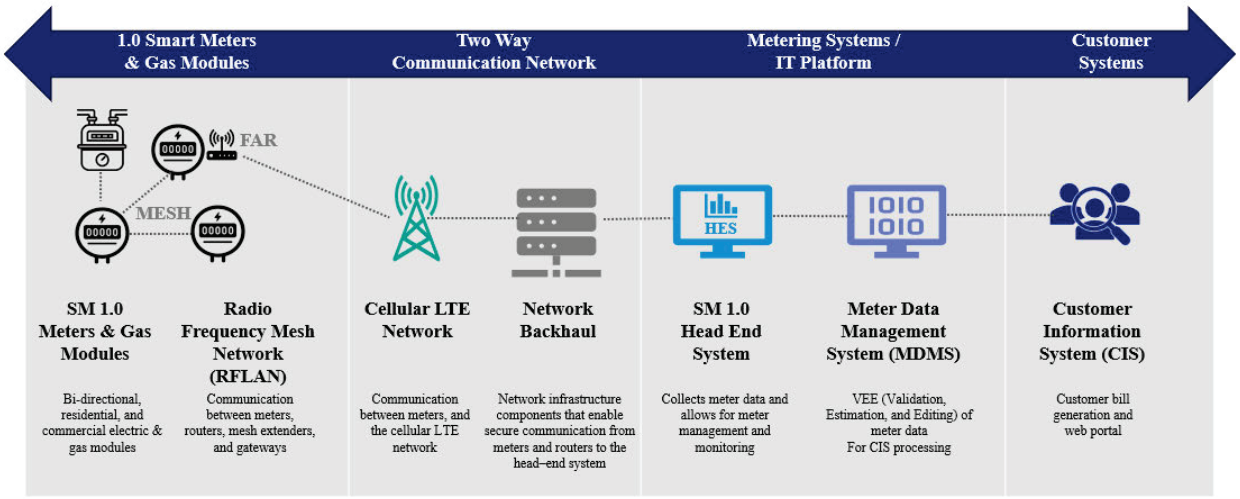
As noted above, SDG&E's existing SM 1.0 infrastructure is comprised of Persistent systems and To-Be-Retired systems; the Persistent systems will remain in place during and after the transition to SM 2.0, while the To-Be-Retired systems will remain in place only until the transition to SM 2.0 has been completed, after which point they will be retired. SDG&E notes that it is not requesting recovery of the costs associated with maintaining operability of the SM 1.0 infrastructure in the instant application.[5] As discussed in Chapter 6, SDG&E will request recovery of costs related to maintaining SM 1.0 in a separate application. The information provided in this chapter regarding SM 1.0 is offered for context and to assist the Commission in understanding how SDG&E proposes to transition from SM 1.0 to SM 2.0.

SDG&E is taking a proactive and strategic approach to addressing the limitations of its aging SM 1.0 infrastructure and sunsetting vendor support while it transitions to the SM 2.0 platform. These efforts include (1) on-going like-for-like SM 1.0 device replacements; (2) implementing targeted upgrades to SM 1.0 systems; and (3) applying mitigation measures to maintain the legacy network for the period of time needed. By maintaining legacy smart meter operations while introducing SM 2.0, SDG&E ensures continuity of existing processes and minimizes disruption. At the same time, these near-term actions lay the foundation for a smooth

[5] SM 1.0 costs are being tracked in memorandum account SM2MA.

transition to the advanced SM 2.0 platform. Figure 3-4 details the components of SDG&E's existing SM 1.0 end-to-end infrastructure.

Figure 3-4[6]
SM 1.0 End-To-End Infrastructure



1. Device Replacement

Until such time that SM 2.0 systems are fully operational and are ready to collect billing information and other data from SM 2.0 electric meters and gas modules, like-for-like replacement of existing SM 1.0 gas modules and electric meters will continue to be necessary. As discussed in Chapter 5, SDG&E anticipates ending like-for-like replacements at the end of 2026.

2. Legacy Technology

To ensure the continuity and dependability of existing metering and operational systems that will need to be maintained during the transition to SM 2.0, SDG&E must make strategic reliability investments in its legacy platforms as well as its network infrastructure (Network Mitigation Measures). These efforts are critical for maintaining stable service, meeting

[6] This illustration is also presented as Figure 2-1 in Chapter 2 and Figure 5-3 in Chapter 5.

regulatory requirements, and supporting customer needs through the deployment of SM 2.0 and beyond.

a. Legacy System Updates - Persistent Systems

These systems will remain in place and will be integrated into SM 2.0. They will continue to be maintained, updated, and enhanced. To modernize data handling and improve efficiency of many of these systems, SDG&E is migrating legacy applications like the Meter Data Management System (MDMS), data mart, and exception management applications to secure cloud environments. This transition provides scalable storage, faster processing, and stronger disaster recovery. By leveraging cloud infrastructure, historical data and exception workflows stay accessible and reliable even as hardware ages. This approach also prepares for future analytics integration and ensures compliance with evolving data governance standards.

b. Legacy System Updates - To-Be-Retired Systems

SM 1.0 systems, like the current HES, continue to support critical operations like billing, outage management, and regulatory compliance. They will remain in service and run in parallel with the new SM 2.0 systems, until all SM 1.0 electric meters and gas modules are fully replaced. In addition, to ensure stability and performance during the transition to SM 2.0, SDG&E will implement essential updates to the SM 1.0 platform to address emerging cybersecurity threats, improve data accuracy, and meet regulatory requirements.

c. Legacy Network Mitigation Measures

Reliable data communication is a cornerstone of effective metering and grid management, and the legacy SM 1.0 network needs to be maintained until SM 2.0 gas modules and electric meters are fully deployed. To address network coverage gaps and signal degradation in hard-to-reach or interference-prone areas, SDG&E will continue to deploy a suite of mitigation solutions on an interim basis. These include the installation of routers for network

traffic management, wireless extenders to boost signal strength in remote locations, and antennas to improve connectivity for legacy meters and devices. These enhancements help maintain data integrity and timely information exchange, reducing the likelihood of data loss or delayed/manual meter readings.

3. Foundational Technology / Network Decommissioning

Recognizing the need for a seamless transition, SDG&E has established a phased plan for the gradual decommissioning of legacy systems and their integrations, as well as the legacy network. This process is carefully coordinated to minimize service disruptions, preserve data integrity, and ensure that all critical functions are fully supported until the new infrastructure is fully deployed. By balancing ongoing maintenance with strategic upgrades and a structured decommissioning roadmap, SDG&E is able to maintain reliable service for its customers while paving the way for next-generation grid technologies.

III. SM 2.0 IMPLEMENTATION COSTS[7]

This section outlines the direct escalated costs of the investments needed to replace the failing infrastructure with SM 2.0 technology.[8] SDG&E has carefully evaluated these investments to ensure customers receive maximum value at the lowest cost. The figures presented are based on the Request for Proposal (RFP) process described below, internal estimates, vendor pricing, and insights from previous projects. Table 3-1 below summarizes the

[7] Table sums may not total due to rounding.

[8] Note that the comparison of vendor options described below in Table 3-9 shows loaded costs rather than direct costs.

total escalated[9] direct costs of $762.0 million covered in this application for the period from 2024 to 2031.

TABLE 3-1[10]
Summary of SM 2.0 Escalated Direct Costs ($M)

SM 2.0 Escalated Direct Cost Categories	Total	Capital	O&M
Electric Meter Replacement	[redacted]	[redacted]	$8.6
Gas Module Replacement	[redacted]	[redacted]	23.9
Foundational Technology	122.3	110.5	11.8
NextGen Technology	42.7	37.2	5.5
Program Management	41.8	38.3	3.5
SM 2.0 Escalated Direct Cost Subtotal	**$701.9**	**$648.5**	**$53.4**
Contingency	60.1	54.3	5.8
SM 2.0 Escalated Direct Cost Total	**$762.0**	**$702.8**	**$59.2**

As shown in Table 3-1, the projected escalated direct costs for procuring, installing, and deploying the technology needed for SM 2.0 are $702.8 million in capital costs and $59.2 million in operations and maintenance costs (O&M).

For total loaded Capital & O&M cost of $825.0 million for SM 2.0, see Table 6-2 in Chapter 6. The capital costs include overhead loaders, AFUDC, and capitalized property tax.

A. Electric Meters and Installation Costs

The costs of electric meters and installation include the hardware associated with the new SM 2.0 electric meters, as well as the labor and equipment used to remove, install, and test the new electric meters. Total electric meters and installation costs are forecasted at [redacted] million.

Table 3-2 presents a breakdown of these costs and includes the split between capital and O&M.

[9] Escalation has been applied to the direct costs to properly account for inflation which is based on indices in SAP Global Quarter 2025 Power Planner utility forecast (published in July 2025) for this application.

[10] *See Chapter 3, Workpaper 1, Tab – Testimony Table 3-1-C.*

Table 3-2[11]
Summary of Electric Meters and Installation Escalated Direct Costs

	($M)		
Cost Category	**Total**	**Capital**	**O&M**
Hardware	[redacted]	[redacted]	$0.0
Install	80.5	80.5	0.0
Removal	8.9	0.0	8.9
Testing & Disposal	1.2	1.5	(0.3)
Warehouse	10.0	10.0	0.0
Total Electric Meters and Installation Costs	[redacted]	[redacted]	**$8.6**

Hardware costs for 1.6 million 2.0 electric meters total [redacted] million in capital costs, out of the [redacted] million allocated for electric meters and installation.

New electric meter installation costs total $80.5 million in capital costs. These costs include both utility and installation contract labor.

The removal costs for 1.0 electric meters, totaling $8.9 million, are classified as O&M costs. These costs include both internal labor and contracted services for meter removal.

Testing and disposal costs total $1.2 million, covering both the testing of new electric meters and the disposal of existing ones. Testing ensures shipment quality and verifies device accuracy and compliance. Disposal costs are associated with retiring legacy meters from SDG&E's systems and safely scrapping the devices.

Warehouse costs of $10.0 million are included for the capital costs of storing hardware and other deployment-related apparatus.

[11] Forecasted SM 2.0 costs do not include loaders and contingencies. See *Chapter 3, Workpaper 1, Tab - WP 3.2.1-C (Capital and O&M).*

B. Gas Modules and Installation Costs

The costs of 2.0 gas modules and installation include the hardware associated with the new gas modules, as well as the labor and equipment used to remove, install, and test the new gas modules. Total gas modules and installation costs are forecasted at [redacted] million.

Table 3-3 below presents a breakdown of these costs and includes the split between capital and O&M.

Table 3-3[12]
Summary of Gas Modules and Installation Escalated Direct Costs

	($M)		
Cost Category	**Total**	**Capital**	**O&M**
Hardware	[redacted]	[redacted]	$0.0
Install	[redacted]	[redacted]	0.0
Removal	21.6	0.0	21.6
Testing & Disposal	3.7	1.4	2.3
Total Gas Modules and Installation Costs	[redacted]	[redacted]	**$23.9**

Hardware costs for 953,000 2.0 gas modules total [redacted] million in capital costs, out of the [redacted] million allocated for gas modules and installation.

New gas module installation costs total $21.8 million in capital costs. These costs include both utility and installation contract labor.

Removal costs for 1.0 gas modules total $21.6 million and are classified as O&M costs. These costs include both internal labor and contracted services for gas module removal.

Testing and disposal costs total $3.7 million, covering both the testing of new gas modules and the disposal of existing ones. Testing ensures shipment quality and verifies device

[12] Forecasted SM 2.0 costs do not include loaders and contingencies. *See Chapter 3, Workpaper 1, Tab - WP 3.3.1-C (Capital and O&M).*

accuracy and compliance. Disposal costs are associated with retiring the modules from SDG&E's systems and safely scraping the devices.

C. Foundational Technology Costs

To implement SM 2.0 Foundational Technology, SDG&E requires IT and network investments totaling $122.3 million. These costs cover the design, development, testing, deployment, and operation of the new foundational technology, as well as the decommissioning of legacy SM 1.0 systems and network. Internal labor, purchased labor, and vendor services are needed to complete these activities. Software is required for the new HES to manage meter data and operations. In addition, meter-to-cloud connectivity and network hardware are necessary to transmit consumption and operational data from electric meters and gas modules to the HES. Cost estimates are based on the RFP process described below, vendor pricing, level-of-effort assessments, and data usage estimates provided in vendor RFP responses, as applicable.

Table 3-4 presents a breakdown of these costs and includes the split between capital and O&M.

Table 3-4[13]
Summary of Foundational Technology Escalated Direct Costs

	($M)		
Cost Category	**Total**	**Capital**	**O&M**
Internal Labor	$6.8	$6.6	$0.2
Purchased Labor (Contractors)	7.3	7.0	0.3
Vendor Services	[redacted]	[redacted]	6.3
Network Hardware Decommissioning	4.9	0.0	4.9
Software	[redacted]	[redacted]	0.1
Meter-to-Cloud Connectivity	[redacted]	[redacted]	0.0
Network Hardware	[redacted]	[redacted]	0.0
Total Costs – Foundational Technology	**$122.3**	**$110.5**	**$11.8**

SM 2.0 IT and network costs for Foundational Technology include capital costs of $110.5 million and O&M costs of $11.8 million.

SDG&E must make significant investments to successfully design, integrate, and implement the SM 2.0 solution. These investments include developing future-state business processes, establishing robust system integration, and defining a comprehensive solution architecture to ensure seamless interoperability across all platforms. They also include the implementation of the new HES, remediation and configuration of existing systems, deployment of supporting infrastructure, and testing to validate requirements and performance. Cybersecurity protections are required to safeguard customer data and operational functions. Additional activities include IT procurement and contracting, post go-live operational support, decommissioning of SM 1.0 systems and network, and expanding capacity for the MDMS, CIS and analytics systems. The total cost for these activities is [redacted] million and consists of internal labor, purchased labor, vendor services, and network hardware decommissioning.

[13] Forecasted SM 2.0 costs do not include loaders and contingencies. *See Chapter 3, Workpaper 2, Tab - WP 3.4.1-C (Capital and O&M).*

The program also requires [redacted] million for software to cover a new SaaS HES, and eSIM to enable secure connectivity.

Meter-to-cloud connectivity and new network hardware are required to enable meter communications for customer billing and operational functions such as remote service turn-on and turn-off. Additional hardware is needed for hard-to-reach areas where LTE coverage is limited. The total cost for each of these items (meter-to-cloud connectivity and network hardware) are [redacted] million and [redacted] million, respectively.

D. NextGen Technology Costs

To implement SM 2.0 NextGen Technology, SDG&E will require $42.7 million in IT and network investments. These funds will support the design, build, testing, deployment, and ongoing operations of the new capabilities. The work will involve internal labor, purchased labor, and vendor services. Additional Meter-to-Cloud Connectivity capacity is required to enable these capabilities. Software is required for the new SaaS analytics platform and grid-edge applications required for the in-scope NextGen capabilities. To fully implement these NextGen capabilities, business transformation & enablement activities are required. Cost estimates are based on vendor responses to SDG&E's RFP, level-of-effort assessments, and data usage estimates provided in vendor RFP responses as applicable.

These investments ensure the successful deployment and ongoing operation of NextGen technologies.

Table 3-5 presents a breakdown of these costs and includes the split between capital and O&M.

Table 3-5[14]
Summary of NextGen Technology Escalated Direct Costs

	($M)		
Cost Category	**Total**	**Capital**	**O&M**
Internal Labor	$3.6	$2.2	$1.4
Purchased Labor (Contractors)	0.5	0.5	0.0
Vendor Services	[redacted]	[redacted]	4.1
Software	[redacted]	[redacted]	0.0
Meter-to-Cloud Connectivity	[redacted]	[redacted]	0.0
Business Transformation & Enablement	6.2	6.2	0.0
Total Costs – NextGen Technology	**$42.7**	**$37.2**	**$5.5**

SM 2.0 NextGen Technology includes the capabilities of customer insights: real-time energy monitoring, meter transformer mapping, phase identification, and transformer health & load management. The total cost for these activities is $37.2 million in capital costs and $5.5 million in O&M costs.

For implementation of NextGen capabilities, SDG&E must invest in the development and deployment of these technologies. These efforts include creating future-state business processes, system integration activities, and defining a robust solution architecture for interoperability across all required platforms. They also include the IT leadership, configuration and remediation of existing systems, deployment of supporting infrastructure, and testing to validate requirements and performance. Cybersecurity and privacy protections (including validation) are required to safeguard both customer and operational data. Additional costs include labor for post-implementation support and leased network links between cloud platforms to secure customer

[14] Forecasted SM 2.0 costs do not include loaders and contingencies. *See Chapter 3, Workpaper 2, Tab - WP 3.5.1-C (Capital and O&M).*

data. The total cost for the activities is [redacted] million and consists of internal labor, purchased labor, and vendor services.

Software costs of [redacted] million cover term licenses for the vendor SaaS analytics platform, necessary grid-edge applications, and the load disaggregation platform.

Incremental meter-to-cloud connectivity capacity of [redacted] million to obtain incremental data from electric meters required to enable the NextGen capabilities.

Business Transformation & Enablement costs $6.2 million and represents expenditures for project management, change management, customer engagement, and business implementation activities.

E. Program Costs

Program Costs include Program Management, Training and Change Management, Customer Engagement, and Business Implementation costs to manage the AMI Program's transition to SM 2.0.

Table 3-6 below shows the Total Program Costs of $41.8 million.

Table 3-6[15]
Summary of Program Escalated Direct Costs

	($M)		
Cost Category	**Total**	**Capital**	**O&M**
Program Management	$8.9	$5.4	$3.5
Training and Change Management	3.2	3.2	0.0
ME&O	7.3	7.3	0.0
Business Implementation	4.5	4.5	0.0
Deployment	17.9	17.9	0.0
Total Program Costs	**$41.8**	**$38.3**	**$3.5**

[15] Forecasted SM 2.0 costs do not include loaders and contingencies. *See Chapter 3, Workpaper 1, Tab - WP 3.6.1 (Capital and O&M).*

Program management, training and change management include labor costs for general project management leads, coordinators, reporting analysts, change management analysts and trainers and comprise $8.9 million and $3.2 million of the total program costs respectively.

SDG&E Marketing, Outreach and Education forecast includes the labor and messaging costs necessary for customer outreach related to the AMI Program and comprises $7.3 million of the total Program Costs.

Business implementation includes labor costs for as-is, business related Business Process Design (BPD) and requirements gathering, business testing and Subject Matter Resources (SMRs), and equals $4.5 million of the total Program Costs.

Deployment capital costs total $17.9 million and include planning for and deploying new devices in the field, managing inventory levels, field and back-office exceptions, quality audits, tracking and reporting performance metrics, and implementing process improvements. These costs also include activities to support the transition of device ownership to SDG&E meter operations, including monitoring device health to ensure usage reads are available for billing.

F. Contingency Costs

Further, as part of the overall application, SDG&E requests contingency costs. Applying contingencies transparently to projects of significant size and complexity, such as the SM 2.0 project, is standard practice to mitigate the risk of unknown or unforeseen expenses.[16] Although factors like inflation are included in the cost forecast to anticipate cost changes over time, over the duration of the project, it is possible that financial, regulatory, or market conditions will shift.

[16] *See, e.g.,* Decision (D.) 18-08-008 at 11 (approving a total nominal project contingency for the CIS Replacement Program of $29.6 million).

As the effect and magnitude of these changes cannot be reasonably anticipated, SDG&E's contingency request takes different risk probabilities into account across cost categories.

Within the cost categories for gas module replacement, the electric meter replacement, and NextGen electric capabilities, different contingency factors are applied based on confidence level in the estimates and SDG&E experience to provide a reasonable assessment of contingency needs across cost categories. Overall, this approach ensures sensible cost forecasting to mitigate the inherent uncertainties in implementing the AMI Program's transition to SM 2.0. SDG&E's forecasted contingency cost is shown in Table 3-7 below:

Table 3-7
SM 2.0 Contingency Escalated Direct Costs

	($M)		
Cost Category	**Total**	**Capital**	**O&M**
SM 2.0 Contingency	$60.1	$54.3	$5.8
Total Costs	**$60.1**	**$54.3**	**$5.8**

The project costs in Table 3-7 above do not incorporate potential impacts from government-assessed tariffs. There are uncertainty and variability regarding tariff costs and their possible effects on SDG&E's financial projections related to hardware, module, and meter costs. This unpredictability may affect the accuracy of the financial estimates provided. Should there be government-assessed tariffs, SDG&E may file a request to seek supplemental cost recovery for unaccounted government-assed tariffs. This process will help present a more transparent base case concerning potential tariff implications. Due to the significant volatility associated with the potential impact of tariffs, SDG&E has not included any contingencies to address this risk.

IV. PROCUREMENT PROCESS

A. Starting with the Future in Mind

While SM 1.0 was state-of-the-art technology at the time it was adopted and has provided substantial value to customers and to SDG&E over the past two decades, it is now approaching the end of its useful life and no longer aligns with emerging regulatory expectations or the data needs of a more dynamic distribution grid. To determine the appropriate path forward given the impending obsolescence of the SM 1.0 technology and increasing device failure rates, SDG&E undertook a comprehensive enterprise-wide effort to identify the limitations of the SM 1.0 system, understand future requirements, and explore capabilities needed to support the next era of grid planning, safety, resiliency, and clean energy delivery.

A key driver of this initiative was the increasing alignment between statewide policy objectives and SDG&E's need for more advanced metering capabilities. The Commission and stakeholders have continued to request more detailed metering data to support a variety of regulatory efforts. For example, in Rulemaking (R.) 22-11-013[17], the Commission emphasized that utilities must provide scalable data, such as from AMI to track, monitor, and audit program performance for DER participants. Additionally, the notion of more granular AMI data has also been discussed in D.25-08-049[18], where there is an emphasis that moving toward real-time rates will require a robust technological foundation, and deliberation of whether the technology should be able to handle CAISO's day-of market price intervals. Similarly, in Decision D.22-12-056[19],

[17] R.22-11-013, Order Instituting Rulemaking to Consider Distributed Energy Resource Program Cost-Effectiveness Issues, Data Use and Access, and Equipment Performance Standards (filed November 17, 2022).

[18] D.25-08-049.

[19] D.22-12-056 at 132 ("this decision directs the utilities to include both channels of data in 15-minute intervals in their customer-authorized energy usage data portals.").

the Commission directs utilities to deliver fifteen-minute consumption interval data to customers – functionality that the legacy SM 1.0 infrastructure cannot provide at scale. Parallel efforts such as the California Energy Commission's EPIC 4 research program (2021–2025 cycle)[20] continue to demonstrate the operational and safety benefits of more granular AMI measurements.

Against this evolving landscape, SDG&E began its Smart Meter 2.0 planning by identifying the most critical capabilities required to meet both future operational needs and emerging regulatory expectations. The first step in this initiative was to identify the most critical capabilities. To gather insights into essential capabilities, SDG&E retained Ernst & Young to work with internal stakeholder groups across electric and gas engineering, IT, operations, meter shop, network infrastructure, and supply management. These collaborative sessions focused on identifying SM 2.0 use cases that not only resolve the current SM 1.0 challenges but also enable new functionalities, optimize operations, and achieve a flexible platform for the future. This effort resulted in the identification of potential use cases, such as customer insights: real-time energy monitoring, electric vehicle (EV) identification, high impedance detection, and transformer health and load management, among others. Once identified, the capabilities were evaluated and prioritized.

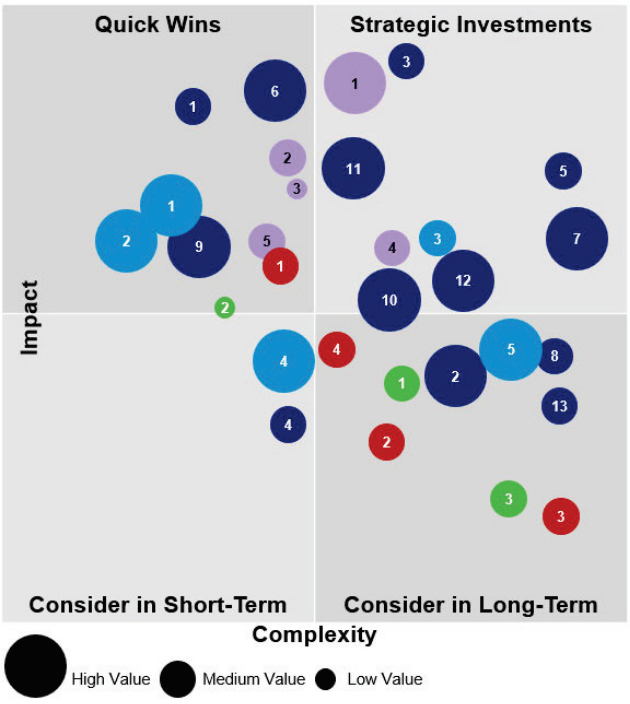
After mapping the use cases, SDG&E assessed the feasibility and complexity of implementing these capabilities through a Business Capability Maturity Assessment. Working with key stakeholders, SDG&E conducted a high-level review of its current ability to deliver the desired use cases. This readiness exercise identified gaps in business capabilities and highlighted potential implementation challenges.

[20] A.22-10-002, Application of SDG&E (U 902 E) for Approval of Fourth Electric Program Investment Charge Plan for Years 2021-2025 (filed October 3, 2022).

Next, SDG&E evaluated each capability based on strategic alignment, potential impact, and implementation complexity, as illustrated in Figure 3-5 below. Use cases were then plotted on a 2x2 matrix with four categories:

- **Strategic Investments** (high impact, high complexity)
- **Quick Wins** (high impact, low complexity)
- **Consider Long Term** (low impact, high complexity)
- **Consider Short Term** (low impact, low complexity)

Figure 3-5
SM 2.0 Priorities



The results of this process formed the foundation for SDG&E's procurement strategy, undertaken in 2025, which requires a model enabling granular, meter-level visibility and edge computing for long-term adaptability and future-proofing.

B. Vendor Selection Process

Selecting the right vendor solution is crucial for the ongoing success of SDG&E's AMI Program and for meeting the expectations of customers, stakeholders, and the Commission. After issuance of the Commission's decision in SDG&E's 2024 GRC case proceeding, which directed SDG&E to submit a separate application to propose its smart meter upgrade solution, SDG&E sought to refresh its consideration of available options since the proposal included in SDG&E's 2024 GRC had been developed in 2021. SDG&E engaged business and technology consulting firm, West Monroe , to support the vendor selection process based on its expertise and knowledge of best practices in managing similar procurement processes. As discussed below, SDG&E conducted both a comprehensive Request for Proposals (RFP) process to solicit bids from established AMI vendors, and a Request for Quotation (RFQ) process to request information from SDG&E's incumbent vendor regarding extending the life of SDG&E's current SM 1.0 solution. SDG&E's vendor selection process included a thorough evaluation and review process considering costs, technology capabilities, supply chains, and other factors.

1. RFP Process

SDG&E issued an RFP in March 2025 soliciting bids from the leading five smart meter vendors (including SDG&E's incumbent vendor) for replacement of electric meters and gas modules and supporting technology. Two vendors responded to the RFP with comprehensive proposed solutions. SDG&E's incumbent vendor did not offer a bid into the solicitation.

The RFP followed a structured, multi-phased evaluation process to ensure thorough review and vetting of all proposals and the evaluation team included internal subject matter experts (SMEs) across electric and gas engineering, IT, operations, customer experience, meter shop, network infrastructure, and supply management functions. As shown in Table 3-8, the evaluation framework considered technical performance, functional requirements, delivery

requirements, bidder sustainability, commercial terms, and future use case opportunities, among other criteria.

Table 3-8
SM 2.0 Technology RFP Evaluation Criteria

Group	Evaluation Criterion	Criterion Summary
Functional Requirements	System Functionality	Ability of the proposed system, as a whole, to meet SDG&E's functional requirements
	Network Functionality	Extent to which the network meets SDG&E's technical and functional requirements for Endpoint connectivity
	Endpoint and Endpoint Mgmt.	Degree to which the meters and modules can be configured to meet potential SDG&E use cases
	Future Capabilities	Ability of the proposed system to deliver against SDG&E's planned and/or contemplated future capabilities
Delivery Requirements	Technical and IT Conpliance	How fully the proposed system, and the associated services, will comply with SDG&E's technical standards – including Disaster Recovery, Cybersecurity, general IT Standards, and Change Management procedures
	Service Compliance	Bidder's willingness to provide the requested scope of implementation and operational services and to comply wit the requested performance standards
	Commercial Compliance	Extent to which Bidder will agree to SDG&E's proposed compensation structure, financial remedies for non-performance, and service, product, and system warranty terms
Bidder Suitability	Approach and Experience	How confident is SDG&E in Bidder's ability to deliver the proposed solution?
	Sustainability	How completely will Bidder align to SDG&E's intentions to create a lasting and positive community impact?
Transaction Robustness	Legal T&Cs and Financial Stability	Extent to which Bidder can provide SDG&E the assurance, protections and commercial flexibility it requires
	Pricing	The total anticipated cost of the propcsed solution

The base functional requirements focused on ensuring that a SM 2.0 system would meet SDG&E's operational, safety and technical needs. This includes the ability of the system to deliver reliable metering functionality for electric and gas applications, such as interval data collection, demand measurement, outage and restoration notifications, and remote disconnect/reconnect capabilities – these are technical needs today for SM 1.0. The solution must also support network functionality through robust connectivity options (*e.g.*, cellular, and micro-mesh networks) and provide scalable endpoint management for provisioning, monitoring, and maintaining meters. Additionally, the system should integrate seamlessly with SDG&E's IT environment, offer comprehensive reporting, and enable bi-directional metering. These requirements ensure the system is resilient, interoperable, and capable of supporting SDG&E's current and future capabilities.

Supply chain analysis was another key component of SDG&E's risk management strategy for SM 2.0. Vendors' supply chains were assessed for vulnerabilities that could impact system reliability, data privacy, and national security. Special attention was given to the sourcing of foreign-manufactured components, particularly core processing and communication modules, to mitigate cybersecurity risks. The evaluation prioritized vendors capable of securing long-lead components, addressing current global supply chain volatility.

In addition, it was essential that the SM 2.0 meters and modules be designed for long-term adaptability and support future or NextGen capabilities. A helpful analogy for the NextGen capabilities is to compare the NextGen Meter to a smartphone. The core functionalities included out of the box (shown as proposal features in the table below) are like the phone's basic features, while the NextGen capabilities are like apps in the 'app store' that can be purchased and installed later. This approach makes the SM 2.0 meters more flexible and future proof than prior generations. The following is a brief overview of the NextGen capabilities that were offered by the vendors as part of the RFP process.

- **Customer Insights: Real-Time Energy Monitoring**: Allows customers to see in real-time what is happening in their home through a web portal or app on their phone. It allows them to see what devices are on and how much energy those devices are using in real-time. This also allows customers to receive an alert in cases when certain devices are operating more often than they should (*e.g.*, water heater)**.**
- **Transformer Health & Load Management**: Although SDG&E already monitors transformer loading and performance today, NextGen technology enhances this capability by delivering higher-resolution interval data and

improved grid visibility. These advancements enable more precise visibility into load patterns and may provide earlier detection of emerging issues and automated notification for operations. As a result, the system can more effectively prevent overloads and reduce outage risk.

- **Meter Transformer Mapping**: While SDG&E maintains meter-to-transformer associations today, NextGen technology improves the accuracy and maintainability of this mapping. These enhancements support identification and association of customer electric meters with their corresponding distribution transformers and circuit phases by using computing at the meter to pinpoint, with a high degree of accuracy, which electric meters are connected to specific transformers within the network. This capability encompasses the integration of data from this solution into the Geographic Information System (GIS), ensuring synchronization with the Network Management System (NMS).
- **Phase Identification**: Provides the ability to determine which of the three electrical phases a customer or piece of equipment is connected to within the power distribution system. Phase identification is critical for load balancing, outage management, voltage control and successful integration of distributed energy resources (DERs).
- **Enhanced Power Quality Analysis**: Enables real-time monitoring and analysis of voltage, current, and power quality metrics across the grid to proactively identify and resolve anomalies.

- **DER Management**: Allows SDG&E to proactively identify and manage energy sources like solar generation, batteries, and electric vehicles through a Wi-Fi connectivity between the meters and the DER devices.
- **EV Charging Optimization**: Enables proactive intelligent management of EV charging and energy flow to customers' homes with existing electric infrastructure, with the increasing adoption of EVs.
- **Enhanced Theft and Tampering Detection**: Enables utilities to identify and address instances of electricity theft more effectively, through the new NextGen meters detailed data collected. Traditional electricity meters provided limited information, making it challenging for utilities to detect electricity theft.

Following months of comprehensive evaluations and several days of vendor interviews, scores were compiled based on established criteria (functional requirements/delivery requirements/bidder sustainability/transaction robustness), identifying the vendor that best aligns with SDG&E's priorities both for the present day and the future. This step was especially important because prudently selecting technology is not simply a matter of choosing the option with the lowest upfront cost. A meter installed today will remain in the field for more than a decade and must support evolving customer expectations, regulatory requirements, and dynamic grid conditions that will look very different from those in 2025. Choosing a technology that lacks flexibility or adaptability may appear cost effective in the short term, but may ultimately result in higher long-term expenses when the device needs to be replaced early or retrofitted to perform functions it was never designed to support.

In simple terms, the lowest cost option today can become the most expensive option tomorrow. In contrast, selecting a technology platform that is ready for future use cases, even if

every envisioned capability is not needed immediately, provides clear and lasting value. A future-ready SM 2.0 solution protects customer dollars by reducing the likelihood of obsolescence before technology end-of-life, lowering long-term operating costs, and ensuring that the system can meet needs without major reinvestment. The optimal solution allows flexibility and offers a technical foundation that can support innovations that are not yet fully defined today but are expected to be essential as the electric grid becomes more distributed, more dynamic, and more dependent on timely and accurate data.

Applying the criteria discussed above, SDG&E thoroughly evaluated each RFP bid with the objective of identifying the solution that would offer proven and robust technologies capable of meeting today's needs, while also demonstrating the extensibility, processing power, and feature depth necessary to meet future system demands. SDG&E's evaluation of the bids offered in response to the RFP separately considered base features (*i.e.*, those functions and capabilities that are "must haves" and are essential to operation of the smart meter system) and NextGen capabilities, which offer valuable enhancements that can be implemented at any time – now or in the future. Table 3-9 shows the comparison between vendor bids and the base features and NextGen features offered with each.

Table 3-9
SM 2.0 Technology Proposal Evaluation (Loaded Cost Comparison)

	CONFIDENTIAL	Vendor 1		Vendor 2
	Meter Proposed	**Legacy Meter(1)**	**SM 2.0 Proposal**	**SM 2.0 Proposal**
	Base Features			
Foundational	Legacy Smart Meter Features	●	●	●
Foundational	Enhanced Cybersecurity	[redacted]	◔	●
Foundational	Remote Feature Updates and Troubleshooting	[redacted]	◔	●
Foundational	Future Proof Flexibility	[redacted]	◔	●
Foundational	Point-to-Point Network Solution	●	●	●
	Total Foundational SM Cost (2024-2031)	[redacted]	[redacted]	**$775m**
	Selected NextGen Capabilities			
Additional Capabilities	Customer Insights: Real-Time Energy Monitoring	[redacted]	[redacted]	●
Additional Capabilities	Transformer Health & Load Management	[redacted]	[redacted]	●
Additional Capabilities	Meter Transformer Mapping	[redacted]	[redacted]	●
Additional Capabilities	Phase Identification	[redacted]	[redacted]	●
	NextGen Capabilities SM Cost (2024-2031)	[redacted]	[redacted]	**$50m**
	Other Available NextGen Capabilities	[redacted]	[redacted]	
	Enhanced Power Quality Analysis	[redacted]	[redacted]	●
	DER Management	[redacted]	[redacted]	●
	EV Charging Optimization	[redacted]	[redacted]	●
	Enhanced Theft/Tampering Detection	[redacted]	[redacted]	●

(1) Meter does not have the capability to add features, or it would be cost prohibited in the future
(2) Incremental cost expected once features become available

As shown in Table 3-9, Vendor 1 offered two potential solutions. The first "bare bones" solution is Vendor 1's version of SM 1.0; it offers the functionality of SDG&E's current SM 1.0 system (*i.e.*, it meets the "legacy smart meter features" criterion) with an improvement over SDG&E's existing SM 1.0 infrastructure in the area of point-to-point network solutions. However, the bid does not meet critical requirements for base features related to cybersecurity protections and remote feature updates and troubleshooting. Nor does this solution ensure the ability to "future proof" the system; in other words, the solution fails to ensure the capacity of the system to adapt to new requirements as they arise over time and offers no NextGen capabilities. The second solution offered by Vendor 1 meets some but not all of the criteria established for the solicitation. It only partially satisfies the RFP evaluation criteria related to cybersecurity, remote feature updates/troubleshooting, and future proofing, and while the bid submitted by Vendor 1

lists NextGen capabilities on its product roadmap, these capabilities are not offered currently and when they *are* offered, they will be first generation products for this vendor (and offered at additional cost not included in the bid).

The SM 2.0 bid offered by Vendor 2 is far superior on a comparative basis. Unlike Vendor 1's bids, the solution proposed by Vendor 2 satisfies the full set of evaluation criteria related to SM 2.0 base features and offers a suite of mature, robust NextGen capabilities that can be deployed immediately or at any time in the future. Vendor 2's solution directly addresses the limitations of SDG&E's current SM 1.0 system and aligns with future regulatory and operational needs. As shown in Table 3-9, Vendor 2's SM 2.0 proposal delivers more functionality at a lower overall cost compared to Vendor 1's SM 2.0 proposal. The total estimated cost of the SM 2.0 solution offered by Vendor 2 is $ 825 million, which covers immediate[21] deployment of the "selected NextGen capabilities" indicated in Table 3-9,[22] versus Vendor 1's [redacted] million, which includes <u>no</u> NextGen capabilities. The delta between the costs of the solutions proposed by Vendor 1 and Vendor is expected to grow as Vendor 2's NextGen features become available. Vendor 1's legacy meter proposal is not viable given the relatively high cost for what would be a minimal improvement in smart meter functionality. Put simply, Vendor 2 is the most cost effective and strategically aligned choice for SDG&E's next generation metering solution.

2. RFQ Process

SDG&E issued its RFQ to the incumbent vendor to assess the feasibility of maintaining its SM 1.0 infrastructure over the next two decades through like-for-like device replacements and technology upgrades. SDG&E's Master Services Agreement (MSA) with the incumbent vendor

[21] According to the phased schedule described in Chapter 4.

[22] SDG&E does not propose to deploy the NextGen capabilities listed in the "Other Available NextGen Capabilities" category in Table 3-9 at this time, but may seek to do so in the future.

expires in 2028. The incumbent vendor has indicated that due to component obsolescence and technological advancements, the SM 1.0 platform specified in the current MSA is being transitioned to the supplier's next-generation solution. As a result, in the RFQ response, the incumbent vendor committed to working with SDG&E but did not guarantee sufficient supply of SM 1.0 devices between 2028-2035. Additionally, the incumbent vendor indicated that it could not secure guarantees from its suppliers (specific to RFLAN) to support SM 1.0 product availability or support beyond 2035. Based on these factors, the incumbent vendor advised SDG&E to develop a transition plan to ensure continuity and mitigate risk.

C. Other Options Evaluated

SDG&E has considered other alternatives for addressing SM 1.0 challenges, including: a) delayed SM 2.0 implementation and continued replacement of failing SM 1.0 electric meters and gas modules with like-for-like SM 1.0 devices; b) battery replacement for gas modules (partial solution); and c) utilizing smart inverter technology. For the reasons discussed below, none of these options are feasible. Rather, the optimal solution is SDG&E's proposed SM 2.0 replacement approach described above.

1. Delayed implementation with continued like-for-like SM 1.0 device replacements

SDG&E believes that its proposal to implement SM 2.0 in 2027 is the optimal approach, however it also considered the option of delaying implementation – *i.e.,* beginning SM 2.0 implementation in 2031 or 2032 – and continuing to replace failing SM 1.0 electric meters and gas modules with like-for-like SM 1.0 devices in the meantime. This approach is problematic for several reasons, including significantly increased cost, potential unavailability of replacement devices, operational burdens, negative impacts on customer experience, and potential network vulnerabilities. Put simply, delaying SM 2.0 implementation and prolonging investment in

obsolete technology will serve only to increase costs for customers, create operational challenges, and degrade the customer experience.

a. Cost Impacts

As part of its evaluation, SDG&E analyzed the incremental costs associated with delaying the transition to SM 2.0, including costs for replacing failing devices, field installations, IT maintenance, and sustaining the SM 1.0 network. Table 3-10 below provides a comparison of the costs associated with the various deployment options that SDG&E considered.

Table 3-10[23]
Deployment Scenario Cost Comparison ($M)

Deployment Timing	SM 2.0 Direct Costs	Escalation Impact	Adjusted SM 2.0 Costs	Incremental SM 1.0 Direct Costs	Total Direct Costs
Beginning in 2027*	$762.0	N/A	N/A	N/A	$762.0
Beginning in 2031	$762.0	$71.3	$833.3	$188.1	$1,021.4
Beginning in 2032	$762.0	$86.9	$848.9	$274.4	$1,123.3

*Note: Proposed Option

Delaying the transition to SM 2.0 significantly impacts overall program costs, with costs increasing materially with each additional year. Under SDG&E's proposed timeline for implementation (beginning SM 2.0 deployment in 2027), the escalated direct program cost is estimated at $762.0 million. A delay to 2031 would raise this to $833.3 million, and a delay to 2032 would increase further to $848.9 million.

In addition, continuing to install SM 1.0 devices through 2031 is estimated to add approximately $188.1 million in incremental direct costs, while delaying until 2032 increases that figure to about $274.4 million. These amounts reflect the additional direct costs of addressing SM 1.0 failures.

[23] *See Chapter 3, Workpaper 3, Tab 3.10.1(Delayed Deployment)*

When combined, the total incremental direct costs under the 2031 and 2032 delay scenarios are projected at $1,021.4 million and $1,123.3 million, respectively.

Additional costs would also arise from the need to significantly expand the resources available to handle continued full operation of the SM 1.0 infrastructure. SDG&E's current workforce cannot accommodate the anticipated surge in SM 1.0 device failures in 2030-2032. At present, SDG&E can replace approximately 60,000 devices per year, insufficient to keep pace with projected failures. To avoid catastrophic degradation of the SM 1.0 system, SDG&E would need to significantly augment its workforce, either through new hires or third-party vendors. These staffing increases would impose substantial additional costs on SDG&E and, ultimately, on customers.

In addition, delayed SM 2.0 implementation would create significant operational challenges. As the company troubleshoots and replaces failing infrastructure, impacts will ripple across the network, call centers, billing systems, and multiple customer-facing and support organizations. With device failures accelerating through 2030–2032, SDG&E will incur additional costs to sustain the SM 1.0 network. These efforts will be largely reactionary, as gaps in the RFLAN network caused by device failures reduce SDG&E's ability to quickly identify and resolve issues. This inefficiency will increase strain on call centers, field operations, and billing teams. Maintaining the aging network will require more devices, truck rolls, and labor hours, thus driving up direct costs. Billing estimations and exceptions will become more frequent, negatively impacting customer experience.

The delayed implementation scenarios also results in additional costs associated with legacy devices. For instance, as the incumbent vendor deprioritizes production of existing devices (which it signaled in its response to the RFQ it intends to do), SDG&E will need to

"stock up" and procure enough SM 1.0 devices in advance of product discontinuation. SDG&E estimates that the number of units required will be between ~0.8 million and ~1.2 million depending on the length of the delay in implementing SM 2.0. This pre-purchase of devices would also result in incremental inventory and warehousing costs in order to manage the larger volume of SM 1.0 devices. Costs could also include potential premium support costs from the incumbent vendor to help prolong the lifespan of existing systems.

Table 3-11 below provides a detailed cost breakdown for each deployment option considered in Table 3-10.

Table 3-11[24]
Cost Comparison Across Various Options Considered ($M)

Cost Categories	Proposed	4 Year Delay Costs	5 Year Delay Costs
Electric Meter Replacement	[redacted]	[redacted]	[redacted]
Gas Module Replacement			
Foundational Technology	122.3	157.7	164.8
NextGen Technology	42.7	46.0	47.0
Program Management	41.8	49.7	50.5
Contingency	60.1	81.8	90.8
Total	**762.0**	**1,021.4**	**1,123.3**

b. Unavailability of SM 1.0 Devices

As discussed above, a key question in the RFQ issued to the incumbent vendor was whether replacing failing SM 1.0 electric meters and gas modules with like-for-like devices was a viable option and, if so, for how long. The vendor indicated that due to component obsolescence and technological advancements, the platform specified in the current MSA is being transitioned to the supplier's next-generation solution. In its RFQ response, the vendor did not guarantee sufficient supply of SM 1.0 devices between 2028-2035. This limitation,

[24] *See Chapter 3, Workpaper 3, Tab 3.10.1(Delayed Deployment Scenarios).*

combined with nearly one million failures in 2030, would greatly exacerbate the current challenges associated with SM 1.0, described in Chapter 2.

c. Additional Impacts, Including Increased Network Vulnerability

As a practical matter, as the vendor shifts production to SM 2.0 meters, securing SM 1.0 replacements will become increasingly difficult, leading to longer lead times and higher costs due to limited inventory and competitive demand for limited inventory. Uncertainty of access to hardware after 2028 poses significant risk – not having access to RFLAN devices after 2035 creates a hard stop. Further, if a large number of installed devices were to fail, SDG&E would lose connectivity with electric meters and gas modules, making it impossible to generate accurate timely bills, effectively manage outages, or execute connect/disconnect orders, while also complicating the customer's ability to access usage data, as well as receiving timely and accurate bills. In addition, continued reliance on the SM 1.0 platform, which may soon have limited or no manufacturer support, increases SDG&E's exposure to cybersecurity risks.

2. Battery replacements for gas modules

The challenges currently faced by SDG&E with its SM 1.0 infrastructure include (but are certainly not limited to) gas module failures. While gas module batteries are only one area of failure, SDG&E has explored the option of battery replacement as a potential partial solution to address ongoing gas module failures during a supply-chain constrained environment. However, several factors make battery replacement an impractical and inefficient solution compared to full gas module replacement.

First, in its response to SDG&E's RFQ, SDG&E's current SM 1.0 vendor did not offer an opportunity to remedy the gas module battery issues through procurement activities. SDG&E also received manufacturer's guidance not to replace gas modules with expired warranties or if

the battery is already inoperable. Thus, it is not clear that SDG&E would be able to pursue a gas module battery replacement approach, even if it were inclined to do so. In addition, design and operational constraints make individual battery replacements for legacy gas modules impracticable. The SM 1.0 gas modules were engineered as sealed, non-serviceable devices with internal batteries embedded in potting material, which means that any attempt to replace the battery would require breaching factory seals and dismantling the unit, actions that compromise structural integrity and introduce risks such as moisture ingress and permanent damage. Even if such replacements were technically feasible, the modules would still rely on Zigbee communication through electric meters to transmit gas consumption data to SDG&E's back-office systems. This dependency persists regardless of battery life, so replacing batteries does not resolve the underlying limitation related to the Zigbee communication protocol. Furthermore, the battery replacement process would demand highly trained technicians, specialized tools, and controlled environments for disassembly and reassembly, making it a labor-intensive, time consuming and costly endeavor across many sites. Any errors during this process could render the module unusable, leading to additional hardware and labor expenses. Accordingly, battery replacement is not a viable solution for ongoing gas module failures.

3. Utilizing smart inverter technology

During SDG&E's most recent GRC proceeding, it was suggested that smart inverter technology could serve as an alternative pathway for addressing the aging SM 1.0 meter infrastructure. However, this is not a viable solution for several reasons. Smart inverters are designed for an entirely different purpose: they convert direct current (DC) from solar systems into alternating current (AC) for use in homes and businesses and provide grid support functions related to renewable generation. These devices are not metering instruments, nor are they intended to perform the core functions of a revenue-grade electric or gas meter. Even assuming

for purposes of argument that smart inverters were a viable solution (which they are not), implementing this option would require *all* customers to have solar generation equipment, which is not realistic or equitable.

Additionally, smart inverter solutions fail to address the underlying issue with SM 1.0 - the failure of metering hardware. These failures require purpose-built metering devices that can accurately measure consumption, support billing operations, facilitate outage and restoration processes, and provide the operational data needed to run a modern distribution grid. Moreover, since gas modules are battery operated devices that lack any relationship to inverter-based technology, smart inverters offer *no* remedy for gas module failures.

Thus, smart inverter technology cannot substitute for a modern metering solution. The technologies serve fundamentally different purposes and relying on smart inverters to solve metering failures would neither meet customer needs, nor ensure that SDG&E has the capabilities necessary to operate the grid safely, reliably, and efficiently.

V. CONCLUSION

SDG&E's proposed Smart Meter 2.0 solution will establish a stable, resilient platform that supports SDG&E's commitment to dependable service and operational excellence and provides the flexibility necessary to incorporate NextGen capabilities that will both benefit customers and support utility operations and the state's policy objectives. The functionality associated with the SM 2.0 platform is essential to empower customers to optimize energy consumption, improve grid reliability and resilience, streamline outage management, and positions SDG&E to continue delivering safe and reliable energy services.

This concludes our prepared direct testimony.

VI. WITNESS QUALIFICATIONS FOR DAVID H. THAI

My name is David Thai. I am employed by San Diego Gas & Electric Company (SDG&E) as the Strategic Initiatives Manager. My business address is 4949 Greencraig Lane, San Diego, California, 92123. My current responsibilities include overseeing SDG&E's next generation smart meter strategy and program, and providing engineering expertise in the areas of AMI networks and metering engineering. I assumed my current position in 2024. I have been employed by SDG&E since 2008 and have held engineering positions of increasing responsibility in Substation Construction and Maintenance, Distribution Planning, Transmission Engineering and Project Management. I have held numerous leadership positions as Grid Operations Technical Support Manager, Electric and Fuel Procurement Origination Analytics Manager, and Smart Meter Operations Manager.

I hold a Bachelor of Science degree in Electrical and Electronic Engineering from California State University, Sacramento and a Master of Science degree in Electrical Engineering from San Diego State University. I am also a licensed Professional Engineer in the State of California.

I have previously testified before the Commission.

VII. WITNESS QUALIFICATIONS FOR BRADLEY M. BAUGH

My name is Bradley M. Baugh, and I serve as a Senior Group Product Manager at San Diego Gas & Electric Company (SDG&E). My business address is 4949 Greencraig Lane, San Diego, California, 92123. In my current role, I lead SDG&E's Customer Field and Emergency Management Information Technology organizations. These teams are responsible for delivering innovative, people-focused, secure, and resilient technology solutions that support key areas including the Advanced Metering Infrastructure (AMI) Program, Legacy Smart Meter Activities, Clean Transportation, and Emergency Management. I was appointed to my current role in November 2021. Since joining SDG&E in 2003, I have held a series of positions of increasing responsibility across Information Technology and Customer Services. Prior to joining SDG&E, I held positions at Sierra Systems Consulting Group, GS Lyon Consulting, and Andersen Consulting.

I have a Bachelor of Science in Business Administration Degree (Finance & Banking), a Bachelor of Science in Business Administration Degree (Economics), and a Bachelor of Science in Accountancy Degree from the University of Missouri – Columbia in 1992.

I have previously testified before the California Public Utilities Commission.

APPENDIX A
DECLARATION OF DAVID H. THAI

CONFIDENTIAL & PRIVILEGED; ATTORNEY WORK PRODUCT

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

DECLARATION OF DAVID H. THAI REGARDING CONFIDENTIALITY OF CERTAIN DATA/DOCUMENTS PURSUANT TO D.21-09-020

I, David H. Thai, do declare as follows:

1. I am the Strategic Initiatives Manager in the Customer Services Department for San Diego Gas & Electric Company ("SDG&E"). I have been delegated authority to sign this declaration by Dana Golan, Chief Customer Officer. I have reviewed the confidential information included within

- Ex. SDG&E-03, Prepared Direct Testimony of David H. Thai and Bradley M. Baugh on Behalf of San Diego Gas & Electric Company, Chapter 3 (Smart Meter 2.0 Proposal and Options Evaluated) (December 18, 2025).
- Chapter 3 – Workpaper 1 – SM 2.0 Program and Deployment
- Chapter 3 – Workpaper 3 – Delayed Deployment Cost Analysis
- Chapter 3 – Workpaper 4 – Vendor Cost Comparison

2. I am personally familiar with the facts in this Declaration and, if called upon to testify, I could and would testify to the following based upon my personal knowledge and/or information and belief.

3. I hereby provide this Declaration in accordance with Decision ("D.") 21-09-020 and General Order ("GO") 66-D to demonstrate that the confidential information ("Protected Information") provided in the aforementioned Exhibits is within the scope of data protected as confidential under applicable law.

4. In accordance with the narrative justification described in Attachment A, the Protected Information should be protected from public disclosure.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct to the best of my knowledge.

Executed this 18th day of December, 2026, at San Diego.

Signed by:
David Thai
4B7935B08D38455...

David H. Thai
Strategic Initiatives Manager

ATTACHMENT A

SDG&E Request for Confidentiality

Location of Protected Information	Legal Authority for Confidentiality	General Rationale
Yellow highlighted in Ex. SDG&E-03 for Electric Meters and Gas Modules, Implementation Costs and Procurement Process sections And yellow highlighted component of the workpapers: Chapter 3 – Workpaper 1 – SM 2.0 Program and Deployment Program; Chapter 3 – Workpaper 3 – Delayed Deployment Cost Analysis; and Chapter 3 – Workpaper 4 – Vendor Cost Comparison	Based on input received by SM 2.0 bidders, and based on SDG&E's concurring position, the produced documents are proprietary and represent and contain, commercially sensitive information not intended for public disclosure. SM 2.0 bidders efforts involve communications which are intended only for access by designated members. Public disclosure would pose potential negative impacts and/or harm to SM 2.0 bidders. Gov't Code § 7927.705 ("Records, the disclosure of which is exempted or prohibited pursuant to federal or state law") • Cal. Civil Code §§ 3426 *et seq.* (Uniform Trade Secrets Act)	Disclosure of the information poses a risk of financial damage to the SM 2.0 bidders. In addition, NDA: - There is an active non-disclosure agreement (NDA) contained in the RFP with bidders that requires SDG&E to seek confidential treatment of price quotes. Uniform Trade Secrets Act: - While bidders represent that they are not disclosing trade secrets, price quotes typically have the potential to meet the definition of trade secrets under California Civil Code § 3426 et seq. - Disclosure would cause competitive harm. - NDA + internal controls show reasonable efforts to maintain secrecy. - SM 2.0 bidder general pricing is not accessible publicly on their websites. - Price quotes in connection with the bid submittal are even more sensitive as they are more specific.

APPENDIX B
DECLARATION OF BRADLEY M. BAUGH

CONFIDENTIAL & PRIVILEGED; ATTORNEY WORK PRODUCT

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

DECLARATION OF BRADLEY M. BAUGH REGARDING CONFIDENTIALITY OF CERTAIN DATA/DOCUMENTS PURSUANT TO D.21-09-020

I, Bradley M. Baugh, do declare as follows:

1. I am Bradley M. Baugh, Senior Group Product Manager in the IT Department for San Diego Gas & Electric Company ("SDG&E"). I have been delegated authority to sign this declaration by Dana Golan, Chief Customer Officer. I have reviewed the confidential information included within the following Exhibits ("Ex."):

- Ex. SDG&E-03, Prepared Direct Testimony of David H. Thai and Bradley M. Baugh on Behalf of San Diego Gas & Electric Company, Chapter 3 (Smart Meter 2.0 Proposal and Options Evaluated) (December 18, 2025).
- Chapter 3 – Workpaper 2 – SM 2.0 Program – Foundational and NextGen Technology Workpapers.

2. I am personally familiar with the facts in this Declaration and, if called upon to testify, I could and would testify to the following based upon my personal knowledge and/or information and belief.

3. I hereby provide this Declaration in accordance with Decision ("D.") 21-09-020 and General Order ("GO") 66-D to demonstrate that the confidential information ("Protected Information") provided in the aforementioned Exhibits is within the scope of data protected as confidential under applicable law.

4. In accordance with the narrative justification described in Attachment A, the Protected Information should be protected from public disclosure.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct to the best of my knowledge.

Executed this 18th day of December, 2025, at San Diego.

Signed by:
Bradley M Baugh
24980EA7F09C4AB...

Bradley M. Baugh
Senior Group Product Manager

ATTACHMENT A

SDG&E Request for Confidentiality

Location of Protected Information	Legal Authority for Confidentiality	General Rationale
Yellow highlighted portions in Ex. SDG&E-03 for Foundational and NextGen technology cost sections Yellow highlighted portions in Chapter 3 – Workpaper 2 – SM 2.0 Program – Foundational and NextGen Technology Workpapers".	Based on input received by SM 2.0 bidders, and based on SDG&E's concurring position, the produced documents are proprietary and represent and contain commercially sensitive information not intended for public disclosure. SM 2.0 bidders' efforts involve communications which are intended only for access by designated members. Public disclosure would pose potential negative impacts and/or harm to SM 2.0 bidders. Gov't Code § 7927.705 ("Records, the disclosure of which is exempted or prohibited pursuant to federal or state law") • Cal. Civil Code §§ 3426 *et seq.* (Uniform Trade Secrets Act)	Disclosure of the information poses a risk of financial damage to the SM 2.0 bidders. In addition, **NDA:** • There is an active non-disclosure agreement (NDA) contained in the RFP with bidders that requires SDG&E to seek confidential treatment of price quotes. **Uniform Trade Secrets Act:** • While bidders represent that they are not disclosing trade secrets, price quotes typically have the potential to meet the definition of trade secrets under California Civil Code § 3426 et seq. • Disclosure would cause competitive harm. • NDA + internal controls show reasonable efforts to maintain secrecy. • Even SM 2.0 bidder general pricing is not accessible publicly on their websites. • Price quotes in connection with the bid submittal are even more sensitive as they are more specific.