



Section 4 – SMART GRID STRATEGY

4.1 INTRODUCTION

SDG&E's Smart Grid Deployment strategy focuses on empowering customers with technology and service choices that maximize their comfort and convenience, while also maximizing the value of their energy and protecting the privacy of their energy usage and other personal data. It embraces the evolution of the Smart Grid by maintaining system reliability with self-healing¹⁶ and resilient capabilities, while also incorporating increasing levels of renewable energy from centralized and distributed intermittent resources. The Smart Grid platform described in this plan supports California's emission reduction goals by integrating renewable resources and large numbers of PEVs, while also maximizing the efficiency and maintaining the security of the electricity and information infrastructure that serves the San Diego region. This Smart Grid platform will empower customers with opportunities to incorporate multiple options for demand response, energy efficiency, generation, and storage into existing and future energy markets. SDG&E's Smart Grid deployment efforts as a whole will significantly contribute to the reduction of the environmental footprint of electricity generation and delivery in the region by integrating renewable resources, electric vehicles, and other technologies that will assist in the avoidance of emissions associated with traditional solutions.

In developing its Smart Grid Deployment Plan, SDG&E's strategy was to engage employees and a broad cross-section of stakeholder groups from across the service territory in the process. SDG&E's outreach sought and received input from over 25 organizations representing a wide variety of customer interests, including municipalities, regional organizations, industry, and academia. Following a framework derived from the NIST Smart Grid Conceptual Model¹⁷, 10 domain teams led by SDG&E directors and

¹⁶ A self-healing grid is one that automatically reconfigures via autonomous switching operations in response to a system fault improving local reliability.

¹⁷ <http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/SGConceptualModel>

executives from across the company developed perspectives and plans that were then integrated together. Its strategy for Smart Grid deployment includes ongoing efforts to further integrate Smart Grid into company planning and operations, and to continue engaging SDG&E's stakeholders in order to align the utility's plans to their priorities. Because this Smart Grid Deployment Plan is based on SDG&E's best estimates of inherently uncertain outcomes, SDG&E intends to adaptively manage, revise, and update this plan on an ongoing basis, to ensure that it evolves as customers, stakeholders, technologies, and services evolve.

SDG&E's Smart Grid strategy rests on three pillars: policy, customer value and pilots. While state and federal policy frequently drives Smart Grid technology requirements and investments, maximizing the customer's energy value by enhancing their energy experience and supporting their preferences is the criteria against which all new technology investment is evaluated, even where it is required to comply with state or federal policies. While policy-driven investment decisions are always evaluated for least-cost/best-fit, potential customer and societal benefits are calculated as well. In other cases, it is customer value, where the projected benefits outweigh the costs or where the investment is necessary to effectively communicate with customers that drive SDG&E's deployment strategy. The piloting component of SDG&E's Smart Grid strategy is employed as a mechanism to mitigate risk and determine, prior to full deployment, whether the technology investment will deliver the benefits anticipated and within the costs projected.

SDG&E began making foundational "smart" utility investments many years ago even prior to SB 17's enactment and before the Commission ordered utilities to file Smart Grid Deployment Plans. As a result, its Smart Grid strategy is also based on experience and the best practices in technology evaluation and in the implementation it has developed and is continually refining. SDG&E is also positioned to build cost-effectively on this foundational platform by leveraging prior investments in AMI, OpEx 20/20 and other infrastructure. These prior investments are consistent with its Smart Grid strategy

because they help the utility deliver customer value by supporting their preference to adopt distributed solar generation and PEVs ahead of the national curve, and meet SDG&E's commitment to achieving state and federal policy objectives. Lastly, SDG&E's strategy for interoperability will be based on the use of open standards where possible and will avoid stranded costs through piloting new technologies to ensure they meet the utility's Smart Grid requirements.

As SDG&E transitions to a smarter grid, much of its power delivery infrastructure and customer experience and service focus will remain the same. However, the way SDG&E manages the grid and the types of services it provides will change significantly, which will cause the value of services provided to customers to increase. The integration of digital computing and communications technologies will be the biggest enabler of this transition. This section of SDG&E's Smart Grid Deployment Plan describes the utility's strategy for making the investments that will make this possible.

SDG&E's Smart Grid Deployment Plan Strategy will be driven, in large part, by the pace of change in its customers' expectations and decisions (e.g., distributed generation deployment, PEV growth, use of after-meter automation, etc.). SDG&E's strategic framework places a top priority on fulfilling state and federal policy objectives and requirements (e.g., ensuring the safe, secure and reliable delivery of electricity at just and reasonable rates, and complying with other state and federal policy requirements).

¹⁸ The utility will also continue to work collaboratively with customers and other key stakeholders to create the foundation for an innovative, connected and sustainable

¹⁸ In this Smart Grid Deployment Plan, SDG&E categorizes investments as either necessary to achieve state and federal policy objectives or as warranted by the value the investment would create for customers. The term "Policy" as used in this Smart Grid Deployment Plan is distinct and distinguishable from the concept of "policy-driven" investments as used by FERC-jurisdictional transmission operators such as the CAISO; as used herein, the term "Policy" includes investments necessary to ensure reliability and safety as well as other investments necessary to comply with SDG&E's obligation to serve, regulatory compact with the state of California and ratepayers, and other federal and state-imposed utility obligations.

energy future in a manner that maximizes customer value, is aligned with SB 17 goals¹⁹, maximizes interoperability, is secure, and supports customer data privacy.

Consistent with the requirements of D.10-06-047, SDG&E includes in this Smart Grid Strategy section a discussion of the following:

- How the utility will ensure our Smart Grid investments deliver value added services and benefits to customers;
- How the utility will prioritize its technology evaluation and deployment efforts to meet the goals defined in Senate Bill 17 and promote the goals of General Order 156²⁰;
- How the utility will evaluate whether using existing communications infrastructure can reduce the costs of deploying the Smart Grid;
- How interoperability standards will be used;

¹⁹ These goals are to achieve the following benefits:

- Be self-healing and resilient;
- Empower consumers to actively participate in the operations of the grid;
- Resist attack;
- Provide higher quality of power and avoid outages;
- Accommodate all generation and storage options;
- Enable electricity markets to flourish;
- Run the grid more efficiently;
- Enable penetration of intermittent power generation resources;
- Create a platform for a wide range of energy technologies and management resources;
- Enable and support the sale of demand response, energy efficiency, distributed generation and storage into wholesale energy markets as a resource, on equal footing with traditional generation resources; and,
- Significantly reduce the total environmental footprint of the current electric generating and delivery system in California.

²⁰ General Order 156 is intended to increase utility procurement from women, minority and disabled veteran business enterprises' (WMDVBE) in all categories.

- How SDG&E will minimize the risk of stranded costs in cases where consensus standards are evolving; and,
- Our plans for adopting and developing interoperable architecture designed to protect the privacy of customer data.

4.2 STRATEGIC DECISION MAKING PROCESS

SDG&E's Smart Grid vision provides a sense of direction and guidance and provides a view of the desired end state. While not mandating specific technical solutions, the utility's vision allows flexibility regarding the evaluation and adoption of emerging technologies. This approach is critical since industry drivers and technology are rapidly evolving in the Smart Grid space and it is difficult to adequately evaluate and project the technologies that will most likely be adopted by customers. Accordingly, SDG&E's strategy is designed to maximize SDG&E's ability to make the right Smart Grid investments for customers at the right time, while recognizing that technology is always changing.

SDG&E's Smart Grid Deployment Plan is designed to ensure that the utility fulfills state and federal policy goals; works with key stakeholders to create the foundation for an innovative, connected and sustainable energy future in a manner that is aligned with SB 17 goals; maximizes interoperability; minimizes risk through appropriate security controls; and ensures customer data privacy.

In order to do this successfully, SDG&E takes a strategic approach to technology evaluation and adoption. It is first necessary to understand the different kinds of Smart Grid investments that could be pursued, how they would operate across the various SDG&E business processes and functions, the state and cost of current technology, the benefits that could be achieved with any given investment, and whether an investment is necessary to comply with state and/or federal policies. This approach can be summarized as the following steps:

1. Identify applicable federal and state laws, regulations, and policies.
2. Identify options that could meet those requirements.
3. Determine to what extent those options aid in meeting those requirements.
4. Determine to what extent those options enhance customer value.
5. Select solutions based on their fit to policy requirements, cost effectiveness, and customer value.

In order to ensure that SDG&E has a robust understanding of the universe of potential Smart Grid investments and applications and the potential effects on SDG&E, the utility considers a number of outside sources. These sources are summarized below and discussed in greater detail in the sections that follow.

- The U.S. Department of Energy-funded Smart Grid Maturity Model (SGMM) – The SGMM has assisted SDG&E in setting strategic priorities and allowed it to drive to a common internal understanding of industry tenets. This model helps SDG&E understand the stage of its current technology investments and its aspirations.
- The U.S. Department of Energy’s (DOE’s) Modern Grid Vision - SDG&E believes that this alignment is crucial to adopting a California view that is consistent with the federal view and allows SDG&E and other California utilities access to solutions that will be developed earlier due to consistent requirements nationwide. This also ensures that SDG&E is supporting and aligned to interoperability and security standards while meeting industry-wide customer privacy expectations.
- *Defining the Pathway to the California Smart Grid of 2020* - SDG&E was a key contributor to this report led by the Electric Power Research Institute (EPRI) and

funded by the California Energy Commission (CEC).²¹ This effort resulted in a high level vision and roadmap that the three California Investor Owned Utilities (SDG&E, SCE, and PG&E) supported and adopted. More important, the EPRI report provided a useful reference for SDG&E in the development of its own deployment plan.

- The National Institute of Standards Technology (NIST) - The projects identified in SDG&E's Smart Grid Deployment Plan Roadmap were identified by following the NIST Smart Grid conceptual model and framework to achieve a broad perspective on this Smart Grid Deployment Plan and to understand the implications of Smart Grid investments across the company. More specifically, SDG&E formed teams of internal experts specific to each domain. These teams first identified projects already being considered that might either be Smart Grid projects, or contain elements that might be considered Smart Grid. Then, the teams identified additional potential Smart Grid projects necessary to comply with the utility's obligation to serve as customers' needs and applications change and/or those which are cost-beneficial and would further the objectives of SB 17, customers and other stakeholders. These teams screened out projects that are not worthy of pursuit at this time, and projects underway or planned that were not identified as "Smart Grid". The projects with merit that were identified by those teams are included in this Smart Grid Deployment Plan. This was not a one-time process; SDG&E will continue to monitor the market and solicit input from customers and stakeholders, and the utility will adapt and modify its Smart Grid Deployment Plan as changing circumstances warrant, in the same way that this Smart Grid Deployment Plan is not a wholly new construction, but adapts, modifies, and builds on SDG&E's previous plans for deploying new technology.

²¹ This report has not been published as of May 2011, and is expected to be publicly available in the second half of 2011.

SDG&E's strategic decision-making process also consistently applies the utility's evaluation framework of enhancing customer value and delivering customer benefits while complying with state and federal policy, which is explained further in the following section.

To address the rapid development of digital technologies, SDG&E has designed a technology selection process that recognizes pilot and field evaluation as an integral part of technology evaluation. SDG&E will invest in technologies that work for its customers and on its system and where adequate protection exists to protect customer privacy and data security. Where necessary, SDG&E will conduct pilots to ensure that new technologies meet these requirements prior to a wide-scale deployment.

California, with its ambitious renewable and environmental goals and technology savvy consumers, moves SDG&E into an early technology adopter role. As the quantity of both bulk and distributed renewable resources continues to increase on SDG&E's system, Smart Grid technologies are needed to mitigate the impact of variability while maintaining and/or improving reliable service to customers. SDG&E incorporates the support of these goals in the criteria that it uses to evaluate Smart Grid initiatives.

SDG&E will continue to support General Order 156 in the supplier selection process. Supplier diversity is embedded in the company DNA and it's how the utility does business every day. SDG&E has been a leader within the California IOU's in delivering results and in 2010 procured 36 percent of its goods and services through Diverse Business Enterprise vendors, consultants and manufacturers. SDG&E will continue to champion and strive to exceed the 30 percent goal for DBE eligible purchases across every segment of the organization, including capital projects and other major initiatives. Additionally, SDG&E requests its prime contractors to subcontract 30 percent of costs to diverse suppliers and Smart Grid projects are no different.

SDG&E's decision-making strategy provides a flexible framework that does not restrict SDG&E to the status quo or "as is" processes, but rather enables it to adaptively manage

Smart Grid initiatives as policies, technologies, and customer behaviors evolve. This flexibility will allow SDG&E to meet one of the Commission’s requirements: that its Smart Grid Deployment Plan is “adaptable to change.”

4.3 SDG&E’S STRATEGIC PRIORITIES

As mentioned above, SDG&E has set two priorities at the heart of its Smart Grid plan, compliance with state and federal policy requirements and ability to deliver enhanced customer value and communication. SDG&E assesses projects according to their support of these priorities. SDG&E will first prioritize its Smart Grid investments based, primarily, on whether they are necessary to fulfill state and federal policies such as on their alignment with SB 17 goals. Additional projects will be prioritized based on input from customers and stakeholders and on what they value the greatest and against other important criteria such as DOE’s Modern Grid vision and on their ability to help SDG&E fulfill its own Smart Grid vision of creating the foundation for an innovative, connected and sustainable energy future in the San Diego region.

4.3.1 STATE AND FEDERAL POLICIES

State and federal policies require and SDG&E’s customers expect the safe, secure, and reliable delivery of energy at just and reasonable rates as well as the realization of state energy policy goals. SDG&E views these as utility obligations and as top priorities in making Smart Grid investments.

Several state and federal policies drive this Smart Grid Deployment Plan and its urgency. They include the Renewable Portfolio Standard (SB x1 2²²); the California Solar Initiative; AB 32, the *California Global Warming Solutions Act*; energy efficiency policies; and reliability and security standards set forth by NERC and FERC. Additional discussion of these policies is in the Roadmap section.

²² Senate Bill 2, 1st Extraordinary Session, referred to herein as SB x1 2

Due to new operational challenges posed by intermittent distributed generation resources, automated demand response requirements and significant incremental load from PEVs, the need for timely investments to ensure that existing service levels are maintained is paramount. Absent timely Smart Grid investments, a number of trends in SDG&E's service territory are expected to degrade service levels. SDG&E will prioritize its Smart Grid investments based, primarily, on whether they are necessary to comply with state policies, including the provision of safe and reliable service and effective communication of information to customers regarding their energy use. For example, if rapid penetration of distributed generation on a particular circuit, or in a given region, necessitates Smart Grid investments to maintain reliability, SDG&E will place its highest priority on making those investments. The same is true of investments that may be necessary to accommodate PEV growth in the future without adversely impacting reliability to customers and investments necessary to empower customers regarding their energy use.

SDG&E's strategy in making the investments necessary to address these policy-driven situations is to ensure that the utility understands the costs and benefits of all potential solutions and implements the most cost-effective means of ensuring continued safe and reliable electricity service on this basis. SDG&E has identified in its Smart Grid Deployment Plan Roadmap the most cost-effective means to maintain safe, secure and reliable delivery of energy that will address the changes it is seeing in its service territory.

In addition to reliability and security, SDG&E's programs around Renewable Growth and Electric Vehicle Growth will help achieve SDG&E's vision of being the foundation for an innovative, connected and sustainable energy future in its service territory. These investments will allow SDG&E to apply technologies that will mitigate anticipated operational challenges. SDG&E applies appropriate project planning principles to ensure it is pursuing the least-cost, best-fit solutions that meet system needs.

In addition, SDG&E's workforce development program will ensure that it has the right workforce and skills to support these changes, while its Smart Grid Research, Demonstration, and Development (RD&D) program will enable it to evaluate and pursue new solutions.

SDG&E applies appropriate project planning principles to ensure it is pursuing the least-cost, best-fit solutions that meet system needs.

4.3.2 CUSTOMER VALUE

SDG&E's priorities for pursuing additional Smart Grid investments will be based on the pace of customer adoption of various technologies and a business case that defines anticipated costs balancing these costs against the increased customer value created, safety, state and federal policies, meeting mandated regulatory requirements, maximizing customer value based on input from customers and stakeholders, protection of data and facilities, financial benefit and alignment with SB 17 goals and the DOE's Modern Grid vision, and where interoperability and data security can be assured.

Prior investments, such as AMI, have created a platform that enables better and more effective communication with customers. In the same way that SDG&E must effectively communicate with customers in their language of preference, it must effectively communicate with its customers through and about new technology applications that have been enabled by the Smart Grid platform already created through previous investments, even though the value of that communication may be difficult to quantify.

As described in the Smart Grid Vision section, SDG&E has reached out to customers and a number of other key stakeholders for input into the development of this Smart Grid Deployment Plan. SDG&E will continue to incorporate the input and views of its customers into Smart Grid capabilities, Smart Grid investment priorities and specific Smart Grid projects. In order to obtain continued input from customers and stakeholders, SDG&E intends to proactively develop a methodology to continue an

ongoing dialogue with customers and other key stakeholders. Additionally, SDG&E will form a stakeholder advisory panel and hold regular discussions to better understand the priorities and desires of customers, who should be the focus of these investments. During these dialogues, SDG&E plans to solicit input and recommendations to ensure that its Smart Grid capabilities and investments are focused on areas that customers value.

4.3.3 PILOTS

SDG&E's program areas develop capabilities that require a range of technical solutions, some of which are nascent and still maturing. In some cases, there are different technical solutions that could support the same capability, such as different storage solutions to address renewable intermittency. SDG&E's strategy is to utilize pilots to vigorously test new technologies, ensure adequate functionality, interoperability, security and identify best and least cost ways to deliver needed capabilities and benefits. Pilots are viewed as integral phases in early project planning, but, depending on the evaluation of a technology's maturity, pilots are sometimes organized as separate projects. SDG&E will share results of pilot efforts with other utilities and stakeholders, and will also seek to learn from others' pilots and other research efforts.

4.4 STRATEGY TO ENSURE ALIGNMENT WITH STATE AND FEDERAL POLICY GOALS

4.4.1 SB 17 ALIGNMENT

In D.10-06-047, the Commission has posed a number of questions about how utilities will incorporate the policy goals embraced by SB 17 into the Smart Grid Deployment Plan strategies. SDG&E's responses to these questions are set forth below.

4.4.1.1 PRIORITIZING TECHNOLOGY EVALUATION AND DEPLOYMENT AGAINST SB 17

How will SDG&E prioritize its technology evaluation and deployment efforts against the goals identified for California by SB 17?

SDG&E has built the policy goals of SB 17 into its prioritization, evaluation and deployment criteria for Smart Grid investments. Potential SDG&E projects are evaluated against the SB 17 goals, their fit to the Smart Grid Deployment Plan (SGDP) and the timing requirements. Specifically:

- **Empower Consumers to Actively Participate in the Operations of the Grid.** SDG&E's vision is customer-centric and its strategy requires that the utility place a high priority on implementing technologies that empower customers in ways they value and that enable communications with them while complying with state policy requirements. SDG&E will identify those high value technologies based on ongoing dialogue with customers and other stakeholders and pursue technology investments in a manner where customer value exceeds associated costs, where the investment is necessary to effectively communicate with customers, or where required by policy.
- **Be Self-healing and Resilient.** Options for additional self-healing and resiliency features will be evaluated as SDG&E's system is upgraded and will be implemented in a manner that strives to ensure the associated benefits exceed the costs. SDG&E will monitor the market to ensure that it is aware of these technologies as they develop to optimize the timing of SDG&E's procurement practices.
- **Resist Attack.** SDG&E will place a high priority on technologies that increase the ability of the grid and information systems to resist attack. These technologies will be considered as SDG&E's system is upgraded, and will be implemented as

required to secure the system, and will also be incorporated at every level of project evaluation and implementation following “secure by design” practices. As with self-healing and resiliency technologies, SDG&E will monitor the market to ensure that it is aware of these technologies as they develop to optimize its procurement practices.

- **Provide Higher Quality of Power and Avoid Outages.** SDG&E has a long standing record of providing the highest level of reliability in the western region of the nation. However, as is discussed above, SDG&E is committed to making those investments necessary to maintain this high degree of reliability while accommodating increased intermittency and new loads such as PEVs while preserving power quality and avoiding outages that would otherwise result. SDG&E places its highest priority on safely ensuring reliability of service to customers. It will also make those investments necessary to improve power quality where adequate customer value and customer demand for this service exists to justify the investment.
- **Accommodate All Generation and Storage Options.** As is discussed above, SDG&E is committed to making those investments necessary to accommodate increased intermittency associated with renewable and distributed generation while preserving power quality and avoiding outages that would otherwise result. The highest priority is assigned to ensuring safe and reliable service to customers and, therefore, SDG&E’s strategy requires accommodating all generation and storage options in ways that maintain or improve reliability and support customers' preferences for distributed generation at the least cost.
- **Enable Electricity Markets to Flourish.** By making customer value a key component of SDG&E’s investment decision-making process, by making those investments necessary to preserve power quality and reliability as new intermittent resources and PEVs are added, and by including effective

communication with customers, this decision-making process will place a high priority on creating the utility platform necessary to allow electricity markets to flourish. SDG&E will continue to take a leadership role in this endeavor and will continue to collaborate with the CAISO and other stakeholders in these efforts.

- **Run the Grid More Efficiently.** SDG&E’s analysis of Smart Grid investments will ensure that new technologies are available in time to meet customer expectations and to ensure that the grid continues to operate efficiently. The frameworks being leveraged to identify the best technologies and Smart Grid projects will ensure that all viable technology solutions are considered.
- **Enable Penetration of Intermittent Power Generation Resources.** Absent the deployment of Smart Grid initiatives, power quality and reliability will deteriorate as additional intermittent power generation resources are deployed. As is discussed above, SDG&E is committed to making those investments necessary to accommodate increased intermittency while preserving power quality and avoiding outages that would otherwise result. The highest priority is placed on ensuring the safety and reliability of service to customers, and this strategy will help ensure that SDG&E is able to integrate growing levels of intermittent resources while maintaining safety and reliability.
- **Create a Platform for a Wide Range of Energy Technologies and Management Resources.** As is discussed above, SDG&E’s vision is customer-focused and will place a high priority on implementing technologies that empower customers in ways that customers value. Ensuring interoperability within the Smart Grid platform will ensure that a wide range of technologies and services will be available to customers. SDG&E will identify those high value technologies to pursue, for either of these reasons, based on ongoing dialogue with customers and other stakeholders and pursue technology investments where customer

value exceeds associated costs or where they are required by state or federal policy.

- **Enable and Support the Sale of Demand Response, Energy Efficiency, Distributed Generation and Storage into Wholesale Energy Markets as a Resource, on Equal Footing with Traditional Generation Resources.** As is discussed above, SDG&E is committed to making those investments necessary to accommodate increased intermittency while preserving power quality and avoiding outages that would otherwise result. Through collaborations with the CAISO and other stakeholders, SDG&E will work to develop interoperable standards and technologies that enable and support the sale of distributed resources including demand response, energy efficiency (if applicable), distributed generation and storage, into wholesale markets.
- **Significantly Reduce the Total Environmental Footprint of the Current Electric Generating and Delivery System in California.** SDG&E's Smart Grid Deployment Plan places a high priority on reducing the total environmental footprint of the current electric generating and delivery system in the San Diego region. This is because the operational and potential reliability impacts of increased intermittent renewable generation and clean transportation resources are a key driver of SDG&E's Smart Grid investments. Therefore, SDG&E will evaluate and implement technologies that increase efficiency and reliability in grid operations where these investments are cost-effective. In addition, SDG&E will evaluate and deploy technologies consistent with its vision of working with customers and other stakeholders to create a connected and sustainable smart energy future. This ensures that SDG&E's technology investments create or contribute to a platform for functionality that its customers value and that empowers them to better manage their energy usage. SDG&E's Smart Grid Deployment Plan will significantly reduce the total environmental footprint of the electric system by

creating a platform that will integrate technologies and services supporting California's emission reduction and other environmental goals.

4.4.1.2 ADDRESSING THE OBJECTIVES IDENTIFIED IN D.10-06-047

How will SDG&E's decision-making framework specifically address the 11 objectives identified in D.10-06-047?

SDG&E has designed a series of programs to address key Smart Grid drivers and support California policy goals. A basic tenet of the decision-making framework as it applies to SDG&E's Smart Grid Deployment Plan is that the utility will invest in or pilot new technologies only when they are required to support state and federal policy or deliver a capability valued by customers, where the customer value exceeds associated costs or where the investment is necessary to effectively communicate with customers (see Roadmap section for more).

SDG&E's nine current Smart Grid Deployment Plan programs are outlined below. Technology investments in each area are evaluated and deployment decisions made according to the policy/value framework outlined above. Figure 4-1 following this list depicts how each of the policy goals of SB 17 is supported by one or many of these nine programs, with further discussion below:

1. **Customer Empowerment** - SDG&E is investing in an infrastructure to ensure that customers have the necessary information from the utility and third parties as well as the capabilities to make energy management decisions that meet their needs and desires and provide value added services and offerings;
2. **Renewable Growth** - SDG&E is focused on mitigating the impact of intermittent energy sources;

3. **Electric Vehicle Growth** –SDG&E is deploying new Smart Grid technologies in conjunction with traditional infrastructure to ensure the safe, reliable, and efficient integration of PEV charging load with SDG&E’s overall system;
4. **Reliability and Safety** - SDG&E is mitigating the reliability impacts of an aging electric infrastructure by implementing advanced sensors and associated systems;
5. **Security** – SDG&E is investing to address potential security issues across the cyber and physical security arenas;
6. **Operational Efficiency** – Investments are being implemented to maximize SDG&E’s operational efficiency;
7. **Smart Grid Research, Development and Demonstration (RD&D)** - SDG&E is planning to create an integrated test facility to research new technologies, integrate emerging technology solutions, test for interoperability, and provide proof-of-concept demonstrations;
8. **Integrated and Cross-cutting Systems** – SDG&E is deploying integrated, cross-cutting systems that support the range of Smart Grid technologies across many functions; and
9. **Workforce Development** - SDG&E is investing to develop its current and transition its future workforce to meet the unique demands of Smart Grid technologies.

Figure 4-1: SB 17 to SDG&E Smart Grid Deployment Plan Program Mapping

SB 17 Policy Goals ▼		SDG&E SGRP Programs ▶									
		Customer Empowerment	Operational Efficiency	Reliability & Safety	Security	Renewable Growth	Electric Vehicle Growth	Integrated/Cross-cutting Systems	Workforce Development	Smart Grid RD&D	
1	Be self-healing and resilient;		☒	☒	☒	☒			☒		☒
2	Empower consumers to actively participate in the operations of the grid;	☒	☒		☒				☒		☒
3	Resist attack;			☒	☒				☒		☒
4	Provide higher quality of power and avoid outages;		☒	☒	☒	☒	☒	☒			☒
5	Accommodate all generation and energy storage options;	☒	☒	☒		☒	☒	☒			☒
6	Enable electricity markets to flourish;	☒	☒		☒	☒			☒		
7	Run the grid more efficiently;		☒	☒		☒	☒	☒	☒	☒	☒
8	Enable penetration of intermittent power generation sources;	☒	☒	☒		☒	☒	☒			☒
9	Create a platform for deployment of a wide range of energy technologies and management services;	☒	☒		☒			☒	☒	☒	☒
10	Enable and support the sale of demand response, energy efficiency, distributed generation, and storage into wholesale energy markets as a resource, on equal footing with traditional generation resources; and	☒	☒				☒	☒	☒		
11	Significantly reduce the total environmental footprint of the current electric generation and delivery system in California.	☒	☒	☒			☒	☒			☒

1. **Empower Consumers to Actively Participate in the Operations of the Grid.**

SDG&E’s Customer Empowerment programs will deliver transparency and accessibility to marketplace information so that customers can make energy management decisions that meet their needs and support the effective operation of the grid. Utilizing investments in customer outreach, HAN infrastructure, and dynamic pricing enabled by real- and near-real time communications, SDG&E will drive energy efficiency, demand response, and more efficient energy management which are key components of the Operational Efficiency program. Investments SDG&E makes in the Security and Integrated Cross-cutting Systems programs will

ensure the security of customer information as SDG&E investments in data management and analytics allow SDG&E to supply increasing useful information to customers. The Smart Grid RD&D program will ensure new customer empowerment solutions are continually being developed and brought online as appropriate and where the benefits outweigh the costs or improve customer communication.

2. **Be Self-healing and Resilient.** SDG&E's Reliability and Safety program improves measurement, control, protection, and optimization to support the resiliency and responsiveness of the grid. SDG&E is investing in equipment monitoring to identify issues before they occur as well as fault identification and management technologies that provide faster isolation and load restoration. In addition, the Operational Efficiency, Security, Renewable Growth, Integrated and Cross-cutting Systems and Smart Grid Research Demonstration and Development (RD&D) programs are all designed in various ways to contribute to a self-healing and resilient grid.
3. **Resist Attack.** SDG&E's Security program meets increased physical and cyber security requirements with developments to policy and strategy, security infrastructure investment, and Smart Grid risk management. SDG&E's Security program includes investments in security threat, vulnerability, and incident management as well as physical substation hardening, to ensure that risks are well understood and managed effectively. Resisting attack is a key outcome of the Reliability program and SDG&E's ongoing Smart Grid RD&D investments.
4. **Provide Higher Quality of Power and Avoid Outages.** SDG&E's Renewable Growth and Electric Vehicle Growth programs comprise investments that mitigate grid performance issues related to the adoption and impact of new technologies and offerings. These include investments in technologies that will manage intermittency, provide better real-time network visibility, and improved dynamic

control. Service reliability is SDG&E's primary goal and of its nine Smart Grid programs, at least seven are directly involved in supporting this SB 17 goal.

5. **Accommodate All Generation and Storage Options.** SDG&E's Reliability and Safety and Renewable Growth programs make investments across the transmission and distribution network to enable the management of generation and storage across the grid. Investments provide increased monitoring and control to support the full range of energy sources, while maintaining the utmost safety around grid operations. In the case of options that are not fully understood, SDG&E's Smart Grid RD&D program invests in the explorations of technologies to facilitate their incorporation in the grid. This SB 17 goal is key to the Customer Empowerment program that gives customers access to information about grid capacity and the option to provide excess capacity stored in their electric vehicle batteries or produced by their rooftop PV systems, for instance, to the grid, which is an area of focus in both the Electric Vehicle and Renewable Growth programs.
6. **Enable Electricity Markets to Flourish.** SDG&E's Customer Empowerment, Renewable Growth and Operational Efficiency programs guide investments that enable a wider set of resources available to the market and their optimized deployment. Investments in these areas allow customers to make decisions based on increased price transparency and increased access to a variety of market participants and their offerings. Its Security program supports secure electricity market communications and Integrated and Cross-cutting Systems helps integrate market mechanisms across affected programs and systems.
7. **Run the Grid More Efficiently.** SDG&E's Operational Efficiency program invests in technologies to achieve efficient power flow across the grid while also investing in more efficient maintenance, monitoring, and control capabilities. SDG&E's Workforce Development program provides the support necessary to ensure that the right skills are available to efficiently manage Smart Grid technology and

operations. The Electric Vehicle and Renewable Growth programs are both leveraged to achieve more efficient grid operations, and efficiency is one of the conditions of the Reliability and Safety program. Smart Grid RD&D supports new methods of improving efficiency.

8. **Enable Penetration of Intermittent Power Generation Resources.** SDG&E's Renewable Growth program coupled with programs such as Reliability and Safety provide investments for expanded grid management capabilities that support increased penetrations of renewable resources on the grid while providing for improved planning capabilities to facilitate their rapid deployment. Enabling customers' preferences for distributed generation is a key feature of the Customer Empowerment and Electric Vehicle Growth programs as well.
9. **Create a Platform for a Wide Range of Energy Technologies and Management Resources.** SDG&E's Customer Empowerment and Operational Efficiency programs, supported by Integrated and Cross-cutting Systems, provide the infrastructure to provide customers with the information and offerings that they value. Its investments are designed to enable third parties to meet customers' needs, where partners can assist customers to achieve the highest value at the lowest cost. SDG&E's Smart Grid RD&D, Electric Vehicle, Workforce Development and Security programs all contribute to or benefit from its efforts to build a platform for new energy technologies and management resources at SDG&E.
10. **Enable and Support the Sale of Demand Response, Energy Efficiency, Distributed Generation and Storage into Wholesale Energy Markets as a Resource, on Equal Footing with Traditional Generation Resources.** SDG&E's Customer Empowerment and Renewable Growth programs provide the information and control capabilities to improve the reliability and availability of demand response, energy efficiency, and distributed resources. SDG&E's Operational Efficiency program deploys technologies that allows for the optimization and deployment of these different

resources to satisfy demand. SDG&E's Security program strives to ensure that secure market communications are enabled.

11. **Significantly Reduce the Total Environmental Footprint of the Current Electric Generating and Delivery System in California.** SDG&E's Renewable Growth and Electric Vehicle Growth programs support increased renewable generation and alternative fuel vehicles across SDG&E's territory. SDG&E's Customer Empowerment program invests to provide customers with more relevant information and options for customers to act in concert with the environment. Operational Efficiency and the Smart Grid RD&D programs deploy and evaluate technologies, respectively, which support alternative energy resource options. As the environmental footprint of SDG&E's role in the state system is decreased, the Reliability and Safety program seeks to ensure that customers' expectations of reliability, public safety and policy requirements governing reliability are met. SDG&E's Smart Grid Deployment Plan as a whole will support the realization of California's environmental policy goals, including those set forth in the California Global Warming Solutions Act (AB 32), the Renewable Portfolio Standard, and the California Solar Initiative.

4.5 TECHNOLOGY SELECTION

Because many drivers of a smarter grid are more pronounced in SDG&E's service territory than anywhere else in the nation, SDG&E needs to be proactive in technology evaluation. Since many technologies necessary to fulfill policy requirements and maximize customer value are not yet mature, they also require that SDG&E applies a carefully considered technology evaluation process in its overall decision making.

At SDG&E, IT architecture and solutions decisions for existing and new infrastructure must meet business and technical requirements for functionality, including privacy, performance (adequacy and latency), reliability (availability, resilience, and disaster recovery), manageability, scalability, security (cyber and physical), cost-effectiveness, safety and regulatory compliance, as well as interoperability, expandability (additional business function), traceability (transactions/events), flexibility/adaptability, and usability. The definitions and specific criteria for each of these terms are derived from the "Non-functional Attributes for a Smart Grid Architecture," in chapter six of the *EPRI Public Interest Energy Research (PIER) Program Report: California Utility Vision and Roadmap for the Smart Grid of Year 2020*.²³

SDG&E will carefully evaluate the reliability and security requirements of each required Smart Grid application and its use cases to determine to what level the existing infrastructure components can meet or be upgraded to meet appropriate performance, reliability, interoperability and security standards for timely and secure Smart Grid information exchange.

SDG&E evaluates technology and vendor roadmaps, product development, R&D investments, manufacturers' capabilities, technology market share, and manufacturer/supplier financial commitments, distribution channels, and stability in determining the risk and value of specific existing infrastructure. In its Technology

²³ *Ibid.*

Reference Model (TRM), SDG&E has categorized its technologies and systems to understand their value and lifecycle for business solutions. The TRM will serve as a guide to prioritize the enhancements and replacements that will enable deployment of the Smart Grid.

The SDG&E IT Product Lifecycle defines the total evolution of an IT product from conception to retirement. This methodology closely adheres to principals and guidance defined by the Project Management Institute; specifically as documented in *A Guide to the Project Management Body of Knowledge* (PMBOK® Guide). At a high-level, Table 4-1 below defines phases in this lifecycle.

Table 4-1 IT Product Lifecycle Phases

Phase	Definition
Concept	Description of the business need and potential solutions to be investigated, and cost/benefits associated with each solution. Provides information to justify the business case completion.
Business Case Development	Completion of Scope of work, schedule and total cost of ownership (TCO) for the project/program. Submission of the proposal for funding and approval.
Project Prep	Completion of vendor contracts, and general mobilization of the project team and resources.
Requirements	Development of process models, detailed functional requirements, technical requirements and use cases to document the business need.
Design	Development of high level and detailed designs based on process models and business requirements in preparation for construction/build phase.
Construction/Build	Development, unit test and string test of code per detailed design.
Test	Execution of System, Integration, Regression and Technical (Non-Functional) tests. Defect fixes and migration.
Implementation	Migration of all tested capabilities into production environments.
Production	Production cutover and systems go-live
Post Implementation Review	Review of post implementation performance metrics.

In addition, SDG&E's technology evaluation process incorporates the lessons learned from its experience adopting automation technology, Smart Meter deployment and the OpEx 20/20 program which included Smart Grid foundational projects such as a state-of-the-art outage management and distribution management system (OMS/DMS), geographical information system (GIS), and condition-based maintenance (CBM).

SDG&E, through its Research, Demonstration and Development (RD&D) program, is collaborating with universities, government agencies, labs, and established and new companies to forge solutions and better understand technology maturity.

4.6 U.S. DEPARTMENT OF ENERGY (DOE) MODERN GRID ALIGNMENT

The DOE funded the Modern Grid Initiative and utilized stakeholder input from across the nation to develop seven Smart Grid characteristics:

1. Enable active participation by consumers
2. Accommodate all generation and storage options
3. Enable new products, services, and markets
4. Provide power quality for the digital economy
5. Optimize asset utilization and operate efficiently
6. Anticipate and respond to system disturbances (self-heal)
7. Operate resiliently against attack and natural disaster

The State of California Legislature through SB 17, and the Commission through its Decision D.10-06-047, took these seven characteristics and modified and expanded them slightly. SDG&E offers a mapping between these two different delineations in Table 4-2.

SDG&E believes that alignment among these different perspectives is crucial to adopting a California view that is consistent with the federal view. Such an alignment allows SDG&E and other California utilities to access solutions on a timelier basis due to

consistent requirements nationwide. Absent alignment, vendors will delay product and standards development which will be a detriment to the State of California's aggressive energy policy goals.

Table 4-2 DOE Modern Grid and CPUC Smart Grid Characteristic Alignment

Modern Grid Characteristics	CPUC Smart Grid Characteristics from SB 17
Self-healing from power disturbance events	Be self-healing and resilient
Enabling active participation by consumers in demand response	Empower consumers to actively participate in the operations of the grid; Enable and support the sale of demand response, energy efficiency, distributed generation, and storage into wholesale energy markets as a resource, on equal footing with traditional generation resources
Operating resiliently against physical and cyber attack	Be self-healing and resilient; Resist attack
Providing power quality for 21st century needs	Provide higher quality of power and avoid outages
Accommodating all generation and storage options	Accommodate all generation and energy storage options; Enable penetration of intermittent power generation sources
Enabling new products, services, and markets	Enable electricity markets to flourish; Create a platform for deployment of a wide range of energy technologies and management services; Enable and support the sale of demand response, energy efficiency, distributed generation, and storage into wholesale energy markets as a resource, on equal footing with traditional generation resources
Optimizing assets and operating efficiently	Run the grid more efficiently
Accommodating all generation and storage options, enabling active participation by consumers in demand response, and optimizing assets and operating efficiently	Significantly reduce the total environmental footprint of the current electric generation and delivery system in California.

SDG&E's strategy for selecting and making Smart Grid investments includes ensuring that they align with both state policy goals (identified in SB 17 and D.10-06-047) and federal policy goals, as identified by DOE. This will ensure furtherance of both sets of policy goals. SDG&E will also ensure that aligning with both sets of policy goals will foster maximized interoperability and consistency with emerging standards, and not create situations where the policy goals are in opposition.

4.7 GENERAL ORDER 156 ALIGNMENT

What are SDG&E's strategies for meeting GO 156 goals and requirements?

Smart Grid is going to transform the way SDG&E delivers power to customers. There are many components to Smart Grid deployment and this provides a wide range of new opportunities. Diverse Business Enterprises (DBE) can provide value by introducing experienced, qualified and certified suppliers and by helping potential DBEs to expand their technical capabilities and capacity building. SDG&E's strategy is to work closely with current and future companies to achieve its DBE goals. The DBE department has a proven track record of identifying and utilizing cross-functional suppliers that provide cost-effective goods and services to SDG&E. Overall Smart Grid provides an opportunity to introduce the energy industry with innovative technologies while supporting a diverse pool of suppliers.

Supporting General Order 156, in 2010 SDG&E achieved greater than 36 percent Diverse Business Enterprise (DBE) spending / procurement from all SDG&E's goods & services, with \$385 million of its procurement dollars going to DBEs. All contracts contain subcontracting language regarding DBE spending: these include spending for Smart Grid projects and DBE is part of SDG&E's evaluation criteria. As an example, Smart Meter achieved 68 percent DBE spending overall in 2010. SDG&E will employ the same procurement strategies that have proven successful in meeting General Order 156 goals in the past in implementing this Smart Grid Deployment Plan in the future. In addition,

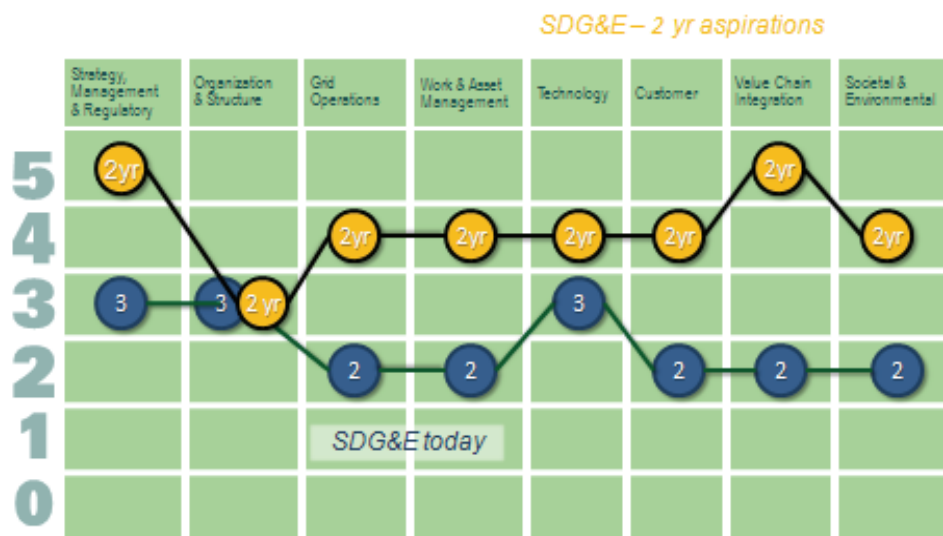
SDG&E plans to further develop its DBE program by working with DBEs to build their technical capabilities to participate in Smart Grid projects.

4.8 SMART GRID MATURITY MODEL ALIGNMENT

SDG&E was one of the original co-developers of the Smart Grid Maturity Model as part of the IBM Global Intelligent Utility Network Coalition (GIUNC). The DOE is now funding Carnegie Mellon University to expand and maintain this tool. The tool utilizes eight categories and by responding to questions regarding activities in the categories, a utility is able to rank its Smart Grid activities and prioritize areas for future initiatives. The scale varies from zero to five, with zero being business as usual and no Smart Grid activities to five with Smart Grid deployed in the category. SDG&E's existing score and aspirations are shown below.

Figure 4-2: Smart Grid Maturity Model Results

SDG&E 2 year SGMM aspirations



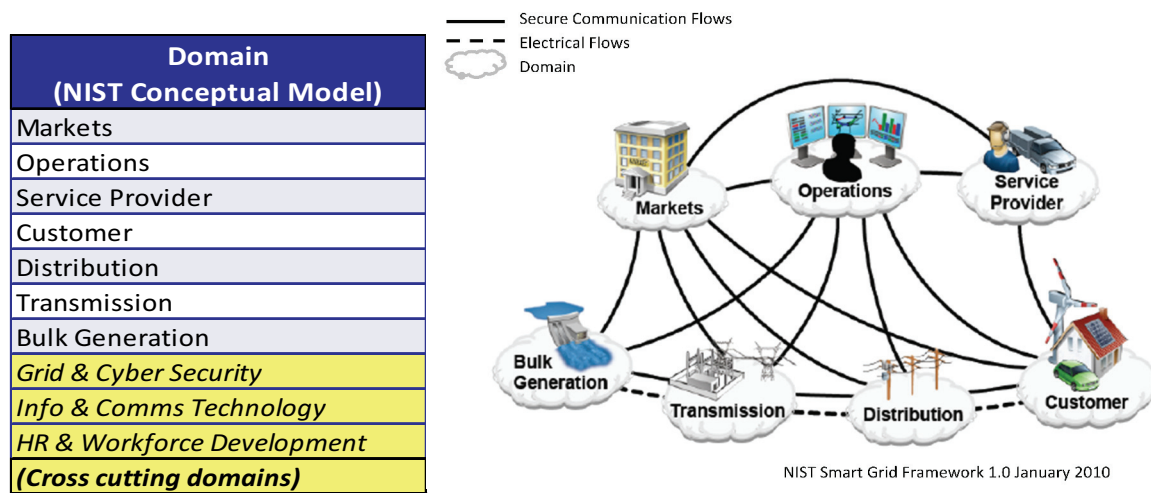
As a maturity model, the SGMM assists in guiding the organization through the journey of improvement. This model was developed to encompass many aspects of strategy and operations (and not limit itself to just “Smart Grid” aspects). The scope of an SGMM assessment includes everything that an end-to-end intelligently linked network effects within the utility such as assets, end user devices, business processes and customer interaction.

SDG&E has found this tool to be very useful in developing its Smart Grid strategy since many individuals are present in the same room debating the level in each category. The aspirations that SDG&E has established are guides to its initiative planning process.

4.9 NIST MODEL ALIGNMENT

SDG&E’s plan development leveraged a framework based on the NIST Smart Grid conceptual model, extended with three additional “cross-cutting” domains as shown in Figure 4-3. The advantage of this model is that it is representative of the electric energy ecosystem and is flexible to accommodate future ecosystem evolution. Teams were assembled for each of the ten domains and they developed strategies that address the implications to technology, people, and business processes.

Figure 4-3: NIST Conceptual Model and Additional Cross-cutting Domains



4.10 PRIVACY CONSIDERATIONS

Privacy strategy or architecture begins with a company security policy, which guides the risk management decision-making process. While SDG&E has always respected customer privacy as an important element of its security program, privacy has become a critical and foundational component as the result of new data created by Smart Grid technology.

To that end, SDG&E intends to adapt several aspects of emerging guiding principles into its security and privacy frameworks. For example, SDG&E supports the four dimensions of privacy²⁴ as described by NIST and the Fair Information Practice (FIP) principles developed by the Federal Trade Commission (FTC) as key components of its security and privacy programs. In addition, from a process and technology design perspective, SDG&E also sees value in other guiding principles such as the Privacy by Design Seven Foundational Principles²⁵. This effort will permeate every part of the utility's privacy framework, from policy, guidelines and security requirements, to security architectural principles and design standards, to process and technology implementation. It will positively influence the way SDG&E offers services to its customers by building confidence and trust. After appropriate principles have been applied, SDG&E must consider how customer information is managed from its collection to its destruction.

1. SDG&E will determine if a piece of data about a customer is necessary to collect either for itself, for example to accurately bill a customer, or for a third party, such as regulators or law enforcement.
2. If it is deemed necessary to collect the information, SDG&E will then ensure that adequate controls are in place to protect the information while it is in the utility's possession. These security controls must be regularly tested for potential

²⁴ From "Guidelines for Smart Grid Cyber Security: Vol. 2, Privacy and the Smart Grid"

²⁵ From Privacy by Design : Seven Foundational Principles,
<http://www.ipc.on.ca/images/Resources/7foundationalprinciples.pdf>

vulnerabilities that could result in the inadvertent loss in the confidentiality, integrity or availability of the information.

3. Next, SDG&E will ensure mechanisms are in place to securely transport information from itself to third parties that have a need-to-know based on a variety of factors, including applicable law and regulation, and customer desire to share the information with a third party.
4. While in its possession, SDG&E will safeguard the integrity of customer information, ensuring that customer information is accurate, both while SDG&E stores it and during its transport to third parties.
5. Finally, SDG&E will determine the appropriate information retention policy according to all applicable laws and regulations, as well as best practices, and ensure the information is disposed securely and permanently when it is no longer needed.

4.10.1 INTEROPERABILITY AND PRIVACY

How will SDG&E adopt and develop an interoperable architecture designed to protect the privacy of customer data?

SDG&E has named a Chief Customer Privacy Officer and director responsible for customer privacy. These roles include ensuring the completion of a privacy impact assessment and other ongoing efforts, including plans for Grid and Cyber Security Strategy and a robust approach to enterprise architecture and information modeling / standards with privacy-related interoperability standards, based on the four dimensions of privacy described by NIST in its security policy framework and the Privacy by Design Seven Foundational Principles.

SDG&E is partnering with the Office of the Information and Privacy Commissioner (IPC) of Ontario, Canada, to put into action the policies, approach, and standards to protect

the privacy of customer data by working together on a Dynamic Pricing Program. By designing privacy in from the beginning, the project will result in a model that can be leveraged and further improved across the industry.

4.10.2 STANDARDS AND PRIVACY

How will SDG&E evaluate the impact of standards on privacy?

To evaluate the impact of standards on privacy, SDG&E will use a risk management based approach to determine how new standards may impact the confidentiality, integrity and availability of sensitive information based on potential threats, vulnerabilities and impacts. Additionally, because SDG&E recognizes the importance of customer participation in the Smart Grid, it will seek to measure the confidence customers have in the Smart Grid privacy system. Project implementation will leverage privacy and security related standards in order to meet security requirements, regulations, and mandates related to customer information.

4.11 INTEROPERABILITY CONSIDERATIONS

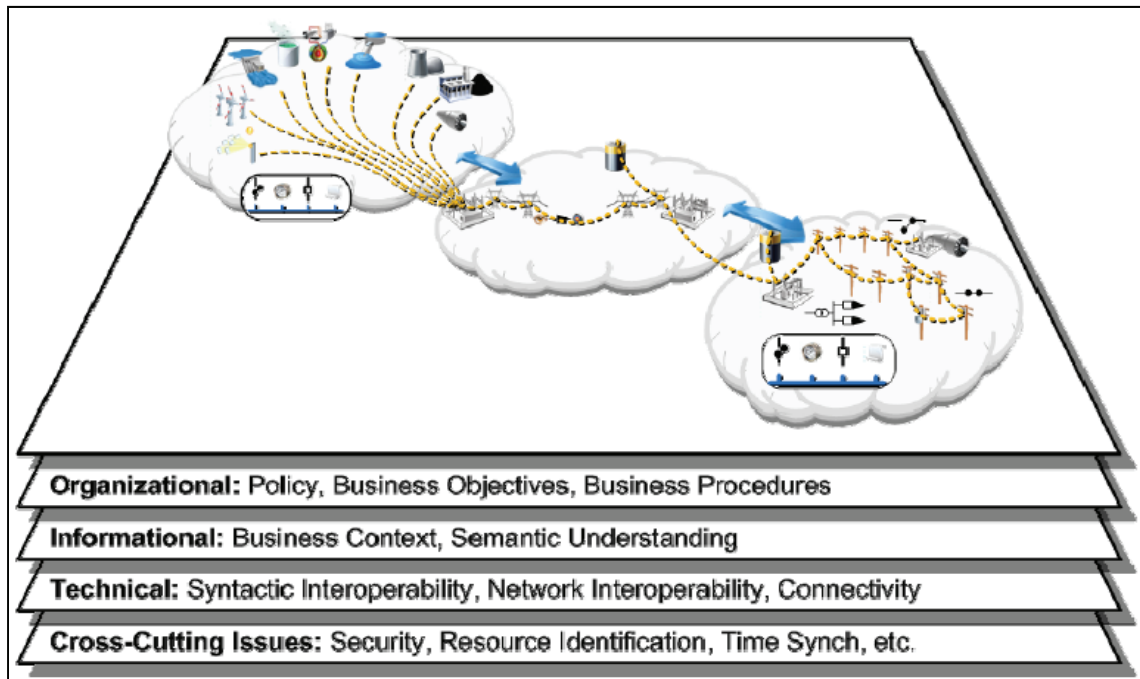
4.11.1 INTEROPERABILITY STANDARDS

How will SDG&E use interoperability standards?

Standards are essential for Smart Grid interoperability to ensure that information can be exchanged between utility systems, applications and customer devices and so that information remains secure.

There are an extraordinary number of potentially applicable standards relating to Smart Grid deployments. A recent NIST report collated existing standards into categories. These categories are structured on the GridWise Architecture Council's layered reference architecture as shown below.

Figure 4-4: GridWise Architecture Council Interoperability Model



The *NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0*²⁶ listed the multitude of potentially applicable standards in each domain. The full analysis is not repeated here, but a selection of key strategic standards of interest to SDG&E is highlighted in the table below.

²⁶ NIST Special Publication 1108;
http://www.nist.gov/public_affairs/releases/upload/smartgrid_interoperability_final.pdf

Table 4-3: NIST Interoperability Standards Roadmap List

NIST Domain	Key standards of interest	Applicability
Operations	IEC 61968, IEC 61970, ICCP (IEC 60870-6/TASE 2), DNP3, IEC 61850	Core standards for exchange of telemetry and reference data within the network operations domain.
Markets	Metering Standards (as developed), aseXML and associated payload standards for market transactions	Smart metering working groups are developing relevant metering data collection and exchange standards. Wholesale, retail and B2B standards are mandatory.
Service Provider	Open ADE/NAESB ESPI	Exchange of customer usage with customer authorized third-party service providers
Bulk Generation		N/A
Distribution	DNP3, IEC 61850-7-2, W3C XML, W3C XSD, W3C SOAP, W3C EXI, W3C WSDL, ANSI C12.22, IEC 60870, IEC 61968, IEEE 1686-2007, NERC-CIP, IEEE C37.111-1999, IEEE 37.118, IP Suite, TCP/IP	Inter-application and industry interoperability standards apply and multiple levels of data exchange (from physical to application). Service oriented architecture standards.
Transmission	As above plus emerging NASPI	As above
Customer	ZigBee, OpenHAN, HomePlug and others	In-home/ beyond-the-meter technologies to encourage the uptake of demand response opportunities.
General	ISO 9001	Quality and safety standards to be maintained as for all other SDG&E activities.
Security	ISO27002, NIST 800-53, NERC CIP, IEEE 1402	ISO and NIST provide a broad framework for security in technology, process and governance domains. The Critical Infrastructure Protection (CIP) standards are more specific to grid transmission security. IEEE provides a standard for physical security at substations.

SDG&E incorporates these standards in its decision making process by aligning to standards where it would achieve the greatest benefits for customers (e.g. lowest cost, easiest installation). SDG&E is participating on an ongoing basis with standards and coordination groups such as OpenSG²⁷, NIST's Smart Grid Interoperability Panel (SGIP), the North American Energy Standards Board (NAESB), and the North American Electric Reliability Corporation (NERC). SDG&E also monitors other areas to ensure the standards are moving in support of customer interests. In areas where standards deliver customer value, SDG&E prioritizes interoperability in its requirements by implementing a preference for suppliers that do not use proprietary technologies or implementations.

SDG&E seeks to design systems for modularity and implement standards at key interfaces, particularly those between the utility and third parties. Standards at these interfaces enable the utility to maintain the flexibility needed to integrate new technology solutions and vendors. It is difficult to predict the evolutionary path of various technologies and, therefore, SDG&E values consistent interfaces that enable the utility to change technologies and vendors as and when needed. SDG&E believes this is a key guiding principle as it explores the many components of Smart Grid solutions.

4.11.2 STANDARDS AND MINIMIZING RISK OF STRANDED COSTS

How will SDG&E minimize the risk of stranded costs in cases where standards are evolving?

To minimize the risk of stranded assets where standards are still evolving, SDG&E will start with pilots of new technologies to ensure they meet its requirements. SDG&E will

²⁷ The Open Smart Grid subcommittee within the UCA International User's Group, see <http://osgug.ucaiug.org>

also ensure that field devices are upgradeable over the air, so that as evolving standards firm-up, SDG&E's investments can be protected.

Project management practices include evaluation of factors in order to decrease the risk of stranded costs. The SDG&E project lifecycle provides for a review of technology (for adherence to standards - both external and internal), service and processes, as well as a vendor evaluation throughout the lifecycle of a project.

SDG&E will also suggest new regulatory structures that will provide the utility with the proper incentives to adopt appropriate Smart Grid technology in a way that responds quickly to market technology changes, and minimizes the risks of stranded costs. As the electric grid and markets are revolutionized by the Smart Grid, SDG&E will need the ability to respond quickly and make decisions that previously might have required direct regulatory approval and lengthy regulatory hearings. Unless this structure is changed, SDG&E and the California utilities will fall behind the best industry practices and will not be able to provide what customers require and demand.

4.11.3 OPENADR AND SMART ENERGY PROFILE COEXISTENCE

What is the feasibility and cost-effectiveness of offering OpenADR coexisting with Smart Energy Profile 2.0?

Deploying technologies that are compliant with the OpenADR specification on dedicated servers will become more practical as more vendors enter this arena and begin building products that support the OpenADR specification, including interfaces, demand response automation servers, end devices, and so on. In these early stages, it will be more cost-effective to execute initial pilots through software as service offerings from vendors. This approach will reduce the cost impact associated with internal deployment of the technology while also speeding deployment to support initial pilot efforts.

SDG&E has a limited implementation of OpenADR to large commercial customers and will continue to expand it for this class of customers, and will explore its implementation

for other customer classes as new products and services are brought to market. SDG&E's advanced metering infrastructure solution includes a ZigBee wireless communications module in the meter and is designed to support the associated Smart Energy Profile. SDG&E's future decisions in this area will be driven by customer adoption, interoperability, and market maturity.

Assuming the technologies built against the OpenADR specification mature and more vendors enter this arena, more cost effective solutions and internal deployment and support of these products will become more feasible. Internal deployments on dedicated servers will provide SDG&E greater flexibility in integrating the OpenADR compliant products with internal systems.

4.12 CUSTOMER BENEFITS DELIVERY

How will SDG&E deliver benefits to customers?

After complying with state and federal policy requirements, delivering benefits and maximizing value for its customers is the primary focus of SDG&E's Smart Grid Deployment Plan and a key element to its decision-making process. Even in situations where Smart Grid deployment plans are in response to a policy-driven need, such as managing intermittency resulting from increased installation of rooftop photovoltaic energy, SDG&E evaluates the benefits the project will deliver to customers.

SDG&E collaborates internally with cross-functional teams and externally with its customers and other stakeholders for ongoing customer input, to ensure its Smart Grid Deployment Plan is delivering customer value and providing benefits. By aligning the Smart Grid Deployment Plan internally, with key stakeholders, and with SDG&E's strategic plan, the utility also ensures that its Smart Grid investments and customer projects receive support across the entire organization. Smart Grid planning and investments, in turn, will inform SDG&E's ongoing strategic and operational planning efforts across the company. This view will support the annual updates and reporting to

the Commission which requires centralized portfolio tracking and customer benefits reporting.

SDG&E's strategy to deliver value added services and benefits to customers will continue to be driven by collaboration with customers and other external stakeholders, including ratepayer advocates, government, business, academia, industry, environmental and privacy advocates. This will ensure better alignment with the needs and desires of stakeholders and a more complete understanding of impacts on customers.

By leveraging technology to create a more functional grid, SDG&E customers will become partners in providing energy, managing the grid and ensuring a reliable supply of electricity to the entire San Diego region at minimum costs. SDG&E's deployment plan roadmap is driven by a desire to support customers as they become partners and "prosumers" (those that both produce and consume energy) instead of remaining customers that only consume electricity. For example, Smart Grid Customer Empowerment projects will engage and prepare customers to maximize value by developing rate options, services and programs that customers want while protecting customer privacy and integrating customer-owned equipment including distributed energy resources such as photovoltaic systems, smart appliances, home energy management systems, home storage and electric vehicles. SDG&E will also look for opportunities where the utility can play a unique role or fill a gap to satisfy customer energy needs.

SDG&E recognizes that the rate of customer adoption of emerging Smart Grid customer applications and technologies is uncertain. Therefore, SDG&E will continue to collaborate with industry groups, major technology vendors, consumer appliance and equipment providers and retail delivery channels to understand and interoperate with SDG&E's Smart Grid infrastructure to accommodate the rapidly evolving and changing consumer electronic landscape. For example, delivering customer information and

customer specific alerts to a customer's mobile device will continue to be a challenge as the proliferation of mobile communications technologies and customer-facing application development continue at a rapid pace.

SDG&E will integrate customer renewable resources, storage, and electric vehicles into grid operations while maintaining and/or improving reliability at both the transmission and distribution system. Where appropriate, SDG&E will institute new technologies, such as synchrophasors and dynamic line ratings. Some of this will be done-by partnering with CAISO on identifying transmission expansions and technological improvements and requirements and resource characteristics needed in markets. These activities will improve asset management and grid efficiency by leveraging wide area measurement and control capabilities. By performing these activities, SDG&E will create the platform for new products and services from the utility and third parties.

Customer confidence in security is paramount, and SDG&E will ensure security is maintained or improved with the deployment of smart technologies. This will include hardening systems, testing for vulnerabilities, aligning controls to regulation and enterprise capabilities, tracking threats and vulnerabilities, providing appropriate training to operators, and making all Smart Grid participants more aware of security risks. SDG&E will deploy secure, reliable Smart Grid communications capabilities and leverage service-based integration to provide maximum flexibility and adaptability between systems.

As technology evolves and becomes increasingly complex to maintain and operate, SDG&E will ensure readiness of its workforce as even higher skill levels are required. The well known workforce challenges from an aging workforce and attrition of experienced workers will also be addressed in any workforce plan. This will ensure that SDG&E is able to provide service that maximizes value of new and emerging technologies for customers.

4.13 EVALUATING THIRD PARTY COMMUNICATIONS NETWORKS

How will SDG&E evaluate whether third party communications networks can provide cost-effective communications that meet the security and performance requirements of Smart Grid? How will SDG&E consider both existing and future service provider capabilities (cost effectiveness, security, and performance)?

Secure, reliable network communications are a core requirement for both Smart Grid and traditional utility operations. Network communications solutions for SDG&E's Smart Grid must meet a comprehensive set of functional and technical requirements, and deliver maximum value to the utility and its customers, regardless of whether they are provided by SDG&E's privately operated systems or leverage services provided by network service providers.

Like other technical capabilities and systems, SDG&E will carefully evaluate the feasibility, cost, and technical benefits of using existing communications infrastructure and how they can best be integrated with new technologies to enable Smart Grid deployment. Technologies and systems will be evaluated against business and technical requirements, technology and product maturity and lifecycle, interoperability standards, and fit-for-purpose value.

SDG&E's communications capabilities have been enabled by a mix of private networks and third-party provider services for decades. In its continuous efforts to improve efficiency, functionality, capacity and security; SDG&E constantly monitors the market for available solutions and emerging trends and incorporates promising technologies into its evaluation and analysis process. Through that process, SDG&E has evaluated whether third-party communications networks can provide cost-effective communications that meet the security and performance (including coverage, capacity, reliability, and survivability during adverse events such as earthquake or wildfire) requirements of the Smart Grid – and found that in some cases, they can. Where those

requirements are met, and the solution offered provides the most value, network services from a third-party provider may be selected over a private network solution.

4.14 CONCLUSION

SDG&E has developed a robust strategy for its Smart Grid Deployment Plan. Elements of the strategy have been present and successfully utilized for a number of Smart Grid technology deployments to date. The strategy utilizes a decision making framework that prioritizes projects that are driven by requirements of state and federal policy and projects that deliver customer value where the benefits exceed the costs or where the investment is necessary to effectively communicate with customers. Piloting reduces risks such as stranded costs, among others, while the strategy's approach to interoperability standards and the leveraging of existing infrastructure where possible also help keep costs low. This strategy fulfills the requirements of D.10-06-047 and provides for flexibility as technologies evolve over time.