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Smart Grid Deployment Plan

2013 Annual Report

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1 KEY TAKEAWAYS AND HIGHLIGHTS

The need for development and deployment of Smart Grid solutions in the San Diego region has never been greater.

The electricity industry and grid are quickly transforming, driven by customers' increasing adoption of renewable energy technologies, electric vehicles, and energy management tools and information services, as well as by the implementation of California's ambitious energy policy goals. It is in that context that San Diego Gas & Electric has aligned on its mission to provide a sustainable energy platform with differentiated offerings that enable customer choice and empower industry innovation.

Changes to SDG&E's power supply resource mix are impacting nearly every aspect of the region's electricity system. Continued growth in centralized and distributed renewable energy resources and electric vehicles place new demands on system planners, engineers, and operators to ensure reliability and power quality in a very dynamic environment. With the plant operator's decision to permanently retire the San Onofre Nuclear Generating Station (SONGS) in June 2013 after going offline in January 2012, more than 400 megawatts (MW) of inexpensive, carbon-free base load generation was removed from the region's power supply[2]. Fortunately, the Sunrise Powerlink, SDG&E's new 500-kilovolt (kV) transmission line, came online just in time in June 2012 to help increase the level of imported power from the Imperial Valley by 20-30% on a normal day, which has partially offset the loss of SONGS and ensured that the region has adequate power supplies for peak usage periods.

SDG&E customers have installed distributed generation systems with a peak capacity of more than 184 megawatts.

SDG&E has signed agreements in place for 10 renewable energy projects in the Imperial Valley, totaling more than 1,200 MW of power that will utilize the Sunrise Powerlink, with several of these large-scale projects already coming online. In addition, other agreements with large scale solar projects under development in eastern San Diego County will provide power to the San Diego region. At the same time, SDG&E's customers are installing rooftop solar energy systems on their homes and businesses in greater numbers, resulting in 37.5% overall growth in Net Energy Metering (NEM) generation capacity to more than 184 MW during the 12 months ending June 30, 2013 (the "Reporting Period"), which is forecast by the CEC low load scenario to be 248 MW by 2015[3]. These renewable sources have significant environmental benefits, but due to intermittent power production they require Smart Grid solutions to ensure their reliable integration into the electricity system.

[2] SONGS units 2 and 3 have a total combined capacity of 2,200 megawatts. SDG&E owns 20% of SONGS.

[3] California Energy Demand 2012-2022 Final Forecast, CEC-200-2012-001-CMF-VII.

SDG&E is engaging customers who now have many more choices in the tools available to help them manage their energy use. Home Area Network (HAN) devices such as energy information displays and other energy management devices that are tested as compatible with SDG&E's Smart Meter network are available from multiple manufacturers, and listed on sdge.com. Customers can choose between a variety of online energy information services and mobile applications, enabled by the open standards-based Green Button Connect My Data platform, that provide valuable, detailed analysis of their Smart Meter data. They can easily and securely authorize these third parties to automatically receive their energy usage data on a daily basis through a simple registration process on SDG&E's My Account portal, while protecting their privacy.

Figure 1 : Candi PowerTools Enabled by SDG&E

Electric vehicle adoption also continues to show strong growth in the region, with the number of plug-in electric (PEV) and plug-in hybrid electric vehicles (PHEVs) operated by San Diego drivers more than doubling during the Reporting Period. Because of their unique load characteristics, Smart Grid solutions are also essential to the reliable integration of PEVs and PHEVs into the electric grid while minimizing capital infrastructure costs. These solutions will enable PEVs and their charging infrastructure to become grid-integrated, and to leverage time-of-use (TOU) and other alternative rate designs, which will potentially allow SDG&E to integrate even higher levels of renewables in the future, by absorbing excess production during the solar generation peak hours, and ramping down charging demand when needed.

The California Public Utilities Commission (CPUC) has recognized the region's needs for Smart Grid solutions in its decision resolving SDG&E's Test Year (TY) 2012 General Rate Case[4] (GRC) application, when it authorized more than $65 million in Smart Grid-related capital investments[5] needed to successfully implement state energy policy goals and to keep pace with the needs of customers. In their decision, the CPUC recognized the "growing use of photovoltaic generation in SDG&E's service territory, and the impact of this on SDG&E's electric operations" in its decision, among other driving factors.

[4] A.10-12-005 filed on December 15, 2010. Approved by decision 13-05-010, issued May 24, 2013.
[5] Estimated authorized capital for the test year 2012, including $26 million for energy storage, in 2009 direct dollars. Excludes some costs, including Smart Meters that are included in this report.

This *Smart Grid Deployment Plan – 2013 Annual Report* (*"Annual Report")* provides stakeholders with an update on SDG&E's Smart Grid deployment as the San Diego region continues its rapid advance towards a smarter and cleaner energy future.

Similar to the first issuance in 2012, this *Annual Report* provides a status update to SDG&E's Smart Grid metrics, deployment costs, and benefits for the Reporting Period. Other information provided in the report includes additional highlights through September 2013.

Highlights of SDG&E's Smart Grid deployment update include:

- Overall Smart Grid investments of ~$144 million and ~$34 million in benefits during the Reporting Period
- 65 Smart Grid and related enterprise[6] projects in progress or planned
- New customer-facing products and services enabled by Smart Meters introduced, including enhancements to SDG&E's My Account online services, mobile applications enabled by the Green Button Connect My Data platform, and SDG&E's Reduce Your Use[SM] program
- Major enhancements to previously completed transformative foundation projects such as the Outage Management System/Distribution Management System (OMS/DMS) are underway
- Initiated operations of the Borrego Springs Microgrid Demonstration Project, the largest grid-tied community-scale microgrid in the U.S., with multiple demonstrations of islanded operation completed and improvement of local reliability
- Continued strong growth in distributed generation, with 7,103 new systems (primarily solar) connected by customers during the Reporting Period, for a total of 25,100 residential and commercial systems connected (more than 1.8% of SDG&E's customer base now has rooftop solar installed) as of the end of the Reporting Period
- Growth to approximately 5,400 total PEVs connecting to SDG&E's system at the end of the Reporting Period[7], with more than 38% of new PEV customers enrolling in time-differentiated electric vehicle rates that encourage off-peak charging
- SDG&E's Reduce Your Use program was launched in July 2012 to all residential and small business customers with Smart Meters – the program called seven events to date, with those customers opting to receive electronic notifications or alerts reducing their electricity usage during event hours more than 5% of their reference load

[6] "Enterprise" projects are those that meet the broader needs of SDG&E's business but are also related to Smart Grid.
[7] SDG&E has started including neighborhood electric vehicles (street legal plug-in vehicles with a maximum speed of 35mph) in its PEV counts in this 2013 Annual Report – estimated at 1,330. An exact number of PEVs connected to SDG&E's system is unavailable, as PEV drivers are not obligated to notify the utility, so estimates are compiled from a variety of data sources.

- Continued engagement and outreach via regular briefings with feedback from key stakeholders across the SDG&E service territory
- Expansion of SDG&E's extensive weather monitoring network to 144 stations, enabling greater visibility into microclimate weather conditions for utility operators and public safety agencies

PROGRESS TOWARD CALIFORNIA'S ENERGY POLICY GOALS

Many California and federal policies underpin SDG&E's *Smart Grid Deployment Plan*, including Senate Bill (SB) 17, the Renewable Portfolio Standard (RPS), Assembly Bill (AB) 32, AB 2514 (Skinner), the state's distributed generation and demand response goals, the Governor's Clean Energy Jobs Plan, building and appliance efficiency standards, implementation of the electric procurement loading order, and cybersecurity compliance requirements such as the North American Electric Reliability Corporation's Critical Infrastructure Protection (NERC CIP) standards. The majority of Smart Grid projects undertaken by SDG&E are designed to fulfill the utility's role in realizing these goals or complying with mandatory standards.

Figure 2 : Sunrise Powerlink

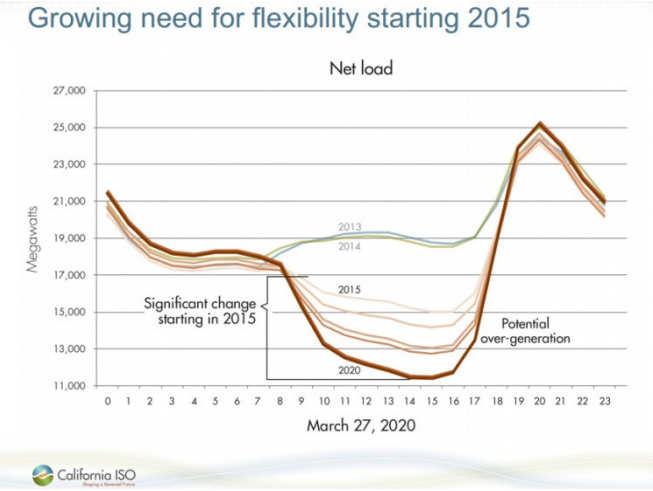
In 2012, SDG&E again led the three California investor-owned utilities (IOUs) by procuring 20.31% of electricity deliveries from renewable power sources[8] as it moves toward the state's Renewable Portfolio Standard (RPS) of 33% by 2020. SDG&E's progress toward that goal includes the signing of agreements for 10 renewable energy projects in the Imperial Valley, totaling more than 1,200 MW of power that will utilize the Sunrise Powerlink. As of August 2013, six of those projects, representing 900 MW of peak capacity at full build-out, are currently operational and delivering power to the San Diego region. The need to deliver energy from these clean, yet intermittent sources continues to be a major driving factor in SDG&E's Smart Grid plans, which will integrate renewables, PEVs, and other technologies safely and reliably.

As a direct result of the Sunrise Powerlink, more than 1,000 Imperial County residents are now employed as part of the electrical workforce building four of the utility-scale solar projects in the county, including hundreds who are entering the trade for the first time.

[8] California Public Utilities Commission – "Current Renewable Procurement Status", http://www.cpuc.ca.gov/PUC/energy/Renewables/index.htm.

With the loss of SONGS from the region's power supply and the rapid growth of centralized and distributed renewable generation in SDG&E's service area, the California Independent System Operator (CAISO) and SDG&E face significant technical challenges in managing intermittently available resources while still meeting the needs of customers. For example, the CAISO and SDG&E will quickly have to adapt operations of the grid to "ramp up" enough generation resources in the evenings to make up for solar generation that becomes unavailable as the sun goes down, as shown in CAISO's example in Figure 3. Managing this rate of change as well as more rapid changes occurring in seconds will require flexible resources including Smart Grid solutions, such as energy storage, dynamic reactive power (VAr) control devices, smart inverters, and advanced control systems that provide operators with strong situational awareness and the ability to quickly respond to problems.

Figure 3 : An Illustrative Outlook at the California Grid 2013-2020 - CAISO



STAKEHOLDER ENGAGEMENT

SDG&E continues to work in collaboration with key stakeholders to create the foundation for an innovative, connected, and sustainable energy future and these collaborations have continued to grow in productivity and scope during this past year.

During the Reporting Period SDG&E's Energy Innovation Center (EIC)[9] hosted 840 events and welcomed more than 28,000 visitors. The Center offers multiple opportunities to learn about energy technologies including HANs, renewable generation, and energy storage systems. External organizations utilizing the Center this past year have included, but are not limited to, the U.S. Department of Energy (DOE), the San Diego Regional Electric Vehicle Infrastructure Working Group, Camp Pendleton, University of California San Diego (UCSD), and the U.S. Green Building Council.

SDG&E has continued its collaboration known as Smart City San Diego that combines its resources with the City of San Diego, GE Digital Energy, UCSD and CleanTECH San Diego. This collaboration grew throughout the Reporting Period and continues to make a positive impact on the San Diego region. More information on Smart City San Diego can be found at http://smartcitysd.org.

[9] More information on SDG&E's Energy Innovation Center is at http://sdge.com/eic.

Examples of Smart City San Diego initiatives include the Solar Energy to PEV Charging exhibit at the San Diego Zoo, a destination for millions of visitors each year, and the car2go all-electric car sharing fleet, which grew 30% and expanded to the City of Chula Vista during the Reporting Period.

Figure 4 : Solar to PEV Charging Exhibit at the San Diego Zoo

Detailed project and power production information for the Solar to PEV Charging exhibit is available to the public at http://ow.ly/oB9wa

On an ongoing basis, SDG&E continues to collaborate with external stakeholders that provided input to its *Smart Grid Deployment Plan*, and who remain engaged with SDG&E on Smart Grid and other issues. These organizations include environmental interests, academia, business organizations, municipal utilities and governments, ratepayer advocates, energy non-governmental organizations, large customer/corporate interests, collaborative organizations, and workforce interests.

In June of 2013, SDG&E joined Pecan Street Inc., a leading national research and development organization in Austin, Texas focused on developing and testing advanced technology, business models, and customer behavior surrounding advanced energy management. SDG&E plans to work with Pecan Street Inc. on a consumer engagement study on as many as 50 customers in a new San Diego housing development that includes many sustainability features. These customers' homes will be instrumented with sensors that will collect high resolution data on their energy use, and the customers will be provided with additional tools that will allow them to better understand and manage their energy use.

SDG&E has also continued its collaboration on the Area Situational Awareness for Public Safety Network (ASAPnet), which offers high-speed wireless communications and emergency response capabilities to rural fire stations. This system provides public safety agencies with access to real time weather data from SDG&E's extensive weather network, as well as access to other resources that will improve those agencies' situational awareness and the ability to better deploy their resources and maintain public safety through improved communications. This network has recently been expanded to include 50 additional fire stations in the SDG&E service area.

SDG&E is working with stakeholders such as the Western Electric Industry Leaders (WEIL) Group on advocacy for the installation of smart inverters on all new solar generators in the region. Inverters installed at customer generators that can securely communicate with utility operations systems have

the potential to address many of the concerns related to the intermittency of solar generation, by responding to control signals that will set the mode of operation on those inverters to mitigate conditions on the distribution grid. SDG&E and its WEIL partners strongly believe that deployment of this technology is imperative to the safe, reliable integration of high levels of intermittent renewable energy sources.

More generally, SDG&E has continued to engage stakeholders across a wide spectrum of Smart Grid issues seeking input and ideas related not just to SDG&E's Smart Grid technology deployment, but the accompanying issues raised, such as customer data privacy.

OPPORTUNITIES TO WORK WITH DIVERSE BUSINESS ENTERPRISES

Smart Grid projects represent exciting new initiatives that will bring more opportunities for SDG&E to work together with Diverse Business Enterprises (DBEs) and help the region's communities thrive. From integrating new technology and renewable energy projects that will transform the electric grid into a Smart Grid, many opportunities lie ahead to work with DBEs. These exciting new endeavors will require SDG&E to continue to seek DBE partners in its region with the technological know-how to implement sophisticated smart networks to continue to strengthen the electric grid and serve the region's communities with reliable and environmentally sustainable energy. In areas where those capabilities are not sufficiently strong, SDG&E works to provide technical assistance and capacity building to grow awareness and capabilities among DBEs wishing to participate in the Smart Grid space.

At the end of 2012, 25% of SDG&E's Smart Grid purchases were from diverse business enterprises surpassing its goal of 15%. SDG&E's Smart Grid-related DBE purchases were accomplished through focused efforts that included DBE requirements in RFPs, and identification of qualified DBEs for logistics, warehousing, installation, and other products and services.

SDG&E anticipates there will be many opportunities in the next few years for business owners from diverse backgrounds to get involved and be a part of this exciting new effort.

INDUSTRY RECOGNITION

San Diego and SDG&E's Smart Grid deployment efforts have continued to be acknowledged by industry observers.

In 2012, *POWER Magazine*, one of the most widely read power industry trade publications, recognized SDG&E with its "Smart Grid Award" noting its customer-focused and all-inclusive *Smart Grid Deployment Plan* as a major factor in their selection. In 2013, SDG&E was listed for the second consecutive year among the "Top Ten North American Utilities in Smart Grid" by GreenTech Media and

GTM Research. In 2012, for the seventh consecutive year, PA Consulting recognized SDG&E as having the best reliability in the western United States.

These and the other recognitions recognizing SDG&E's efforts in Smart Grid demonstrate that SDG&E has proven itself as a national leader in implementing a comprehensive and effective Smart Grid program focused on providing benefits for its customers and other stakeholders.

OTHER INDUSTRY ENGAGEMENT

SDG&E is represented on a number of different boards, including the GridWise Alliance, the Electric Drive Transportation Association, and the Smart Grid Consumer Collaborative, where it influences public policy and other industry issues. It is also regularly consulted by the U.S. DOE and other government agencies for participation in research and development peer review and other activities that promote the development of Smart Grid nationwide.

SDG&E also collaborates with utilities worldwide, though its active participation in IBM's Global Intelligent Utility Network Coalition (GIUNC). This international consortium provides SDG&E opportunities to learn about other utilities' solutions to problems that their U.S. counterparts such as SDG&E share. International collaboration also continues through SDG&E's participation in a DOE-sponsored working group within the U.S. – Russia Presidential Bi-lateral Commission on Energy, working with counterparts at the Russian grid operating companies. The purpose of this program is to allow for collaboration on the development of programs to advance EE and joint development and integration of cutting edge technology.

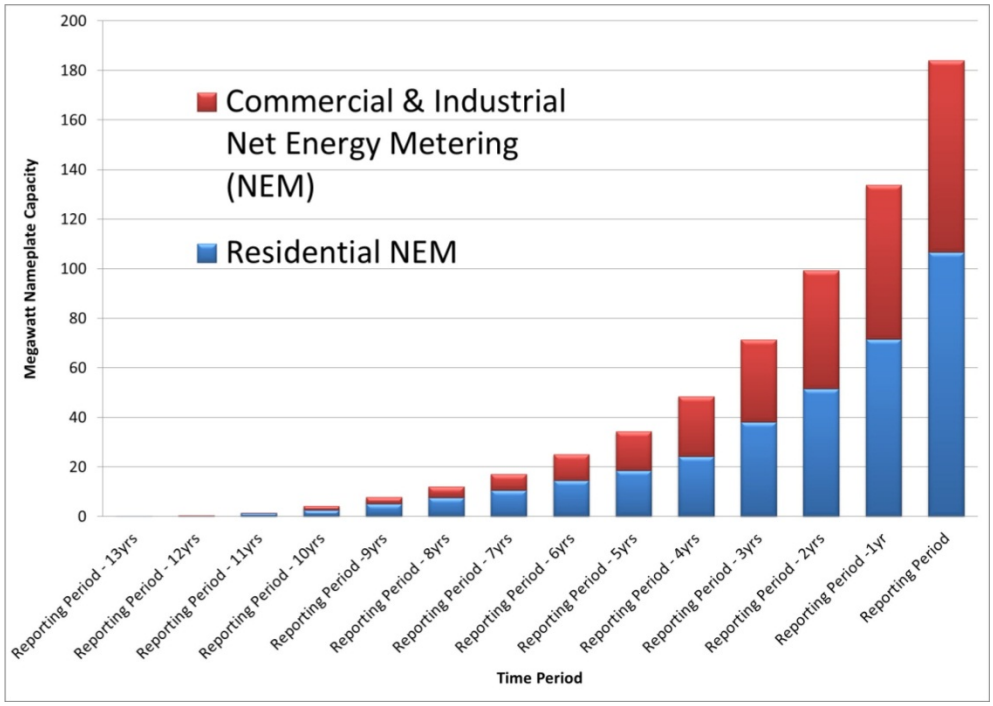
1.1 CUSTOMER DRIVERS

SDG&E is investing in Smart Grid solutions in response to three major customer-driven factors:

- Installation of intermittent distributed (primarily PV) generation systems, which have variable power output and lack compensating controls for grid reliability (such as those that would be found in smart inverters);
- Purchase or lease of PEVs by a quickly growing number of SDG&E customers; and
- Geographic clustering of PV, PEVs (often at the same customer premises), and the related disproportionate effects of intermittency and their mitigation requirements.

As shown in Figure 5, SDG&E customers are continuing their investments in distributed generation systems, primarily PV technology, with more than 1.8% of SDG&E's customers generating from 25,000+ systems installed at their premises at the end of the Reporting Period. At a pace that is roughly doubling the installed capacity every two years (in August 2013, the most recent full month for which data is available, more than 1,000 new PV systems were interconnected); this trend demonstrates the immediacy driving SDG&E's development of Smart Grid solutions that are needed to integrate the quickly growing number of small generators, while maintaining the level of system reliability that customers expect.

Figure 5 : Growth in Net Energy Metered Distributed Generation Capacity of Residential and Commercial and Industrial (C&I) Customers of SDG&E



Distribution circuits where the penetration of PV generation is highest are where many of SDG&E's Smart Grid solutions are focused. Because the intermittent availability of solar generation impacts the distribution system's voltage and other power quality standards, technologies such as energy storage, dynamic voltage controls, distribution synchrophasors and controllable capacitors have been deployed to areas with power quality concerns to help operators keep the system stable.

SDG&E's Smart Grid investments that respond to these customer choices are intended to reliably and efficiently integrate these new technologies. In addition to delivering energy, SDG&E provides standby, power quality, and reliability services to its customers; however, the state's current NEM rate design results in those customers receiving these services for free, while other customers that have not and may not have the ability to make investments in solar energy systems bear the cost of providing those services. SDG&E believes that optimal rate design is cost-based, provides accurate price signals, and is fair for all customers, while clearly identifying public policy-driven subsidies. Changes to the current rate design are critical to ensure the continued and sustainable growth of renewable energy resources. SDG&E is deeply involved in collaboration with the CPUC and other stakeholders and the California

legislature to design new rates that can sustain future growth in renewable generation and electric vehicles, in alignment with the state's ambitious energy policy goals.

1.2 CUSTOMER VALUE

Many of SDG&E's Smart Grid projects are being undertaken to create value for customers where the projected benefits outweigh the costs or where the investment is necessary to effectively communicate with customers. The benefits of these customer value-driven and other policy-driven Smart Grid investments are already being realized. For example, SDG&E's Smart Meter deployment now provides residential and small commercial customers with their hourly energy consumption data, viewable online through SDG&E's My Account tool or transferred automatically to other service providers in an industry standard format and protocol. Actively managing energy consumption can provide value for customers if coupled with rate design that encourages off-peak energy use. This also promotes operational efficiencies of an interconnected grid, enabling growth in customer- owned renewable generation and electric vehicle charging.

Customer value is also created through environmental benefits related to the integration of distributed energy resources, such as solar power generation, electric vehicles, and demand response. Carbon dioxide equivalent (CO_2e) and particulate emissions associated with conventional generation can be displaced with distributed renewable energy resources, or otherwise avoided through the reliable integration of clean power sources and the use of these sources as a clean transportation fuel.

2 *SMART GRID DEPLOYMENT PLAN* UPDATE

2.1 CHANGES TO THE DEPLOYMENT PLAN RESULTING FROM REGULATORY ACTION OR LEGISLATION

As Smart Grid deployment continues at its rapid pace in the San Diego region, changes in external requirements inevitably mean changes to SDG&E's deployment plan. Table 1 discusses those changes resulting from CPUC or other regulatory action or due to developments in state or federal legislation.

Changes reported in previous *Annual Reports* are not repeated here; readers should refer to those earlier reports for that information. SDG&E's previous *Annual Reports* can be retrieved from http://www.sdge.com/smart-grid-deployment-plan.

Table 1: Changes to SDG&E's *SGDP* from Regulatory Action or Legislation

Project	Change from Original *SGDP*	Reason for Change
The California Energy Systems for the 21st Century collaboration (CES-21)	Added Project	CPUC Decision D.12-12-031 authorized funding for the CES-21 project. Refer to section 2.3 for additional information.

2.2 CHANGES TO SDG&E'S DEPLOYMENT PLAN RESULTING FROM IOU INITIATIVES

Other changes to the *Smart Grid Deployment Plan* are due to new information or understanding of issues, solutions, and market and technology developments, leading to the following changes listed in Table 2:

Table 2: Changes to SDG&E's *SGDP* from Utility Initiatives

Project	Change from Original *SGDP*	Reason for Change
"DERMS" > Integrated DER	Added Project	The urgency to develop the capability to

Project	Change from Original *SGDP*	Reason for Change
Management & Control Systems		communicate, sense, and control distributed grid assets - both customer and utility owned - continues to increase. Previously deferred, this project is now underway.
Smart Meter Operations Center	Added Project	Full deployment of Smart Meters to SDG&E customers and the corresponding increase of events and alarms generated by Smart Meter systems.
Distribution Interconnection Information System (DIIS)	Added Project	Process automation for the quickly growing number of distributed generation interconnection applications.
Solar Power Prediction	Added Project	The quickly growing number of distributed solar energy systems in SDG&E's service area has triggered the need for better tools that can help forecast production from those systems.
Microgrid Community Hardening	Removed Project	Research into the costs and benefits of this project did not demonstrate it would be cost-effective at this time.

2.3 PROJECT UPDATES

2.3.1 PROJECT COSTS

During the Reporting Period, SDG&E estimated expenditures of $144 million breakdown in the areas listed in Table 3:

Table 3: Estimated Smart Grid Deployment Costs for the Reporting Period

Estimated Spend During the Reporting Period Amounts in Thousands of USD	Reporting Period Value	
Customer Empowerment and Engagement	$	54,443
Distribution Automation and Reliability	$	36,676
Transmission Automation and Reliability	$	5,865
Asset Management, Safety and Operational Efficiency	$	25,142
Security	$	12,825
Integrated and Cross-Cutting Systems	$	9,115
Total Estimated Costs	**$**	**144,065**

Expenditures are estimated and based on total spend, including operations and maintenance (O&M) and capital, excluding Allowance for Funds During Construction (AFUDC), Contribution in Aid of Construction (CAIC) and net of grant-based reimbursements from the California Energy Commission (CEC) and DOE.

2.3.2 ESTIMATED BENEFITS

SDG&E continued using the same comprehensive methodology adopted for its *Smart Grid Deployment Plan* to calculate the estimated benefits for the *Annual Report*. This methodology follows a three step process, described in Figure 6.

Figure 6: Estimated Benefits Calculation Process

The framework of this methodology is primarily based on the benefits evaluation model that the Electric Power Research Institute included in the report titled "Methodological Approach for Estimating the Benefits and Costs of Smart Grid Demonstration Projects."[10] SDG&E's methodology includes estimates of economic benefits, reliability benefits based on a Value-of-Service Reliability model developed by the Lawrence Berkeley National Laboratory[11], and environmental and societal benefits based on a model developed by SDG&E in collaboration with the Environmental Defense Fund[12].

When evaluating the benefits of Smart Grid projects, it is important to consider that some of the estimated benefits would be constant and achieved at a normalized rate period over period. This type of benefits includes items such as permanent operational expenses avoided due to the implementation of Smart Grid technologies. However, some other estimated benefits would be cyclical in nature and will not be realized in most cases at a normalized rate period over period.

As with any utility and technology investments, estimated benefits are expected to be realized over the life of the investment, which in nearly all cases is long beyond the time period in which costs are incurred. For example, a particular investment may drive cost for three years, but provide benefits for as long as the asset is useful, which could be 10 years, 15 years, or even longer. Therefore, it is inappropriate to compare estimated benefits to cost incurred during the Reporting Period due to these time differences. However, some Smart Grid projects with phased implementations such as Smart Meters or CBM may also accrue benefits during the course of project implementation.

Another aspect to consider when evaluating benefits is that many Smart Grid projects are done to meet requirements and/or energy policy goals, and while the specific solutions chosen to meet those goals will be the least-cost, best-fit response to a particular need, the quantifiable benefits may not always exceed the costs for an individual project.

Economic benefits are primarily reduced and avoided costs of utility operations. Reliability benefits estimate the societal value of avoided outages for customers among residential, commercial, and industrial classes. Environmental benefits estimate a value of avoided greenhouse gas and particulate emissions, while societal benefits include other costs avoided by customers, such as the avoided cost of gasoline for transportation fuel when electric vehicles are used as alternatives.

[10] Final Report No. 1020342, "Methodological Approach for Estimating the Benefits and Costs of Smart Grid Demonstration Projects", January 2010.
[11] Final Report No. LBNL-2132E, "Estimated Value of Service Reliability for Electric Utility Customers in the United States", June 2009.
[12] For further details on the methodology for environmental and societal benefits see http://docs.cpuc.ca.gov/PublishedDocs/EFILE/RESP/140924.PDF.

During the Reporting Period, SDG&E continued to realize benefits from previously completed projects plus several new projects that were completed during the Reporting Period. These projects generated benefits not only for SDG&E's operations but also for its customers, the environment, and society in general. Table 4 provides a summary of the estimated benefits identified during the Reporting Period:

Table 4: Estimated Smart Grid Benefits in the Reporting Period[13]

Estimated Benefits During the Reporting Period Amounts in Thousands of USD		Reporting Period Value
Economic Benefits	$	22,970
Reliability Benefits	$	6,301
Environmental Benefits	$	2,882
Societal Benefits	$	1,443
Total Estimated Benefits	**$**	**33,596**

SDG&E's mass deployment of Smart Meters continued providing benefits during the Reporting Period. The Smart Meter program has achieved relevant reduction and avoidance of operating expenses due to the elimination of a significant portion of meter reading activities and customer services field activities. In addition, the avoided truck rolls due to reduction of meter reading and customer services field activities remained at normalized levels compared to previous period continuing providing environmental benefits to the region. The Smart Meter program also facilitated the implementation of Reduce Your Use, a Smart Grid Demand Response program. Beginning in 2013, Reduce Your Use was only available to residential customers with incentive amounts and event triggers. There were seven Reduce Your Use events called during the Reporting Period. The primary overall finding is that, on average, only customers who opted to receive electronic notifications, or alerts, of these peak-time rebate events reduced their electricity usage during Reduce Your Use event hours by approximately 5.0 to 8.5% of their reference load, which translated into avoided capacity.

The deployment of projects under the Asset Management, Safety and Operational Efficiency program also generated economic and reliability benefits in addition to the existing projects in place during the Reporting Period. Two key projects put in service during the Reporting Period were Geospatial Information System (GIS) and Outage Management System/Distribution Management System (OMS/DMS). Despite the short duration in service of OMS/DMS during the Reporting Period, the project generated benefits improving the reliability for customers. Existing projects also generated

[13] Environmental benefits calculated based on prices from a report prepared by the California Environmental Protection Agency, *Updated Economic Analysis of California's Climate Change Scoping Plan*, March 24, 2010 and SDG&E's internal forecasts.

some cyclical benefits. For example, the CBM project, by monitoring the real time condition of transformer health, was able to prevent catastrophic failures thus avoiding replacement of distribution and transmission infrastructure.

During the Reporting Period several projects in the area of Distribution Automation and Reliability were completed providing benefits to customers, markets, and the utility. Customers benefit from the reduction in outage time experience since devices can be controlled without the requirement of sending field personnel to switch devices. Markets benefit by quickly restoring service and connection to the grid, which allows third parties to continue to provide grid services. Lastly, the utility benefits since they can avoid sending personnel in the field and incurring operational expenses and improved customer satisfaction. Notable projects that generated these types of benefits were the Borrego Springs Microgrid Demonstration Project ("Borrego Springs Microgrid") and SCADA expansion both increase the use of distribution automation to the grid and improved reliability.

SDG&E also identified environmental benefits during the Reporting Period related to the integration of renewable energy generation resources, both centralized and distributed, which are primarily solar power generation. These environmental benefits include an estimation of the avoided emissions reduction associated with displacing conventional generation with distributed renewable energy resources and the integration of centralized renewable energy for compliance with RPS[14]. The avoided emissions reduction for distributed resources is based on the energy load forecast included in the recent California Energy Demand 2012-2022 Forecast prepared by the CEC[15] for solar systems in SDG&E's service territory. In addition, the implementation of the Distribution Interconnection Information System (DIIS) achieved significant improvements in the process for approving roof top solar interconnections. Customers experienced a reduction in the timing on this process. The integration of 5,400 electric vehicles into SDG&E's electric grid (including more than 1,330 registered neighborhood electric vehicles) also generated additional benefits to the environment and the community. SDG&E estimated that the light-duty electric vehicles integrated into the system during the Reporting Period avoided the consumption of approximately 750,000 gallons of gasoline. This translates into a positive environmental impact to the region by reducing net emissions, the difference between those of liquid fuels and electricity generation. In addition, electric vehicle owners also benefited from the avoided fuel cost of the gallons of liquid fuels displaced.

[14] Estimated benefits based on the assumption that the system can accommodate a 20% RPS without Smart Grid technologies.

[15] Form 1.2 – Net Energy Load of the California Energy Demand 2012-2022 Staff Final Forecast – Low Demand Case for SDG&E Planning Area, http://www.energy.ca.gov/2012_energypolicy/documents/2012-02-23_workshop/low_case/.

2.3.3 PROJECT SUMMARIES AND UPDATES BY PROGRAM AREA

Estimated project costs for the Reporting Period are shown in nominal thousands of dollars.

2.3.3.1 CUSTOMER EMPOWERMENT/ENGAGEMENT

Customer Empowerment/Engagement projects provide customers with readily accessible and reliable information regarding their energy usage. Additionally, projects in this area should help customers gain a better understanding of their energy consumption among their common uses. To further empower customers, price signals must flow to them in a timely and meaningful manner and be integrated into customer energy management and HAN systems.

Generally, projects in this area implement information systems, communication infrastructure, and energy management services along with customer-facing tools, services, and outreach capabilities. Projects included also enable customer-authorized third parties to disseminate important information and educate customers, recognizing that customers often value other sources of information.

Recognizing that smart phone, social media, and tablet usage are increasing among many of the utility's customers, SDG&E must provide the appropriate tools and applications to allow customers to access energy usage data and perhaps other utility provided information. Projects are designed to meet customers' new communications preferences and expectations, and to offer tools that provide customers with relevant information, such as price signals, that result in greater customer awareness of energy impacts. Deploying tools and applications that present valuable customer-specific energy data is a critical component to empowering customers.

Projects that deliver information, services, and control sought by customers and that enable demand response, dissemination of dynamic pricing information, and HAN capabilities are included in this category. Projects included provide customers with transparent and relevant price signals and enable utility and non-utility service providers to offer products and services that provide customer value.

COMPLETED PROJECTS

Project 1: Smart Meters	
Funding Source: Smart Meter Decision (D.12-04-019) **Project Timeframe: 4/2007 to 12/2015**[16]	Reporting Period Estimated Costs: $33,344
Description: The SDG&E Smart Meter project was approved by the CPUC in D.07-04-043 in April 2007. Smart electric meters are solid state, digital devices that record energy usage data and, unlike traditional meters, transmit and receive data. Smart Meters record hourly electric consumption for residential customers and 15-minute consumption for commercial customers. Daily consumption is recorded for natural gas usage.	
Update: As of June 30, 2013, SDG&E's current population of Smart Meters is approximately 2,275,000 endpoints in the service territory. The number of endpoints being billed from Smart Meter reads is approximately 2,272,000 (more than 99.8% of the available endpoints). The number of Smart Meters remaining to be deployed is approximately 7,500, not including meters of customers whom have elected to opt-out of wireless Smart Meters. Smart Meter has continued to realize its business case benefits and incorporated these operating benefits as reductions in the recent 2012 GRC. Operational benefits include meter reading reductions, customer service field reductions, reduced customer outage calls, automated outage analysis, crew deployment improvements, emergency and planned switching support, advanced metering operations reduced maintenance, reduction in fleet vehicles, and billing area benefits. SDG&E received the opt-out final decision (Phase I) on April 19, 2012 (D.12-04-019). This decision established the alternative solution and fees for residential customers until a final decision on cost and cost allocation gets established via the opt-out Phase II regulatory proceeding. As of June 30, 2013, there are 1,953 residential customers who have selected this option. The proposed decision for Phase 2 is still pending.	

[16] While the Smart Meter project is materially complete, D.11-03-042 (March 2011) approves SDG&E's Petition for Modification of D.07-04-043 (approving SDG&E's Smart Meter deployment) to allow project costs to be recorded in the Advanced Metering Infrastructure Balancing Account (AMIBA) until such time as deployment of its AMI system is fully complete. SDG&E anticipates that meter installations of final hard-to-reach and commercial/industrial customers will occur in 2013.

IN-PROGRESS PROJECTS

Project 2: Connected…to the Sun	
Funding Source: Application (A.12-01-008) **Project Timeframe: Upon approval**	Reporting Period Estimated Costs: <$100

Description: In January 2012, SDG&E filed an application with the CPUC for a pilot program called "*Connected…..to the Sun*," which will give all SDG&E customers two options to buy solar power, even if they do not own a home, cannot afford the upfront cost of solar, or do not have the ability to put PV panels on their roof. Customers could lock in their solar energy cost and take solar service with them if they relocate within SDG&E's service area. A brief overview of the two solar options are as follows:

1. *Share the Sun*
    a. Solar provider constructs projects in San Diego for purchase by SDG&E customers
    b. Customers purchase energy rights from a participating solar provider
    c. Customers receive solar energy and a credit on their monthly bill from SDG&E
2. SunRate℠
    a. SDG&E sets aside local solar projects under contract for customers
    b. Customers can subscribe to pay the SunRate price for 50%, 75%, or 100% of their electricity use
    c. Customers receive solar energy from SDG&E

Update: SDG&E and the CPUC held workshops with stakeholders and regulatory parties in San Francisco and San Diego in Q1 2013. The CPUC scheduled a new pre-hearing conference for Sept. 25, 2013. The project is awaiting pending legislation (SB 43), which, if approved, would mandate the California IOUs to offer a green tariff program.

Project 3: Green Button Connect My Data	
Funding Source: GRC **Project Timeframe: Ongoing**	Reporting Period Estimated Costs: $1,127

Description: Energy Services Provider Interface (ESPI – CEN Phase 3a) - Green Button Connect My Data is the automated sending of Green Button data to third parties (per customer request/consent) via a standard interface (NAESB/ESPI). Customers' data will be sent using one of two models: One and done (one-time data transmission of up to 13 months of customer

Project 3: Green Button Connect My Data	
consumption depending on customer data availability) and Ongoing (customer data to be transmitted on an ongoing basis as long as customer is enrolled with third party).	
Update: As of June 30, 2013, there are a total of six tools available for customers to authorize sharing of energy usage data via automation, of which four are for residential-use and two are for commercial and industrial use.	

Project 4: Smart Grid Demand Response Programs	
Funding Source: Application (A.11-03-002) **Project Timeframe: 1/2012 – 12/2014**	Reporting Period Estimated Costs: $649
Description: Smart Grid related demand response programs are a subset of the programs included in SDG&E's demand response application (A.11-03-002) filed on March 1, 2011. Specifically, these include SDG&E's Reduce Your Use program (referred to as 'Peak Time Rebate' [PTR] in A.11-03-002) and new construction programs (NCDRP).	
Update: On April 19, 2012, the CPUC issued decision (D.)12-04-045 adopting demand response activities and budgets for all three IOUs for 2012-2014 and in this decision SDG&E was granted an overall budget of ~$65.8 million. For the programs specifically designated as Smart Grid (PTR and NCDRP), SDG&E received ~$11.1 million. Beginning in 2013, Reduce Your Use was only available to residential customers with incentive amounts unchanged and event triggers unchanged. There were seven Reduce Your Use events called during the Reporting Period. The primary overall finding is that, on average, only customers who opted to receive electronic notifications, or alerts, of events reduced their electricity usage during Reduce Your Use event hours by approximately 5.0 to 8.5% of their reference load. NCDRP has been delayed but intends on evaluating one or two projects each from residential and/or commercial by the end of 2014.	

Project 5: Electric Vehicle (Clean Transportation) Education and Outreach	
Funding Source: GRC **Project Timeframe: Ongoing requirement, per the CPUC[17]**	Reporting Period Estimated Costs: $612
Description: The objective of this project is to provide educational outreach to all customers and electric transportation stakeholders through various means (printed and digital/online collateral, website, web tools, call center, utility-hosted seminars), at SDG&E's Energy Innovation Center, community events, in-person meetings, and training on the following topics: 1) Rates, metering, and billing analysis (service choices), 2) Safety and reliability, 3) Line extension rules, 4) Basic information about PEVs, information resources, PEV supply equipment, and support services, and 5) Environmental and financial benefits (AB32, off-peak charging). In addition to addressing the information needs of SDG&E customers and various PEV stakeholders, the overarching outcome of these education and outreach efforts (as well as the projects listed below) leads to broader PEV market developmental and support.	
Update: SDG&E participated in numerous outreach events and completed an online EV Rate Education Campaign which has contributed to a high rate of EV adoption. Highlights include: • Nominated the City of San Diego for the Governor's Economic & Environmental Leadership Award for their coordination with SDG&E on various EV efforts and won over numerous cities. • Signed a partnership with the U.S. DOE committing to be leaders in workplace EV charging and continues to make good on that commitment by educating business customers about the utility's one-of-a-kind innovative workplace charging solutions for employees and fleet.. • Smart City San Diego agreed to a third year of focusing their efforts increasing EV adoption. • Held workshops for multi-family property managers and employers interested in workplace charging; and a 4th Fleet Roundtable for fleet customers wanting to electrify their fleets.	

[17] D.11-07-029

Project 6: HAN Projects • **DRCA (Demand Response Control Application)** • **Reduce Your Use In-home Display (IHD) Pilot** • **DRCA/HAN Pilot & Study** • **DR (Demand Response) Signaling**	
Funding Source: GRC **Project Timeframes: 8/2010 and ongoing**	Reporting Period Estimated Costs: $868
Description: **DRCA Phase 1**: The first phase implementation of a HAN Demand Response Control Application (HAN DRCA) will achieve the functionality required by resolution (R.)E-4527 and will allow customers to provision a HAN device to their Smart Meter. **Reduce Your Use IHD Pilot**: The objective of this pilot is to study the impact of customer energy savings during Reduce Your Use events when provided with an IHD. **DRCA/HAN Pilot & Study**: The objective of this project was to implement a back-office system (DRCA) to manage and control HAN devices, study the HAN technology and customer's response to the technology. **Demand Response Signaling**: Provide an interim solution to send demand response signals to ZigBee enabled thermostats connected to Smart Meters in support of the demand response programs deploying thermostats.	
Updates: **DRCA Phase 1**: This project went live on Nov. 5, 2012 allowing provisioning, de-provisioning and reporting capabilities on HAN devices. This project also included publishing of the HAN website (www.sdge.com/han), allowing customers to request HAN device connections to their meter. **Reduce Your Use IHD Pilot**: A total of 650 customers were provided with an IHD at no cost. These customers received alerts on seven Reduce Your Use event days asking them to save energy. Final results indicate that customers with an IHD saved 6-8% on Reduce Your Use days, more than twice as much as customers without an IHD. **DRCA/HAN Pilot & Study**: A total of 715 customers were enrolled and had varying HAN devices installed in their home. A complete process evaluation was completed and posted on the California Measurement Advisory Council (CALMAC) website. The Pilot officially concluded on Nov. 30, 2012. **Demand Response Signaling**: As of June 2013, an interim solution is available to send demand response signals to ZigBee enabled thermostats connected to Smart Meters.	

Project 7: Smart Pricing Program (Dynamic Pricing)	
Funding Source: Application (A.10-07-009) **Project Timeframe: 9/2010 to 12/2015**	Reporting Period Estimated Costs: $17,580

Description: SDG&E's smart pricing program was proposed via application A.10-07-009 filed on July 6, 2010 and modified as described in the Joint Party Settlement Agreement filed on June 20, 2011. The application and Settlement Agreement describe SDG&E's plans to implement TOU and dynamic rates for residential and small business customers, along with the system upgrades and customer outreach and education efforts necessary to successfully transition SDG&E's electric customers to smart pricing. On Dec. 12, 2012, the CPUC adopted D.12-12-004 approving TOU and dynamic rates for SDG&E's residential and small business customers.

Update:

Technology: Implemented key pieces of functionality during the Reporting Period, including the ability to send marketing campaigns to customers, an online tool for customers to receive an estimate of the benefits from installing a solar energy system, and an online tool for residential and business customers to receive information on their energy consumption, set savings goals, and create an action plan for their future energy saving needs.

Customer Outreach and Education: The Customer Outreach and Education plan was filed by advice letter 2466-E-A with the CPUC and approved on September 19, 2013. The first quarterly interested parties briefing was also held where parties provided feedback on the draft Outreach and Education Plan and on performance metrics.

Pilot: Approximately 25,000 residential and commercial customers received a weekly email notification containing daily electric usage and gas energy usage information, and charts showing the rising usage from tier 1-4, over a five-month period. This information is delivered weekly to those customers who elected to receive the email on an ongoing basis.

Program rollout is expected to occur by next Reporting Period.

Project 8: PEV Rate Experiment (Study)	
Funding Source: GRC **Project Timeframe: 10/2010 to 9/2014**	Reporting Period Estimated Costs: $252

Description: The objective of this project is to examine PEV consumer TOU charging preferences, the use of smart-charging enabling technology, and other relevant factors through a study that includes the use of CPUC approved experimental PEV rates[18]. SDG&E is conducting this research in collaboration with ECOtality's EV Project and Nissan during the introduction of the Leaf PEV to the greater San Diego region, which began in December 2010. This study will examine the price elasticity of demand for electricity by time-of-day among PEV vehicle consumers as an indicator of the sensitivity of electricity demanded to its change in price.

Update: With more than 400 study participants since January 2011 through June 2013, the following are the interim observations:

- Separately metered EV customers with TOU rates charge their vehicles at off-peak times, with over 90% of the kWh consumption occurring at times other than noon to 8 p.m.
- It appears that the group of customers assigned the rate with a 1 to 2 ratio of super off-peak price to on-peak price tends to charge the EV more on-peak and off-peak when compared to the two other rate groups with a larger ratios (1 to 4, and 1 to 6 ratios with higher on-peak pricing)
- Use of on-board PEV technology and the electric vehicle supply equipment technology (to set charging start and stop times) helped enable super off-peak charging (80% of the kWh used for charging were consumed between midnight to 5 a.m.)

PEV residential charging routines take about five months to mature to a steady state, while monthly consumption during the same time increases to more than 240 kWh per month – reflecting increased use of the PEV and increased customer confidence in using the EV for daily driving needs.

[18] For information on the temporary experimental PEV rates EPEV-X, EPEV-Y and EPEV-Z see http://www.sdge.com/electric-tariff-book-residential-rates.

Project 9: Centralized Calculation Engine	
Funding Source: GRC **Project Timeframe:**	Reporting Period Estimated Costs: $0
Description: The development of a centralized calculation engine which will take data passed in from multiple data sources and provide price and cost calculations as output. The calculation engine will be flexible and all comprehensive rate, price, and cost modeling, as well as the ability to manipulate curved, types of charges (consumption, demand, fixed, etc.) peak moves, event hour shifts, and more. It will ensure consistency of calculations and output across many operations and users.	
Update: In initial project planning stage with intention to develop and release an RFP for further evaluation.	

PROPOSED / PLANNED PROJECTS

Project 10: Vehicle to Home (V2H) Pilot	
Funding Source: GRC **Project Timeframe: 1/2012 and Ongoing**	Reporting Period Estimated Costs: $0
Description: There is ongoing activity to track the progress and findings of the Vehicle-to-Home pilot sponsored by Nissan in Japan to determine if a parallel pilot should be conducted in SDG&E's service territory. Although frequency and voltage characteristics of the utilities between the two countries are different, the applications introduced by Nissan and others are being evaluated for U.S. application and potentially limited testing. The investigation of the safety features of the applications is paramount. For example, understanding the safety precautions embodied in the application in islanding and re-closing of the circuits of the home from the utility grid can be safely accommodated during a period of outage or a planned interruption of service.	
Update: This project is to stay abreast of the progress reported by Nissan in their pilot effort in Japan. SDG&E also remains active in industry forums investigating the safety features incorporated into electronics necessary to island the home from the utility grid to assess	

Project 10: Vehicle to Home (V2H) Pilot	
adaptability to SDG&E's system and forthcoming outcome of IEEE 1547.8 standards (e.g., automation of the disconnect and re-connect functionality under Rule 21).	

Project 11: Smart Meter Operations Center	
Funding Source: GRC **Project Timeframe: 5/2013 to 2/2014**	Reporting Period Estimated Costs: $0
Description: The Smart Meter operations center, network monitoring, and visualization project will provide the tools to determine system status and availability of network devices (meter endpoints). The Smart Meter network monitoring and visualization project is proposed as a precursor to a separately proposed, larger effort for applied data analytics, exception management, asset management, and predictive modeling.	
Update: The project plan was developed as a result of an extensive effort comprised of product analysis, strategies, and collaboration with utilities across the U.S. and Canada that are also involved in Smart Meter deployment and technology improvements. Based on these collaborations, system architecture and a formal business case were created for the network monitoring and visualization phase of the Smart Meter Operations Center project.	

ENTERPRISE PROJECTS

Project 12: Digital Roadmap • **SDGE.com Website** • **Mobile Applications (iPhone, iPad and Android)** • **eServices/My Account**	
Funding Source: GRC **Project Timeframe: Ongoing**	
Description: The digital roadmap provides for six initiatives that supply customers with greater	

Project 12: Digital Roadmap • **SDGE.com Website** • **Mobile Applications (iPhone, iPad and Android)** • **eServices/My Account**	
accessibility to information and easier navigation for more effective communications and time savings in addressing customer energy-related information needs: (a) Re-architecting My Account website; (b) eServices; (c) digital research; (d) including social media into two-way communications; (e) digital advertising; and (f) mobile applications.	
Update: **SDGE.com Website:** The project team focused on a content strategy, which allows users to easily find content they are looking for. Additionally, customers will be able to self-serve on the website, including start/stop service, payment arrangements, and more. It also includes a feature called Live Chat, which allows customers to chat via text/computer instead of calling, and the Contact Us form, which gives customers a number of options, including online chat, phone, and web. **Social Media:** Engagement on social media was high during the Reporting Period with more than 90 mentions a day across Twitter, Facebook, and Pinterest in the first quarter. Twitter has been the most active channel with 70% of SDG&E's online interactions. SDG&E has more than 18,000 Twitter followers and recently won an award from PRNews for the Social Media Icon Award for response to the Sept. 8, 2011 outage.[19] **Mobile Application (iPhone/iPad/Android):** A new update will allow customers to proactively notify SDG&E of service outages at their location. Future enhancements for mobile development could include: access to energy usage information, energy conservation tools, alerts/notifications, and posts of SDG&E employment opportunities. **eServices/My Account:** A planned project to redesign My Account to ensure compliance with web accessibility standards and introduce a framework for personalization conceived as tailored treatments. Through this redesign, the goal is to align My Account with SDG&E's brand, implement responsive design, and find opportunities for improving content management.	

[19] http://www.prnewsonline.com/free/2013/04/17/2013-social-media-icon-awards-crisis-management-campaign/.

Project 13: Community and Stakeholder Engagement • **Energy Innovation Center (EIC)** • **County Fire Network Services (ASAPnet)** • **Smart City San Diego** • **Pecan Street Inc.** • **US-Russia Presidential Bi-lateral Commission on Energy**	
Funding Source: Various **Project Timeframe: Ongoing**	

Description: SDG&E's community and stakeholder engagement effort is intended to provide campaign-level coordination in the utility's engagement effort and ensure that the overarching connections between programmatic outreach and education efforts are present. Encompassed in this effort is a wide variety of stakeholder-focused efforts, all significantly associated with Smart Grid and specifically SDG&E's Smart Grid efforts. SDG&E has actively worked with business association and residential groups to educate them on the changing landscape of the energy industry. After the Smart Meter deployment education effort, SDG&E recognized the need to continue community and business outreach on energy issues. SDG&E is working hard to ensure its stakeholders – in particular, customers – look to SDG&E as a trusted energy advisor.

Update: **Energy Innovation Center (EIC):** The Energy Innovation Center opened in January 2012 with the mission to help San Diego achieve its energy efficiency (EE) potential. The mission includes educating businesses and residents, encouraging the adoption of EE technologies and training San Diego's workforce to install, operate, and maintain EE projects.

County Fire Network Services (ASAPnet): The County Fire Network Services effort involves provisioning new broadband network links to 60 fire stations in the county. This is a collaborative effort among San Diego County, the San Diego County Fire Authority, CalFire, and other agencies to improve those agencies' access to Internet and other data sources that contribute to the region's overall fire preparedness.[20]

Smart City San Diego: Smart City San Diego is a bold, multi-year collaboration combining the resources of the city of San Diego, SDG&E, GE Digital Energy, UCSD, and CleanTECH San Diego. Together, these leading organizations from government, business, education, and nonprofit

[20] http://www.10news.com/news/new-public-safety-network-to-communicate-fire-information-in-san-diego-county-activated.

Project 12: Digital Roadmap • **SDGE.com Website** • **Mobile Applications (iPhone, iPad and Android)** • **eServices/My Account**	

sectors are maximizing synergies to drive existing energy programs forward, identify new opportunities, embrace additional collaborators, and move the San Diego region beyond today's boundaries of sustainability.[21]

Pecan Street Inc.: In the first half of 2013, SDG&E joined the Pecan Street Inc. research consortium. [22] Headquartered at The University of Texas at Austin, Pecan Street Inc. is a research and development organization focused on developing and testing advanced technology, business models and customer behavior surrounding advanced energy management systems. Pecan Street Inc. will be working on research surrounding the new integrated community Civita.[23]

U.S.-Russia Presidential Bi-lateral Commission on Energy: The purpose of this commission is to collaborate on the development of programs to advance EE and joint development and integration of cutting edge technology. SDG&E hosted its Russian counterparts in April 2012. As a result of these meetings, SDG&E and MRSK Center agreed to a new action plan for collaboration.[24]

2.3.3.2 DISTRIBUTION AUTOMATION AND RELIABILITY

Distribution Automation/Reliability (DAR) includes projects which improve SDG&E's information and control capabilities for distribution systems. These capabilities may be used to address the complexities associated with integrating distributed energy resources and electric vehicles, advanced outage management, and/or volt/VAr control. DAR will provide the ability to safely and reliably incorporate high penetrations of distributed energy resources by mitigating voltage fluctuations resulting from intermittent power generation. DAR projects will also provide the ability to safely and reliably incorporate the increasing load of charging EVs. The incremental customer load from EV charging is expected to be clustered in specific distribution circuits of the power grid that are not

[21] http://smartcitysd.org/.
[22] http://www.pecanstreet.org/.
[23] http://online.wsj.com/article/PR-CO-20130820-908906.html.
[24] http://www.whitehouse.gov/the_press_office/FACT-SHEET-US-Russia-Bilateral-Presidential-Commission.

currently designed to manage high levels of EV penetration, especially if significant charging activity takes place during periods of higher demand. DAR will detect and isolate faults when they occur, immediately restore service to customers, and provide information about outages in real-time. Self-healing circuits will reduce the number of customers affected by sustained system disturbances and will enable faster service restoration. DAR will also provide optimization of voltage and reactive power on the system to enhance power quality and decrease energy consumption, including system losses.

DAR helps enable electricity markets to flourish and helps deliver a Smart Grid that has the infrastructure and policies necessary to enable and support the integration of demand response, energy efficiency, distributed generation, and energy storage into energy markets.

COMPLETED PROJECTS (NONE)

IN-PROGRESS PROJECTS

Project 14: Advanced Energy Storage (AES) – Distribution	
Funding Source: GRC **Project Timeframe: 10/2011 and ongoing**	Reporting Period Estimated Costs: $11,208
Description: The objective of this project is to install advanced energy storage projects that will mitigate the impact of intermittent renewables and provide SDG&E with experience developing, implementing, and operating new energy storage technologies. The scope will include developing utility scale (300 kW+) energy storage units at substations and other locations, and distributed energy storage systems (DESS - typically 25 to 50 kW) on distribution feeders. DESS are also known as Community Energy Storage (CES) systems.	
Update: During this period, the AES project installed one 500 kW/1500 kWh system designed to mitigate the intermittency of an upcoming photovoltaic installation. Additionally, the project installed six community energy storage units, totaling 200 kW/423 kWh, at various locations around the service territory. Throughout the Reporting Period, demonstrations of a 500 kW/1500 kWh microgrid connected battery, part of the CEC/DOE sponsored Borrego Springs Microgrid project, were ongoing. SDG&E has also contracted with several firms for five new systems totaling more than 5 MW/14 MWh to be installed through the end of 2013 and into 2014. These systems will be used for renewable resource intermittency mitigation, peak shaving, overload mitigation, reactive power dispatch, and islanding, in support of microgrids, as well as other benefits depending upon size, location, and the conditions of the circuits to which they are connected.	

Project 15: Dynamic Line Ratings – Distribution	
Funding Source: GRC **Project Timeframe: 9/2012 and ongoing**	Reporting Period Estimated Costs: $140
Description: This project installs sensors on distribution lines to monitor tension and temperature conditions in order to develop real time dynamic conductor ratings. With this technology as part of a portfolio of projects, increased amounts of renewable generation may be integrated into the grid.	
Update: During the Reporting Period, three dynamic line rating devices have been evaluated. Two field monitoring sites were selected and designed.	

Project 16: Dynamic Voltage Control	
Funding Source: GRC **Project Timeframe: 12/2011 and Ongoing**	Reporting Period Estimated Costs: $1,805
Description: The objective of this project is to perform an engineering study of a circuit with 40+% PV generation to determine the impact of voltage compensating equipment. This project will also install voltage compensating equipment, monitor circuit performance, and assess the impact of voltage compensating equipment. Two types of installation will occur, a 240 kVAR installation for distributed dispatch and a 2 MVAR installation for a more concentrated approach.	
Update: The 240 kVAR and 2 MVAR installations were completed during the Reporting Period. SDG&E is testing the equipment and gathering data at the units and at PV installations on the feeder using power quality meters. SDG&E engineers are evaluating the results to determine how effectively these units maintain the voltage around predetermined set points. Preliminary results indicate the units are providing a smoother voltage profile within the required operating limits.	

Project 17: Borrego Springs Microgrid Demonstration	
Funding Source: DOE, CEC and GRC **Project Timeframe: 2009 to 10/2013**	Reporting Period Estimated Costs: $4,303

Description: The objective of this project is to establish a microgrid demonstration at an existing substation to prove the effectiveness of integrating multiple Distributed Energy Resources (DER) technologies, energy storage, feeder automation system technologies, and Outage Management System (OMS) with advanced controls and communication systems, for the purposes of improving reliability and affecting feeder/substation capacity in normal and outage/event conditions. This project is being performed in partnership with the DOE and CEC.

Update: During the Reporting Period, the project team completed a number of activities:

- Utilized microgrid resources to provide power to 2,128 customers for 5.5 hours during a planned outage
- Conducted initial demonstration activities for SES
- Conducted coordinated remote demonstrations (generators, SES, and demand response) utilizing Microgrid Visualizer
- Conducted site acceptance test of PDLM software and initial demand response events
- Conducted nine successful island demonstrations of the entire microgrid circuit across three separate days
- Conducted multiple optimized peak shave demonstrations
- Transitioned from event-based demand response events to price-based events
- Utilized microgrid resources to provide power for as many as 1,225 customers for six hours during a weather-related outage

Project 18: Phasor Measurement Units (PMU) – Distribution	
Funding Source: GRC **Project Timeframe: 6/2012 and ongoing**	Reporting Period Estimated Costs: $1,861

Description: The project is installing synchrophasor equipment (Phasor Measurement Units, or PMU) at key locations to enhance the safety, efficiency, operability, and reliability of the distribution system. PMUs are advanced grid monitoring technologies that rely on high speed, time-synchronized, analog, and digital measurements. Phasor measurement technologies are needed for understanding potential problems with the grid and are a key component of a

Project 18: Phasor Measurement Units (PMU) – Distribution	
tightly controlled, stable, self-healing grid. Specific benefits: • Mitigating negative effects of distributed renewables (PV/Wind) • Monitoring and visualization for operations and engineering • Improved distribution system control and protection • Power system restoration	
Update: This project performed a multitude of activities during the Reporting Period including: • Testing • Procurement of material communication solution • Defined 15 PMU target circuits with six back-up • Received patent application initial approval: Falling conductor: patent application number 13/952,433	

Project 19: Sustainable Community Programs	
Funding Source: GRC **Project Timeframe: Ongoing**	Reporting Period Estimated Costs: $2,031
Description: This is a set of projects to test distributed energy resources -- such as solar PV, fuel cells, and energy storage -- and demand response-enabling technologies.. These projects focus on reducing energy demand and integrating clean energy systems while encouraging sustainably designed buildings and communities. These projects are designed to support the development of clean distributed generation systems integrated into the electric distribution system and to provide other benefits.	
Update: **Civita:** The team has developed a conceptual design for a microgrid at an apartment building, which will include fuel cells, solar PV, and battery energy storage (all utility-owned). The DER will support some of the customer's priority load in the apartment building in the event of a grid outage. Project completion is targeted for Q3 2014. Contract negotiations with the developer are expected to be finalized by the end of 2013. **Del Lago Academy:** The project consists of a 170 kW PV system and an integrated 100 kW/200 kWh Advanced Energy Storage System. The PV system has been installed. The project is expected to be completed by the end of 2014, pending delivery of the battery.	

Project 19: Sustainable Community Programs	
Del Lago Park N Ride: The project consists of a 13 kW PV carport, 4 Level 2 EV charging stations, one Fast DC EV charging station, and the infrastructure for a 100 kW/200 kWh Advanced Energy Storage System. Design was completed and submitted to Caltrans. **The Suites at Paseo:** The project consists of a 37 kW PV system and an integrated 18 kW/32 kWh Advanced Energy Storage System. The system was energized on June 20, 2013. **Agua Hedionda Nature Center:** The project scope has been reduced to only include a small (3 kW – 6 kW) PV system. No work has been done on this project beyond preliminary scoping. Additional work pending customer contract completion and funding. **Sharp Rees Stealy:** The project consists of a 74 kW PV system located on the roof and carport of a new, LEED-certified Sharp Wellness Center. The system was energized on Jan. 31, 2013. **UCSD MESOM:** The project consists of a 61 kW PV system and an integrated 6 kW/11 kWh Advanced Energy Storage System. The system was energized on June 14, 2013. **UCSD Structural Materials and Engineering Building:** The project consists of a 120 kW PV system that includes a variety of solar technologies including string inverters, micro-inverters, and DC optimizers, with a robust monitoring system for evaluation. The system was energized on Oct. 22, 2012.	

Project 20: Supervisory Control and Data Acquisition (SCADA) Capacitors	
Funding Source: GRC **Project Timeframe: 3/2011 and ongoing**	Reporting Period Estimated Costs: $6,317
Description: The objective of this project is to convert existing distribution line capacitors to SCADA control in order to provide improved VAr control and improved system efficiency and operability. SCADA controls will also alert utility personnel of operating issues. This will increase capacitor bank reliability, minimize downtime, and expedite repair work. Once fully implemented, the annual capacitor survey will be eliminated as a result of this project. There are approximately 1,400 capacitors (Overhead (OH) switched, OH fixed and Underground (UG) switched) in the system that will be converted by 2017.	
Update: As of June 2013, 40 new 12 kV SCADA capacitors were installed and energized to replace 40 older overhead and pad-mounted non-SCADA capacitors. A total of 47 combined units are pending final permits and 56 units are in design phase. Improved control methods and	

Project 20: Supervisory Control and Data Acquisition (SCADA) Capacitors	
algorithms are being considered for application and assessment.	

Project 21: SCADA Expansion – Distribution	
Funding Source: GRC **Project Timeframe: 1/2012 and ongoing**	Reporting Period Estimated Costs: $5,156
Description: This project will install 300 SCADA line switches to promote a minimum of 1.5 switches on every distribution circuit (mid-points and ties). This project will also install SCADA at 13 legacy (existing) substations. With the completion of this project, automation will be operative for a significant portion of a circuit following an outage.	
Update: As of June 2013, four substation SCADA installations had been completed on the distribution grid. Installation work at Substation 1 and Substation 2 is in progress. Completion of Substation 1 is expected in Q4 2013, and completion of Substation 2 is expected in 2014.	

Project 22: Wireless Faulted Circuit Indicators	
Funding Source: GRC **Project Timeframe: 9/2011 and ongoing**	Reporting Period Estimated Costs: $3,595
Description: The objective of this project is to install as many as 10,000 wireless fault indicators (WFI) devices on the overhead and underground electric distribution system. In the event of a circuit fault, WFIs rapidly transmit fault location data via secure wireless communication to the Distribution Control Center. This information allows distribution operations personnel to direct electric troubleshooters more efficiently, minimizing customer outage time and expediting repair work. The same devices provide a secondary benefit, reporting load data once a day in one hour increments, for system planning and operating use.	
Update: During the Reporting Period, the project team has installed roughly 2,060 overhead	

Project 22: Wireless Faulted Circuit Indicators	
wireless fault indicators to a total nearing 2,900. The team integrated 1,300 of the generation 2 units into GIS and OMS/DMS, providing visual indication of faults directly to system operators. In 2013, the team focused on optimizing the business process, integrating the devices, and cleaning up the GIS data for those previously installed. For the underground, the team has installed 20 units as part of a DOE project. Future plans will add pressure sensors into the device to indicate water level in manholes and other substructures subject to water intrusions.	

Project 23: EV Demand Response – Grid to Vehicle (G2V)	
Funding Source: GRC **Project Timeframe: 9/2011 and ongoing**	Reporting Period Estimated Costs: $260
Description: SDG&E commenced implementation of the first of its kind EV Smart Charging Port in developing Workplace Charging innovation to serve its employees, PEV fleet, and customers interested in learning more about workplace charging solutions. This facility features a centralized charge control kiosk for testing employee-charging decisions based on various time-of-day pricing options. This project allows SDG&E to experiment with enabling technology and behavioral response to greater increases in the range of variable day-ahead pricing tied to system requirements and resource availability, such as with the use of renewable energy supplies. This project will test demand response (DR) applications with SDG&E employees at company charging facilities. To accomplish this, the team took advantage of including the DR requirements in the planning effort already underway to build a PV shaded parking canopy at SDG&E's headquarters facility with 10 parking spaces dedicated to Level 1 (1.4 kW, 120-volt) plug-in vehicle charging for employees and fleet. These are cooperative efforts among multiple SDG&E groups to build a facility to accomplish the following DR related tests: • Demonstrate the utility of Level 1 charging for the workplace and fleet • Develop cost-effective access control and billing systems for potential use at SDG&E facilities for employee charging (adaptable to customer workplace and multi-unit dwelling settings) • Demonstrate remote charging shut-off and/or load control • Provide a platform for demonstration of employee charging response to time-variant pricing schemes and communications • Demonstrate automatic shut-off during DR events	

Project 23: EV Demand Response – Grid to Vehicle (G2V)	
Update: SDG&E created plans and issued a request for proposal to construct the infrastructure for the project. Funding for the DR applications for this effort was approved in Q2 2012 of SDG&E's DR filing (spending in 2013 and 2014). Installation was completed in phases between year-end 2012 and Q1 2013, with initial operation commencing in Q2 2013 with static TOU pricing applied. Programming for and testing of the DR applications, and day-ahead variable pricing commenced late Q2 2013, with beta testing expected in Q3 2013.	

PROPOSED / PLANNED PROJECTS

Project 24: Solar Energy Project	
Funding Source: Application (A.08-07-017) **Project Timeframe: 2008 to 4/2016**	Reporting Period Estimated Costs: $0
Description: The 100 MWdc solar energy project, which CPUC approved in 2010, includes a program to develop as many as 26 MWdc of utility-owned solar generation and 74 MWdc of merchant-owned generation that was to be delivered via power purchase agreements. The 74 MWdc portion has since been added to the 81 MW Renewable Auction Mechanism Feed-in Tariff (RAM-FiT) program. The utility-owned portion of the program calls for SDG&E to install multiple PV systems, as large as 5 MW on SDG&E's distribution system. SDG&E anticipates employing smarter inverters, like those advocated by the Western Electric Industry Leaders, at these sites with the specific capabilities dependent upon local grid needs and size of the PV installation.	
Update: As part of the first phase, SDG&E contracted to build eight projects totaling 17 MW. Four projects totaling 6 MW have fallen out due to expected costs exceeding mandated costs. Replacement sites were not pursued as the CPUC desired a re-bidding. The remaining four projects are in the permitting phase. Due to a lengthy permitting process, final engineering, procurement, and construction are expected in 2015.	

Project 25: Distributed Energy Resource Management Solution	
Funding Source: GRC **Project Timeframe: 4/2013 to 12/2015**	Reporting Period Estimated Costs: $0
Description: In last year's report, this project was deferred pending a GRC decision. The final GRC decision approved funding for this project. The purpose of this project is to monitor, control, and optimize distributed energy resources. • Integrates and aggregates batteries, fuel cells, solar, generators, and other distributed energy resources for reliability, economic, and market participation	

Project 25: Distributed Energy Resource Management Solution	
• Uses load forecasting, day-ahead price signals, demand programs (DRMS), etc. to give multiple options for optimization and scenario-based operations • Integrates with DMS, GIS, DRMS, etc.	
Update: At the time of this report, the project team has issued a Request for Information to prospective DERMS vendors. In addition, the team evaluated the responses, conducted demos, and followed up on reference checks as part of vendor evaluation.	

ENTERPRISE PROJECTS

Project 26: Smart Substations	
Funding Source: GRC **Project Timeframe: 2014 and ongoing**	
Description: The objective of this project is to upgrade legacy electro-mechanical relays to microprocessor controlled, solid-state relays to allow for improved protection and functionality.	
Update: The project will begin in the near future.	

2.3.3.3 TRANSMISSION AUTOMATION AND RELIABILITY

Transmission Automation/Reliability (TAR) includes projects that would provide wide-area monitoring, protection and control to enhance the resiliency of the transmission system. TAR also includes projects to provide the ability to safely and reliably incorporate utility size intermittent power generation, such as centralized solar and wind energy. TAR projects would mitigate voltage fluctuations resulting from integrating intermittent resources.

The wide-area capabilities of TAR would provide the ability to monitor bulk power system conditions, including but not limited to voltage, current, frequency, and phase angle, across SDG&E's geographic area in near real-time. This functionality provides system operators with current information about emerging threats to transmission system stability, enabling preventive action to avoid wide-scale black

outs. In addition, the wide-area capabilities of TAR also include projects for coordination of high-speed communicating transmission protection equipment that would detect events or conditions in the transmission systems and automatically respond to stabilize the system.

COMPLETED PROJECTS (NONE)

IN-PROGRESS PROJECTS

Project 27: Automated Fault Location	
Funding Source: FERC **Project Timeframe: 4/2012 and ongoing**	Reporting Period Estimated Costs: $<100
Description: The objective of this project is to develop automated fault location for transmission events, using relay events from all line terminals to improve accuracy. This will assist in service restoration and outage duration.	
Update: The team has installed server and software at the data center. Testing of this communication equipment is underway as the initial communication solution did not communicate well over the voice over internal protocol (VOIP) network.	

Project 28: Composite Core Conductor	
Funding Source: FERC **Project Timeframe: 5/2012 and ongoing**	Reporting Period Estimated Costs: $2,787
Description: The objective of this project is to evaluate composite core conductors. The tests will allow for the future use of such conductors system-wide. Due to their material properties, these conductors can be loaded higher than conventional conductors allowing for greater power flow with existing infrastructure. This capability among the conductor's superior sag characteristics will improve operation flexibility. Savings are realized by using composite core conductors that do not require the need to rebuild pole and tower structures.	

Project 28: Composite Core Conductor	
Update: Approximately 45,000 feet of conductors have been installed. Through the use of the conductor, the team was able to reduce overall height of one of the structures from approximately 185 feet to 145 feet across a roughly 2,500-foot river. This was especially beneficial to the military as it is in a flight corridor.	

Project 29: Dynamic Line Ratings - Transmission	
Funding Source: FERC **Project Timeframe: 7/2011 and ongoing**	Reporting Period Estimated Costs: $543
Description: The objective of this project is to pursue the evaluation of available market technologies capable of identifying and calculating dynamic line ratings in real-time and communicate that information to grid operations. The project will determine which product will be most suitable to increase the existing transmission line capacity by realizing the dynamic thermal rating margins available. The selected technology will be used as the basis for establishing dynamic line ratings for the SDG&E transmission system in conjunction with the developed NERC assessments for transmission voltage class levels exceeding 138kV.	
Update: During the Reporting Period, the project team completed the following activities: • Evaluated technology from two additional vendors • Installed sensor device on a 500kV transmission line but immediately removed it due to excessive corona • Other devices and their data are currently being evaluated	

Project 30: Phasor Measurement Units (PMU) – Transmission	
Funding Source: FERC **Project Timeframe: 2010 and ongoing**	Reporting Period Estimated Costs: $1,045
Description: The objective of this project is to install high-speed time synchronized PMUs in SDG&E's bulk power transmission network that takes near real-time (sub-second) readings. This	

Project 30: Phasor Measurement Units (PMU) – Transmission	
information will provide an accurate picture of the grid conditions. The system will also provide the operators, engineers, and planners wide-area situational awareness that will help in understanding system outages and avoid system instability and stress. The synchrophasor data will be shared with Western Electric Coordinating Council (WECC), CAISO, and neighboring utilities, which will provide SDG&E with situational awareness of the entire western area interconnection.	
Update: SDG&E has completed the majority of the PMU installations (230 kV and 500 kV) and is transmitting PMU data from selected substations to WECC and CAISO. Testing of Wide-Area Situational Awareness (WASA) and Model Analysis applications are in progress. SDG&E is also developing WASA visualization and applications in-house using time-series data software.	

Project 31: SCADA Expansion – Transmission	
Funding Source: FERC **Project Timeframe: 9/2011 and ongoing**	Reporting Period Estimated Costs: $1,476
Description: The scope of this project is to install, upgrade, and expand SCADA at substations for the transmission portion of substation SCADA Expansion. This will increase reliability for these substations. The work includes replacing transmission breakers and associated relay panels.	
Update: Several substation projects are underway, in various phases of completion.	

2.3.3.4 ASSET MANAGEMENT, SAFETY AND OPERATIONAL EFFICIENCY

Asset Management, Safety and Operational Efficiency (AMSOE) enhances monitoring, operating, and optimization capabilities to achieve more efficient grid operations and improved asset management. AMSOE includes projects that would allow SDG&E to manage the maintenance and replacements of energy infrastructure based on the health of the equipment versus a time base approach. This

functionality would help to avoid critical energy infrastructure failures as well as manage costs associated with maintaining and replacing equipment.

COMPLETED PROJECTS

Project 32: Geospatial Information System (GIS)	
Funding Source: GRC **Project Timeframe: Completed**	Reporting Period Estimated Costs: $729
Description: The objective of this project is to migrate several disparate and aging manual/automated mapping systems to an industry standard GIS. This GIS provides intelligent networking and layering of data/information to support engineering, planning, construction, and compliance processes, while also supporting essential system integrations. The benefits of this project are: • Consolidation of multiple data/information sources into a single enterprise-wide solution • Improves integration and services for essential planning and operational (e.g., outage management) systems • Provides data/information to spatially enable business processes • Positions GIS to better support growing technologies associated with Pipeline Integrity and Smart Grid	
Update: While the project concluded, the project team continues to add features like enhancements to conflict-management tools, mobile field apps, and web printing, in addition to the integration of Smart Grid devices.	

Project 33: Outage Management System / Distribution Management System (OMS/DMS)	
Funding Source: GRC **Project Timeframe: Completed**	Reporting Period Estimated Costs: $1,729
Description: The objective of this project is to replace the existing OMS system and install a new integrated OMS/DMS system to improve outage restoration response, predict potential grid issues, increase loading on existing assets, manage customer impact, and increase process efficiencies. This project will also redesign the planned switching process to take advantage of	

Project 33: Outage Management System / Distribution Management System (OMS/DMS)	
mobile terminals in the field, automated generation, and testing of switch plans. OMS/DMS integrates with the GIS system for the as-built distribution system equipment and connectivity. It uses SCADA device status, AMI power-off alarms and customer calls to predict where outages have occurred on the distribution system. It will automatically send orders to the crew dispatching system (SORT) to dispatch a trouble shooter to assess the predicted outages. Additional orders can be sent to the click crew dispatching system for crews to repair and restore the outage.	
Update: The OMS/DMS system went live on Sept. 29, 2012. The system replaced a number of legacy OMS programs and is the primary system used by electric distribution operators for addressing unplanned and planned outages. A couple key OMS/DMS integrations that have led to improved efficiencies are SCADA and Smart Meter. The integration to SCADA allows operators to switch in real time through the centralized OMS/DMS system that documents steps. The integration to Smart Meter has produced benefits including crews arriving on-site prior to the first customer call. This is a key customer benefit for non-SCADA outages as it allows SDG&E to respond and begin restoration efforts prior to receiving a customer call. From Sept. 29, 2012 through June 30, 2013, there were 21 cases of sectionalizing device outages where the crew arrived on average 35 minutes prior to the first customer call. The longest of these savings was an outage in a commercial zone that occurred during off hours and the crew arrived on site 200 minutes prior to the first customer call.	

Project 34: Advanced Weather Station Integration and Forecasting	
Funding Source: GRC **Project Timeframe: Completed**	Reporting Period Estimated Costs: $552
Description: The objective of this project is to develop a weather network consisting of: • MesoNet weather stations - A network of automated weather stations to observe mesoscale meteorological phenomena • Portable weather stations • Back country weather cameras This weather network will support forecasting capabilities, research and real-time operations.	

Project 34: Advanced Weather Station Integration and Forecasting	

SDG&E will utilize this system to:
 	
• Model and forecast the costal marine layer
  o Statistical approach and research
  o Numerical weather prediction
  o Integrate the marine layer forecasting into PV generation forecasting and Net Load forecasting
• Net Load forecasting model
  o Understand load at the feeder level to improve management of PV generation and load forecasting
• Model historic years for wind, solar radiation, and temperature for the last 50 years
  o Enhance design of system
  o Provide insight for fire hardening needs
  o Support understanding of Santa Ana winds and fire potential
• Acquire atmospheric profiles
  o Improve marine layer forecasting
  o Improve weather forecasting
  o Improve PV generation forecasting	

Update: SDG&E is utilizing the system to collect 130,000 data points daily from 144 weather stations. Historical data collection for the coastal marine layer forecasting model is complete and a classification and regression tree model development is in process. The project team has acquired 50 years of historic wind, solar radiation, and temperature data and is applying data to wind/temperature forecasting weather models. The team is also researching atmospheric profilers for equipment capabilities and functionality. The PV generation forecasting pilot model was successful, and the team is working toward model improvement. Net load forecasting model is in the startup phase.	

Project 35: Solar to EV Project	
Funding Source: GRC **Project Timeframe: Completed**	Reporting Period Estimated Costs: $1,767
Description: Smart City San Diego and the San Diego Zoo have installed solar canopies that will charge PEVs in the Zoo parking lot. One of the first of its kind in the region, the project will use	

Project 35: Solar to EV Project	
solar energy to charge PEVs, store solar power for future use leveraging battery technology, and provide renewable energy to the surrounding community. The Solar to EV project will serve as a new energy infrastructure blueprint that can be replicated throughout the region and beyond. This project will build the foundation for the flexible demand initiative projects. The selection of the San Diego Zoo site and the highly visible location of this facility on Zoo property is educationally strategic, as about two million people visit the Zoo each year. To learn more about the Solar-to-EV Project, visit http://www.sandiegozoo.org/sdgesolar.	
Update: The project consists of 10 solar PV canopies for a total of 90 kW, battery energy storage of 100 kW/100 kWh and five PEV chargers (including one accessible unit, in compliance with the Americans with Disabilities Act (ADA)). The energy storage is used for reducing the intermittency of the PV, electric vehicle charging, and shaving peak load. Former San Diego Mayor Jerry Sanders unveiled the project on Nov. 27, 2012. As of June 30, 2013, there have been 385 PEV charging events consuming 3,572 kWh with an average of 9.3 kWh per event. Implementation of this project relied on the support from the Smart City San Diego collaboration, where regional PEV growth is a top short- and long-term goal.	

IN-PROGRESS PROJECTS

Project 36: Advanced Ground Fault Detection	
Funding Source: GRC **Project Timeframe: 6/2011 and ongoing**	Reporting Period Estimated Costs: $860
Description: The objective of this project is to provide enhanced ground fault detection schemes for distribution circuits to improve detection of operational issues. The project will also install protective relay systems to detect high impedance faults, where the fault current may be very low and the resulting arcing fault may provide erratic current input to the protective relay. The effort is concentrated on the protective relays for distribution feeder and on pole-mounted service restorers. The advanced protection system will provide faster isolation of downed conductors, promoting enhanced safety and improved service reliability.	

Project 36: Advanced Ground Fault Detection	
Update: The project is in the deployment phase with 75 reclosers targeted for software upgrade and 45 reclosers for controller replacement in 2013. The project team will continue working with manufacturers as needed to support deployment. During the Reporting Period, the team received 90 controllers and installed 27 as replacements to obsolete equipment. In addition, the team installed 69 reclosers with the newest upgraded settings. The team experienced a successful advanced ground fault detection trip on Nov. 8, 2012, following a wire-down event. The service restorer that detected the trip was using the new DCD (Downed-Conductor-Detection) logic that had only recently been installed to replace an obsolete service restorer.	

Project 37: Arc Detection – Distribution	
Funding Source: GRC **Project Timeframe: 7/2012 and ongoing**	Reporting Period Estimated Costs: $898
Description: The objective of this project is to develop the capabilities for arc detection on 12 kV overhead circuits. The monitoring equipment will perform data collection and analysis of arcing along long spans. The project will utilize a radio frequency signal to provide fault locations. The evaluation and deployment of this technology will assist in fire prevention activities in fire-prone areas.	
Update: The vendor has finished development of the second generation equipped with low power communications. The team will use the units for testing and development at the training facility before commencing field installation for monitoring the distribution power lines before the end of the year.	

Project 38: Arc Detection – Transmission	
Funding Source: FERC **Project Timeframe: 4/2012 and ongoing**	Reporting Period Estimated Costs: $0
Description: The objective of this project is to develop the capabilities for arc detection on 230 kV overhead conductors on transmission lines. The project will install arc detection sensors and substation grade communication gateways to monitor the transmission lines. The monitoring equipment will perform data collection and analysis of arcing along long spans. The project will leverage wireless communication signals to provide fault locations.	
Update: Sensor and gateway development, testing, and evaluation are still underway.	

Project 39: Condition-Based Maintenance (CBM) –Substation Transformers	
Funding Source: GRC and FERC **Project Timeframe: 2007 to 2020**	Reporting Period Estimated Costs: $9,196
Description: The objective of this project is to extend the useful life and make greater utilization of distribution substation transformers and transition these to condition-based maintenance. The project will utilize technology to monitor the performance/condition of system assets and will provide actionable alerts when attention is required.	
Update: During the Reporting Period, the team deployed CBM monitors at 23 substations with 48 transformers, bringing the project installations to 91 substations and 248 transformers to-date. The online monitoring of substation transformers produced two saves during the past year, in which abnormal conditions were detected and corrective actions were taken to prevent the asset from failing. Additionally, the CBM system continues to closely monitor several assets whose useful life has been extended.	

Project 40: Distribution Interconnection Information System (DIIS)	
Funding Source: GRC **Project Timeframe: 7/2012 – 12/2013**	Reporting Period Estimated Costs: $1,669
Description: The DIIS Phase 2 project will build functionalities to track EVs and new functionality to add Rule 21 (advanced energy storage, fuel cells, and biogas), Wholesale Distribution Access Tariff (WDAT) applications to the existing NEM functionalities built in Phase 1. DIIS will provide analytical tools and reporting functionality for customer-owned generation as well as electric vehicle assets on SDG&E's electric network in combination with other electric customer data.	
Update: The DIIS for NEM application successfully deployed on Feb. 18, 2013 for solar contractors, customers, and internal users. The project enabled the Remote Meter Configuration (RMC) functionality for NEM customers so that the meter program could be changed remotely the majority of the time. The RMC functionality avoids the cost of a crew rolling trucks to physically change out or reprogram customer meters. Currently the DIIS application has 445 solar contractors registered, representing 390 solar companies or self-installers, and 4,597 NEM solar applications have been submitted online through the DIIS system since February 2013. SDG&E has processed record numbers of applications this year, with over 695 monthly NEM applications on average January to July 2013 (compared to last year's average of 363). In addition, contractors and customers receive consistent communications and can check their application status online.	

Project 41: PEV Infrastructure Upgrades • EV Transformer Impact Study	
Funding Source: GRC **Project Timeframe: ongoing**	Reporting Period Estimated Costs: <$100
Description: The objective of this project is to expand utility infrastructure in a manner that enables the safe, reliable, and efficient integration of PEV charging loads with the utility grid, including separate, and large charging station networks. The project will also upgrade the electric distribution system to accommodate increased numbers of PEVs. Upgrades include facilitating customer panel upgrades, residential distribution transformers, services, and	

Project 41: PEV Infrastructure Upgrades • EV Transformer Impact Study	
potential circuit upgrades.	
Update: SDG&E completed three residential service upgrades related to PEVs from July 2012 through June 2013. One of the three upgrades also required a distribution system upgrade to a larger transformer.	

Project 42: Smart Isolation and Reclosing	
Funding Source: GRC **Project Timeframe: 4/2012 and ongoing**	Reporting Period Estimated Costs: $2,566
Description: The objective of this project is to apply off-the-shelf pulse closing technology at additional points on the system. SDG&E has already applied this technology, which limits the amount of energy that the utility re-closes back into faulted circuits, improving public safety.	
Update: The team has replaced 44 field devices with new units from the manufacturer as warranty replacements. Eight new installations occurred during the Reporting Period. In addition, newer products are currently in design with expected evaluation prior to the end of 2013.	

Project 43: Smart Transformers	
Funding Source: GRC **Project Timeframe: 10/2011 and ongoing**	Reporting Period Estimated Costs: $1,921
Description: The objective of this project is to install monitoring devices on all transformers serving customers with charging stations for PEVs that are purchased between 2010 and 2020. Sensing devices attached to the transformers will be used to monitor real-time loading and establish accurate load profiles. The project will also include analysis and evaluation of transformer bushing mounted devices presently on the market.	

Project 43: Smart Transformers	
Update: The primary focus of these activities is to manufacture a production version of the load monitor after successful field performance of the second prototype. To date, 718 monitors (318 pole top and 400 pad mount) monitors have been manufactured and shipped to SDG&E. A total of 22 production version monitors were installed on pole top transformers by the end of the second quarter of 2013. Analysis of the voltage, current, power factor, and temperature data began shortly after installation.	

Project 44: Advanced Distribution Management System (ADMS)	
Funding Source: GRC **Project Timeframe: 9/2012 to 7/2015**	Reporting Period Estimated Costs: $2,350
Description: The scope of this project is to implement new functions within the new OMS/DMS system to support current and future Smart Grid initiatives for managing the electric distribution grid. The project will be delivered in two phases: Phase 1 – OMS enhancements (ping, outage filter, service alerts, outage website, mobile improvements), implement DMS features of NMS v1.10 (power flow analysis, Fault Location Analysis (FLA), Feeder Load Management (FLM), Suggesting Switching (SS), Fault Location Isolation Service Restoration (FLISR) and Volt/VAR). Phase 2 – Integrate DER into the DMS. This phase requires a new version of NMS v1.12 to take advantage of the capabilities of these assets and maintain DMS functionality. This project is an essential component of the implementation of the Smart Grid roadmap.	
Update: During the Reporting Period, the following features were added or implemented: • Provided ping enhancements allowing restoration verification for C&I customers • Reduced false transformer outages by improving filtering of Smart Meter power-offs • Provided more timely and accurate updates to public outage website • Implemented FLA providing the capability to reduce patrol time • Implemented power flow and SS providing the capability to reduce time in developing switch plans	

Project 45: Solar Power Prediction	
Funding Source: GRC **Project Timeframe: 11/2012 – 1-/2014**	Reporting Period Estimated Costs: $200
Description: SDG&E requires solar power generation predictions for real-time operations and day-ahead generation commitments, marine layer predictions, net load predictions, and other core predictive information for multiple stakeholders. SDG&E is developing and implementing a PV power prediction engine and marine layer location prediction engine.	
Update: The project team is developing several power prediction models using different time scales and integrating weather information. A vendor partner is working with SDG&E to adapt an existing model to SDG&E's service territory and system. Power predictions for multiple time scales will be output from the models. The marine layer location prediction engine is in production and field testing.	

PROPOSED / PLANNED PROJECTS

Project 46: Vehicle to Grid (V2G) Pilot	
Funding Source: GRC **Project Timeframe: Ongoing**	Reporting Period Estimated Costs: $0
Description: This pilot integrates stationary batteries with fast public and private PEV charging facilities and includes implementation and testing of sites/units with Electric Vehicle Service Provider (EVSP) and technology partners. In the near term, the use of stationary batteries serves as a proxy for V2G power flow to allow SDG&E to prepare for a time in the future when automotive manufacturers provide vehicle electronics for V2G functionality in production PEVs. As with other related Flexible Demand Initiative projects noted below, the aggregated capacity of the batteries will be bid into the CAISO market.	
Update: Planning for this project is currently in progress.	

Project 47: Flexible Demand Initiative (FDI)	
Funding Source: GRC **Project Timeframe: Ongoing**	Reporting Period Estimated Costs: $0

Description: Expanding on the vehicle-to-grid work described above, again SDG&E will leverage its work with stored energy controls and dispatch to be applied to the unique opportunities inherent in the flexible loads of EV charging and potential battery integrated charging facilities, expected to be deployed throughout the next five years. Demand flexibility coupled with stored energy applications at charging facilities will advance efforts to provide utility grid support. SDG&E plans to test such an application to deliver CAISO ancillary services using aggregated energy storage coupled with publicly-accessible PEV charging.

Update: SDG&E, with technology partners, has initiated discussions with two to three potential customer sites that have expressed interest in hosting FDI facilities, reviewing the requirements, and assessing costs. Also, SDG&E continues to work with potential technology partners who would develop the FDI assets, including the technology necessary to aggregate and dispatch the stored energy and vehicle charging load management resources of such facilities, per CAISO protocols and SDG&E requirements. SDG&E continues to work with CAISO to ensure that the FDI application is consistent with its interests. The benefits include:

- Apply and refine an optimization and control engine for DER aggregated across multiple sites, allowing SDG&E to derive value from existing storage assets through optimized, aggregated control schemes that include participation in CAISO's markets
- Design and develop a standardized third party DER aggregator interface specification available to any capable, authorized aggregator of distributed generation, energy storage, and/or controllable-load resources that facilitates access to CAISO markets and/or utility demand response programs

This project will achieve actual energy market participation for aggregated DER and identify barriers to future, large-scale participation and the provision of additional ISO services.

Project 48: Condition-Based Maintenance (CBM) – Gas Breakers	
Funding Source: FERC **Project Timeframe: 9/2013 to 12/2019**	Reporting Period Estimated Costs: $0
Description: This project is to extend the useful life and make greater utilization of the transmission substation breakers. The project will utilize technology to monitor the performance and condition of system assets to identify issues prior to causing a serious unplanned outage and prior to losing the expensive asset prematurely.	
Update: This project is under development for a scheduled start in Q3 2013. Vendor selection and evaluation are scheduled to occur in 2013.	

Project 49: Dynamic Reactive Support Project (Ocotillo Sol)	
Funding Source: FERC **Project Timeframe: Suspended**	Reporting Period Estimated Costs: $0
Description: The objective of this project is to assess reactive power needs given future anticipated renewable integration. This project initially focuses on the 1300+ MW of renewables expected to be tied electrically to the Imperial Valley substation. The basic assessment or reactive power needs will be applied to other substations and circuits heavily loaded with intermittent renewables. Proposal for IV substation is 100 MVAr, which includes a 20 MW/MVAr PV facility.	
Update: Placed on hold for further review.	

Project 50: Smart Grid Enabled Energy Efficiency	
Funding Source: Application Energy Efficiency (A.12-07-002) **Project Timeframe: 1/2013 to 12/2014**	Reporting Period Estimated Costs: $742

Project 50: Smart Grid Enabled Energy Efficiency	
Description: SDG&E's Smart Grid Enabled Energy Efficiency project consists of the Energy Advisor program included in SDG&E's Energy Efficiency application (A.12-07-002) filed on July 2, 2012. The Energy Advisor program is designed to bring together all services offered to support customer education and participation in energy efficiency, demand response and self-generation, energy reducing opportunities and benefits, along with awareness of greenhouse gas and water conservation activities within one program. These services include benchmarking, an online energy audit tool, non-residential audits, pump efficiency services retro-commissioning and coordination with audits.	
Update: During the Reporting Period, the project team launched the Business Energy Assessment (BEA) Online Tool and the ASHRAE Level II Comprehensive Audit Program (EC, EE, DR, DG). The launch of these programs, in combination with SDG&E's longstanding programs such as the benchmarking service, retro-commissioning program, and pump efficiency program, translates into the Energy Advisor program for SDG&E clients. In addition, the team created the Continuous Energy Improvement (CEI) Program as an enhancement to the Energy Advisor Program. The CEI Program engages small and medium customers for a six-month education process to bring awareness on long-term energy savings solutions.	

Project 51: Second Use of EV/PEV Batteries in Stationary Applications	
Funding Source: DOE **Project Timeframe: 4/2011 and ongoing**	Reporting Period Estimated Costs: <$100
Description: This is a DOE- National Renewable Energy Laboratory (NREL) awarded project focused on developing and testing applications and application-specific load profiles for end-of-life traction PEV batteries. The demonstration site hosts a four-channel, bi-directional power supply capable of consolidating the operation of existing on-site PV generation with second use energy storage systems from vehicles. It serves local load, smoothes intermittent renewable generation, provides ancillary services (voltage and frequency regulation), tests dispatch algorithms and associated duty cycles, and investigates system capability for use in customer applications such as vehicle charging and energy arbitrage.	

Project 51: Second Use of EV/PEV Batteries in Stationary Applications	
Update: Project continues with data collection and execution of test plans. Week-long data sets studied, and compilation of test results and findings undertaken. CEC PON 501 proposal awarded funding to project team. Commenced contracting and project planning.	

ENTERPRISE PROJECTS

Project 52: Early Fire Detection System	
Funding Source: Sunrise Powerlink Decision (D.08-12-058) **Project Timeframe: Completed**	
Description: The objective of this project is to install 36 early detection fire preparedness cameras in high fire-prone areas. The cameras can detect smoke using algorithm software to alert emergency response and reduce wildfire risk to the region.	
Update: There are 29 cameras installed and currently monitoring fire-prone areas in the SDG&E service territory.	

Project 53: Mobile Off-Grid Communications Systems	
Funding Source: Sunrise Powerlink Decision (D.08-12-058) **Project Timeframe: Completed**	
Description: The objective of this project is to expand the radio communications system to extend push-to-talk radio coverage along the Sunrise Powerlink Project in areas where coverage had not previously existed.	

Project 53: Mobile Off-Grid Communications Systems	
Update: The project constructed six self-supported radio sites located in remote areas with no access to the electrical grid. These sites rely solely on solar generation and battery storage for energy needs. The radio expansion enabled two-way communication during construction and will continue to provide communication for future maintenance related activities. These mobile units were utilized for communication and logistics during the construction of the Sunrise Powerlink, contributing to the excellent safety record of the project. This technology will be leveraged further by upcoming Smart Grid technology.	

Project 54: Mobile Command Centers	
Funding Source: GRC **Project Timeframe: Completed**	
Description: The objective of this project is to build and implement mobile command centers for emergency situations offering rapid response to earthquakes, fires, and major incidents. Each vehicle includes voice and data telecommunications, self-contained power generation, and video services for use by SDG&E and other emergency personnel.	
Update: There are currently three operational mobile command centers in the SDG&E fleet.	

2.3.3.5 SECURITY

Physical and cyber security protection of the electric grid is essential and becomes more so as the Smart Grid is deployed. The communications and control systems that are required to enable Smart Grid capabilities have the potential to increase the reliability risks of Smart Grid deployments if they are not properly secured. The security program includes a comprehensive set of capabilities to address the increased physical and cyber security requirements associated with the development, implementation, operation, and management of Smart Grid systems and edge devices. These projects would place and execute security throughout the network to resist attack, manage compliance and risk, and support security from the physical to application layers.

IN PROGRESS PROJECTS

Project 55: Cybersecurity Projects	
Funding Source: GRC **Project Timeframe: Ongoing**	Reporting Period Estimated Costs: $5,944

Description: SDG&E is deploying several cybersecurity projects in conjunction with Smart Grid deployment. SDG&E's risk-based enterprise security program also includes multiple projects that further enhance the security posture of the company, its operations, and the grid.

SDG&E's projects related to cybersecurity include efforts in the categories of risk and vulnerability management, compliance, operations, research, and privacy.

Costs for the physical and cyber security of Smart Grid systems are not isolated within these projects. All other Smart Grid investments include additional security-related costs, particularly those that are specific to the project scope or technology.

As this *Annual Report* is a public document, details of SDG&E's security projects are omitted.

Project 56: Customer Privacy Program	
Funding Source: GRC **Project Timeframe: 3/2011 and ongoing**	Reporting Period Estimated Costs: $453

Description: In March 2011, as the CPUC's decision to implement new privacy rules for the electric investor-owned utilities was being revised, SDG&E formally established its customer privacy program. It also established a cross-functional privacy committee reporting to a lead director on privacy and ultimately the Chief Privacy Officer of the company. Since being established, the program has worked to develop a privacy controls framework for the utility and educate employees of the new rules established by the CPUC.

Project 56: Customer Privacy Program	
Update: SDG&E takes customer energy privacy very seriously, and in 2013, made great strides in implementing customer privacy company-wide. SDG&E's customer privacy program has become the SDG&E Office of Customer Privacy (OCP). This year, SDG&E selected the Generally Accepted Privacy Principles (GAPP) as its privacy framework and developed its first set of privacy controls that combines elements of this framework with other regulatory obligations, and Privacy by Design. The OCP built a Privacy Impact Assessment methodology that is used by project teams and process owners to assess privacy risk in their activities. It has automated its internal process for sharing customer data with third parties to allow for better tracking and information assurance. The OCP continues to build its program and prepare the company, its partners, and its customers for future privacy risks, such as those that arise from third parties accessing customer energy data. Providing better awareness and guidance to third parties around the protection of customer privacy is a key consideration. The OCP will remain engaged with federal, state, and local regulators and legislators to help manage the balance between reasonable and effective customer privacy and other important policy goals.	

Project 57: Substation Physical Security Hardening	
Funding Source: FERC **Project Timeframe: 2011 and ongoing**	Reporting Period Estimated Costs: $6,428
Description: The objective of this project is to complete NERC/CIP compliant corporate security system upgrades to electrical substations. Technology upgrades, revisions to business processes, and personnel training are included in scope.	
Update: During the Reporting Period, the project completed upgrades to several locations. Because of the nature of these activities, details are omitted from this publicly available report.	

2.3.3.6 INTEGRATED AND CROSS-CUTTING SYSTEMS

Integrated and cross-cutting systems refer to projects that support multiple Smart Grid domains, such as grid communications, application platforms, data management and analytics, advanced technology testing, and workforce development/technology training. An integrated approach for these projects will ensure that investments are managed efficiently while creating the platform to deliver a stream of benefits across SDG&E's operations and to its customers.

Integrated communications systems will provide solutions to connect and enable sensors, metering, maintenance, and grid asset control networks. In the mid-to-long term, integrated and cross-cutting systems will enable information exchange with SDG&E, service partners and customers using secure networks. Data management and analytics projects will improve the SDG&E's ability to utilize vast new streams of data from transmission and distribution automation and Smart Meters for improved operations, planning, asset management, and enhanced services for customers.

Advanced technology testing and standards verification are foundational capabilities for SDG&E to evaluate new devices from vendors and test them in a demonstration environment prior to deployment onto the electric system. This reduces the risks associated with new technology projects, and helps SDG&E maximize technology performance and interoperability prior to deployment.

Workforce development and advanced technology training enables the successful deployment of new technologies, ensuring that SDG&E's workforce is prepared to make use of new technologies and tools in order to maximize the value of these technology investments.

IN PROGRESS PROJECTS

Project 58: Integrated Test Facility	
Funding Source: GRC **Project Timeframe: 9/2012 and ongoing**	Reporting Period Estimated Costs: $2,082
Description: The SDG&E Integrated Test Facility will be used to support electric system and information technology integration for smart concept evaluation and testing – both devices and software. Integration spans both utility- and customer-owned equipment and systems. Key aspects of this project include simulation, experimentation, analysis, visualization, integration, demonstration, testing, and validation.	

Project 58: Integrated Test Facility	
Update: The facility is under construction with structural improvements complete and tenant improvement plans in design phase. The facility is expected to be ready for use by the end of 2013, with seven labs available to begin testing smart grid concepts immediately in the areas of system modeling with high renewable penetration on the grid, smart inverters integration, demand-side energy management and communications integration, and information security protections.	

Project 59: Low Power Wide Area Communications Network	
Funding Source: Sunrise Powerlink Decision (D.08-12-058) and GRC **Project Timeframe: 2009 and ongoing**	Reporting Period Estimated Costs: $4,315
Description: This project builds out the low-speed wireless network and backhaul connectivity to enable electric Transmission and Distribution to deploy and monitor numerous smart devices, including faulted circuit indicators (FCIs) and warning lights required for aviation safety. This capability will also provide fault notification and integration with OMS/DMS and other infrastructure and communication monitoring systems.	
Update: Phase 1 – The project objective is to build out 35 wireless access points to support monitoring coverage for overhead (above ground) Smart Grid devices was completed on the scheduled date of Dec. 31, 2012. The back office system to monitor and manage the access points and alerts for endpoint devices was also completed on time. Additionally, interfaces to critical systems were constructed for alarm consolidation, as well as data analytics. Phase 2 – The project scope includes installation of an additional 110 wireless access point sites for monitoring coverage of underground Smart Grid devices, and an upgrade to the back office system to accommodate additional Smart Grid device types. Three sites have been installed to date, and one minor back office update has been performed. Planning for construction of the remaining 107 sites and major back office upgrade is underway. Material for installation of the wireless access points has been purchased. This Phase 2 project will be transferred to the	

Project 59: Low Power Wide Area Communications Network	
SDG&E Grid Communications System program and will be referenced there in the next Reporting Period.	

Project 60: SDG&E Grid Communications Systems (SGCS)	
Funding Source: GRC and DOE **Project Timeframe: 2011 to 2015**	Reporting Period Estimated Costs: $2,289
Description: SDG&E Grid Communication Services will implement an advanced wireless communications system that will allow SDG&E to monitor, communicate with, and control transmission and distribution equipment, thus accelerating deployment of Smart Grid applications and devices.	
Update: Eight WiMAX over private 2.3 GHz pilot Field Area Network (FAN) sites and related microwave backhaul services were constructed during this period. However, after reviewing results from these pilots, SDG&E concluded that its field communication requirements were better served by multiple application-specific networks. Most of the proposed Smart Grid devices have low data rate requirements that can be easily satisfied by enhanced SCADA and other low bandwidth networks. The team submitted the change of scope to DOE for approval in July 2013, and it was approved on Aug. 2, 2013. • Low-Power Communications Network (LPCN) – Unlicensed 2.4 GHz proprietary advanced wireless capability providing low speed, low-power, wide-area communications for remote monitoring of overhead/underground fault circuit indicators (FCI), smart transformers, aviation warning lights, and other low bandwidth assets. • Substation Communications – Expand SDG&E's Wide-Area Network (WAN) to connect additional substations via microwave and last-mile fiber. Also, new substation Local Area Networks (LANs) will provide transport for endpoint sensor data. • Field Broadband Device Connections – Broadband connections at targeted locations to support PMUs and other applicable, high-speed, Smart Grid devices that are installed on distribution circuits. • SCADA Optimization and Enhancements – Implement an upgraded narrowband SCADA system to increase SCADA system capacity and increase reliability and control of the electrical grid, including the ability to quickly restore power in the event of major black	

Project 60: SDG&E Grid Communications Systems (SGCS)	
outs, and auto-de-energize damaged distribution circuits to minimize risk of wild fire, life, and property.	

Project 61: Smart Grid Research, Development, and Demonstration (RD&D)	
Funding Source: GRC **Project Timeframe: Ongoing**	Reporting Period Estimated Costs: $429
Description: These RD&D projects are organized into multiple program areas (operations, customer applications, clean generation, clean transportation, renewable generation, and program management and related) and include standards and protocols, customer DER integration, next generation DER, and next-generation energy storage systems.	
Update: RD&D is continuing to focus on a number of projects in multiple Smart Grid areas. For example, RD&D is working on a solution that would allow for low-cost smart charging of electric vehicles and development of standards-based messaging middleware to facilitate communication between the utility and EVSPs. Many of the RD&D projects are done in conjunction with other Smart Grid projects and therefore the costs are embedded in other projects in this report. A foundational set of projects in this area is included in the pending Electric Program Investment Charge (EPIC) program. Currently, the program decision was withdrawn by the CPUC. A new Proposed Decision (PD) will be issued, and a comment period for the new PD will follow.	

Project 62: Smart Grid 2.0 Engineering and Architecture	
Funding Source: GRC **Project Timeframe: 2013 and ongoing**	Reporting Period Estimated Costs: $0
Description: The objective of this project is to ensure technical, secure, reliable, efficient, and	

Project 62: Smart Grid 2.0 Engineering and Architecture	
integrated operation among Smart Grid projects and programs by establishing systems engineering and architectural descriptions for the SDG&E Smart Grid as a holistic system of systems, meeting the company's overall need for cost-effective deployment.	
Update: The project is now forming its objectives and project plans. Vendors are being interviewed in support of a repository selection. The goal is to have the tool in service and operational by year-end 2013.	

ENTERPRISE PROJECTS (IN PROGRESS)

Project 63: Workforce Development • **California Smart Grid Center Collaboration** • **Customer Contact Center (CCC) Transformation**	
Funding Source: GRC **Project Timeframe: Ongoing**	
Description: California Smart Grid Center Collaboration: This project will result in the implementation of recruiting strategies and client partnerships necessary to manage the Smart Grid related workforce. CCC Transformation: This project will put in place the training, communication, policies, and practices necessary to ensure that as the many Smart Grid-related initiatives are implemented so that change management is handled consistently and effectively. This initiative develops new job skills for some employees, new positions for other required job skills, and new business processes to ensure continued compliance with regulatory and safety mandates.	

Project 63: Workforce Development • **California Smart Grid Center Collaboration** • **Customer Contact Center (CCC) Transformation**	
Update: California Smart Grid Center Collaboration: The Smart Grid Center is continuing work on the four courses focused on Smart Grid curriculum that it will ultimately offer online. The Center is in the process of identifying additional grant funding to complete this work. SDG&E invited the Smart Grid team to San Diego and conducted a meeting with subject matter experts in this arena, including directors, managers, and engineers. The purpose of the meeting was to give feedback on the curriculum. A survey was developed to provide tangible information for the professors to use in this effort. CCC Transformation: Customer Contact Center employees have undergone training to allow a broader range of services to be offered during phone and other interactions with customers to become more of a trusted energy advisor rather than a transaction-oriented order taker. Employees have gone from being 'Customer Service Representatives' to 'Energy Services Specialists,' and initial training started with net-energy metering and electric vehicles.	

Project 64: Data Management and Analytics • **Enterprise Analytics System (EAS)**	
Funding Source: GRC **Project Timeframe: 4/2011 and ongoing**	
Description: The Data Management and Analytics project will provide infrastructure to store and analyze the vast amounts of data generated by existing applications as well as Smart Grid systems. New analytics tools will be deployed and specifically tailored to the Smart Grid business domains to uncover a greater understanding of this new data in areas such as demand forecasting, situational analysis, optimization, and customer usage analytics. Underlying foundational capabilities include ensuring that internal company data is consistently used and aligned with external Smart Grid industry standards.	
Update: EAS is a project combining Customer (CAS) and Operational Analytics Systems (OAS) to create a single point of analysis and data for the whole company. CAS is a project to enhance	

Project 64: Data Management and Analytics • **Enterprise Analytics System (EAS)**	
SDG&E's enterprise capabilities to leverage customer data assets into useful, actionable insights for executives, managers, power users, and customer-facing personnel. It will allow for real-time analytics for grid operators and general analytics for all employees.	

Project 65: The California Systems for the 21st Century Collaboration (CES-21)	
Funding Source: GRC **Project Timeframe: 2012 and ongoing**	
Description: CES-21 involves the CPUC and California IOUs collaborating with Lawrence Livermore National Laboratory (LLNL) to improve and expand energy systems to meet 21st century needs. CES-21 plans to create a set of collaborative technology development initiatives that will accelerate the deployment of advanced systems and technologies from renewable generation to Smart Grid technology. CES-21 current plan is to develop project proposals in four areas: electric resource planning, Smart Grid operational tools, cybersecurity and gas system planning, and operational tools.	
Update: The advice letter for CES-21 was signed in late December 2012. The board of directors for CES-21 was installed, an executive director was hired, a business case was developed, and a public workshop was held for commentary. The IOUs and LLNL also developed the Cooperative Research and Development Agreement (CRADA). CES-21 business cases were approved by the CES-21 board of directors. The advice letter with the business cases and CRADA were submitted to the CPUC on April 19, 2013. In September 2013, the California legislature passed Senate Bill 96, which if signed by the Governor, will impose statutory restrictions on the CES-21 program and its funding. As of September 23, 2013, the Governor has not taken action on S.B. 96.	

2.4 IMPACTS TO THE SMART CUSTOMER, SMART MARKET, AND SMART UTILITY

Table 5 discusses the impacts from each of SDG&E's Smart Grid project categories to the Smart Customer, Smart Market, and Smart Utility areas.

Table 5: Impacts to Smart Customer, Market, and Utility by Project Category

Project Category	Smart Customer	Smart Market	Smart Utility
1. **Customer Empowerment and Engagement**	Smart Meters, Green Button, and related web-based and mobile apps empower SDG&E's customers by giving them a means to conveniently access their usage data and giving them greater control over how and when they use energy. Because these are standards-based, open access initiatives, they also enable new applications and information services that provide greater value to customers.	Projects such as Green Button Connect My Data and Smart Pricing Program contribute to the development of a Smart Market by providing a platform for third parties to develop new products and services, encouraging changes in customer behavior through new pricing and rate models. Connected to the Sun opens access to solar generation to all customers, even those lacking capital or property to install their own.	Smart Meters, Demand Response programs, and DER- and PEV-related projects are helping to create a Smart Utility by supporting the reliable and cost-effective integration of widespread intermittent renewable generators and PEVs, as well as new TOU rates that send more accurate price signals to customers.
2. **Distribution Automation and Reliability**	These projects contribute to the Smart Customer through Sustainable Community Programs and the Borrego Springs Microgrid	Projects in this category help drive a Smart Market through development and deployment of technologies that will enable high penetrations of renewable distributed	Projects such as Advanced Energy Storage, SCADA Expansion, and SCADA Capacitors enable the Smart Utility by empowering distribution system operators with

Project Category	Smart Customer	Smart Market	Smart Utility
	Demonstration that advance community awareness of Smart Grid technologies and benefits so that customers understand the role of these investments in improving distribution system reliability and power quality.	generation and PEVs, and utility-integrated microgrids that will provide new options for differentiated reliability services in the future.	energy storage options that expand capacity as well as improved reliability through better failure detection and prediction, improved power control, and faster isolation of faulted electric distribution circuits for faster load restoration.
3. **Transmission Automation and Reliability**	Projects in this category contribute to the goals for the Smart Customer by integrating large-scale centralized renewables while maintaining reliable services to customers and helping to avoid large-scale outages that economically impact customers.	Projects such as PMUs and SCADA Expansion will help build a Smart Market by using sensing and control technologies to improve wide-area situational awareness, leading to more efficient market operations and maintaining reliability while integrating large-scale intermittent renewable generation sources.	Projects such as PMUs contribute towards the objectives of the Smart Utility by using innovative approaches to maximize network capacity, while others include advanced materials, sensors, and control systems that will help maintain or improve reliability.
4. **Asset Management, Safety, and Operational Efficiency**	These projects help to create the Smart Customer by making improvements and advances to systems that will optimize investments, system	Projects in this category such as the Flexible Demand Initiative contribute to the Smart Market by integrating technologies and services that benefit the grid while	The Smart Utility will be realized in part through projects such as CBM, GIS, OMS/DMS, and Smart Isolation and Reclosing, which proactively manage asset health, improve

Project Category	Smart Customer	Smart Market	Smart Utility
	efficiency, and public safety. Projects such as the Solar to EV initiative include advanced technology integration and outreach efforts that will reach large numbers of customers.	creating opportunities for innovative new business models.	situational awareness, maximize operational and system efficiency, while protecting worker and public safety.
5. **Security**	SDG&E's Customer Privacy Program will help create the Smart Customer by ensuring that the ever-increasing amount of data collected for and about customers is appropriately managed and protected while being made available to third parties after customer authorization.	A Smart Market must guarantee the availability of systems, confidentiality of information, and integrity of data and transactions, all of which depend on a robust risk-based security program.	Projects in this category help to create the Smart Utility by ensuring that systems, assets, and customers are protected from physical and cyber security issues that could affect reliability or customers' trust in the system.

Project Category	Smart Customer	Smart Market	Smart Utility
6. **Integrated and Cross-cutting Systems**	Projects in this category ensure Smart Customers are be served by a Smart Utility workforce that understands their preferences and needs for more tailored energy services.	Enabled in part by RD&D and integrated system testing efforts in this project area, the Smart Market will develop with assurance that interoperable systems will support market and transaction integrity.	Projects in this area will ensure robust and secure communications are widely available and enable cost-effective implementation of sensor and control capabilities that provide a variety of benefits. Workforce development initiatives will ensure that skills of existing employees evolve, and future hires have the blend of skills needed for the Smart Utility.

2.5 CUSTOMER ROADMAP

2.5.1 INTRODUCTION / BACKGROUND

SDG&E's Customer Roadmap describes the customer outreach and engagement plans needed to support those Smart Grid projects that directly impact customers. A summary of SDG&E's assessment of customer impacts and detailed engagement plan summaries and timeline are included.

2.5.2 CUSTOMER OUTREACH AND ENGAGEMENT PLANS

This *Annual Report* updates 65 SDG&E Smart Grid projects, grouped by the following project areas: Customer Empowerment, Distribution Automation and Reliability, Transmission Automation and Reliability, Asset Management, Security, and Integrated Cross-Cutting Technologies. SDG&E has assessed the customer outreach and engagement efforts needed for each of these projects based on the level of customer impact according to three categories: Direct Customer Outreach, Evident to Customers, and Less Evident to Customers, as shown in Table 6.

The first category, Direct Customer Outreach, refers to projects that require direct communications with or tools and programs for customers; therefore, requiring direct customer outreach and engagement plans. These projects intend to provide customers:

- Pricing plan options that better meet their needs, including time-variant and green rates, and the information and tools they need to make informed choices
- HAN capabilities in Smart Meters
- Incentives and the capability to vary their load in response to price or other signals (demand response)
- Information for those considering a PEV purchase
- Energy usage information for themselves or their designated third parties
- Privacy controls

These projects will require that SDG&E work with customers and service providers to increase customer engagement with and adoption of new energy management technologies and behaviors. The second group, Evident to Customers, contains projects that are not squarely focused at the customer, but rather on the grid side of the meter but still physically evident to customers. These projects generally address reliability and/or power quality concerns, and due to their size or operational characteristics, may also garner concern from customers. For example, a community storage (Advanced Energy Storage – Distribution) system might consist of a large piece of equipment – perhaps just smaller than a compact automobile – placed in the utility right-of-way that many customers are likely to notice.

The third project group, Less Evident to Customers, contains projects that, like group two, are not squarely focused at the customer but rather on the grid side of the meter, and in this case, will largely be transparent to the customer. These projects generally address reliability and/or power quality issues, provide efficiencies or technical improvements, and may include the installation of equipment that is not imposing or that may be located in the substation and that, in general, customers simply will not see. That said, these projects are still a vital part of the Smart Grid, and customers will need to have a high-level idea about the issues they are designed to address and have confidence that investments in these projects are wise for system reliability and power quality purposes.

Table 6: Customer Outreach and Engagement Assessment

Smart Grid Program Area	Direct Customer Outreach	Evident to Customers	Less Evident to Customers
Customer Empowerment			
1 - Smart Meters	X		
2 - Connected…to the Sun	X		
3 - Green Button Connect My Data	X		
4 - Smart Grid Demand Response Programs	X		
5 - Electric Vehicle (Clean Transportation) Education and Outreach	X		
6 - HAN Projects	X		
7 - Smart Pricing Program (Dynamic Pricing)	X		
8 - PEV Rate Experiment	X		
9 - Centralized Calculation Engine			X
10 - Vehicle to Home (V2H) Pilot	X		
11 - Smart Meter Operations Center			X
12 - Digital Roadmap	X		
13 - Community and Stakeholder Engagement	X		
Distribution Automation and Reliability			
14 - Advanced Energy Storage		X	
15 - Dynamic Line Rating (Dist)			X
16 - Dynamic Voltage Control			X
17 - Borrego Springs Microgrid	X		
18 - Phasor Measurement Unit (PMU) (Dist.)			X
19 - Sustainable Community Programs	X		
20 - SCADA Capacitors		X	

Smart Grid Program Area	Direct Customer Outreach	Evident to Customers	Less Evident to Customers
Distribution Automation and Reliability			
21 - SCADA Expansion (Dist)			X
22 - Wireless Fault Indicators			X
23 - EV Demand Response (G2V)	X		
24 - Solar Energy Project		X	
25 - Distributed Energy Resource Management Solution			X
26 - Smart Substations			X
Transmission Automation and Reliability			
27 - Automated Fault Location (Trans)			X
28 - Composite Core Conductor (Trans)			X
29 - Dynamic Line Rating (Trans)			X
30- Phasor Measurement Unit (PMU) (Trans)			X
31 - SCADA Expansion (Trans)			X
Asset Management, Safety and Automation			
32 - Geospatial Information System (GIS)			X
33 - OMS/DMS			X
34 - Advanced Weather Station Integration and Forecasting			X
35 - Solar to EV Project	X		
36 - Advance Ground Fault Protection			X
37 - Arc Detection (Dist)			X
38 - Arc Detection (Trans)			X
39 - Condition-Based Maintenance - Substation Transformers			X
40 - Distribution Interconnection Information System (DIIS)			X
41 - Plug-In Electric Vehicle (PEV) Infrastructure Upgrades			X
42 - Smart Isolation and Reclosing			X
43 - Smart Transformers		X	

Smart Grid Program Area	Direct Customer Outreach	Evident to Customers	Less Evident to Customers
Asset Management, Safety and Automation			
44 - Advanced Distribution Management System (ADMS)			X
45 - Solar Power Prediction			X
46 - Vehicle to Grid (V2G) Pilot		X	
47 - Flexible Demand Initiative (FDI)		X	
48 - Condition-Based Maintenance- Gas Circuit Breakers			X
49 - Dynamic Reactive Support Project - Ocotillo Sol			X
50 - Smart Grid Enabled Energy Efficiency	X		
51 - Second Use of EV/PEV Batteries in Stationary Applications		X	
52 - Early Fire Detection System			X
53 - Mobile Off-Grid Communications Systems			X
54 - Mobile Command Center		X	
Security			
55 - Cybersecurity Project			X
56 - Customer Privacy Program	X		
57 - Substation Security Hardening			X
Integrated and Cross-cutting Systems			
58 - Integrated Test Facility			X
59 - Low Power Wide Area Communications Network		X	
60 - SDGE Grid Communication Systems (SGCS)		X	
61 - Smart Grid RD&D			X
62 - Smart Grid 2.0 Engineering & Architecture			X
63 - Workforce Development			X
64 - Data Management and Analytics			X
65 – CES-21 (Livermore Labs)			X

2.5.2.2 CUSTOMER ENGAGEMENT TIMELINE

Projects assessed as requiring Direct Customer Outreach are grouped based on four customer engagement initiatives: Enablement Tools, Customer Premise Devices, Rates and Programs, and Pilot Deployment Projects. For each project, a timeline has been developed, show in Table 7.

Table 7: Customer Outreach and Engagement Timeline by Initiative

Direct Customer Outreach	2012	2013	2014	2015
Enablement Tools				
Green Button Connect My Data	X	X	X	X
Connected…to the Sun			X	X
Customer Premise Devices				
HAN Projects	X	X	X	X
Smart Meters	X	X	X	X
Rates and Programs				
Smart Grid Demand Response	X	X	X	X
Smart Pricing Program	X	X	X	X
PEV Rate Experiment		X	X	X
Electric Vehicle (Clean Transportation) Education and Outreach		X	X	X
Digital Roadmap			X	X
Smart Grid Enabled Energy Efficiency		X	X	X
Customer Privacy Program	X	X	X	X
Community and Stakeholder Engagement		X	X	X
Pilot Deployment Projects				
Vehicle to Home Pilot			X	X
Solar to EV Project			X	X
Borrego Springs Microgrid	X	X	X	X
EV Demand Response (G2V)			X	X

2.5.3 OVERVIEW OF THE CUSTOMER ENGAGEMENT PLAN

For each customer engagement initiative outlined in the above Customer Engagement Timeline (Table 7), section 2.5.4 - Smart Grid by Engagement Initiative - provides more detail on existing or planned customer outreach and engagement activities, including the target audience, messaging, current roadblocks and strategies to overcome those roadblocks. SDG&E's goal is to offer the right information to the right customer through the right channel at the right time to enable customers to adopt smart energy solutions and make informed energy management decisions. Collectively, these are the projects that "...will create a utility foundation for an innovative, connected, and sustainable energy future."[25] Through these projects, SDG&E will work with customers and service providers to increase customer

[25] SDG&E *Smart Grid Deployment Plan* 2012 Annual Report, Oct. 1, 2012.

engagement with and adoption of new energy management technologies and behaviors. From a Smart Customer perspective, this will give consumers the opportunity to capture the benefits of a wide range of existing and emerging energy technologies and associated energy management products and services.

These projects allow customers to "... be aware, informed and knowledgeable about their energy choices, and have the tools to act upon those choices."[26] As stated in its *Smart Grid Deployment Plan*, "SDG&E recognizes that engaging with and proactively reaching out to customers is critical to the success of its Smart Meter deployment and Smart Grid utilization efficiency." These projects continue that journey.

2.5.4 SMART GRID BY ENGAGEMENT INITIATIVE

In this section, SDG&E describes the customer engagement elements for each initiative identified in Table 7 above, as requested by CPUC Staff in its March 1, 2012 Smart Grid Workshop Report contained in Tables 8 through 11.

Table 8: Customer Engagement Initiative - Enablement Tools

Related Projects	**Green Button Connect My Data, Connected…to the Sun**
Project Description	- Provide energy usage information directly to customers or securely to their designated third parties, empowering innovation and valued energy-related services to customers. - Provide customers greater pricing plan options including green rates
Target Audience	- Primarily residential and small commercial customers (< 20 kW peak load)
Sample Message	- Download your electricity use data with the simple click of a button and share it securely with third parties to help you understand your energy use - Providing all customers with access to local solar generation - Join the San Diego Energy Challenge. Win prizes for you and your school. The more you play, the more chances you and your school will have of winning

[26] *Ibid*.

Related Projects	Green Button Connect My Data, Connected…to the Sun
Source of Messaging	- Utility - Third-party partners
Current Roadblocks	- Customers are not aware of how much energy they use, when they use it, or how much it costs - Energy Usage is a low-engagement activity where many customers would rather not spend time thinking about their energy usage or costs - Overcoming language, ethnic, and cultural barriers to provide a direct and positive impact for SDG&E's most vulnerable populations - Some customers desire other information services providers than the utility - Customers who want to install a PV system but cannot due to multiple constraints (such as multi-dwelling units or limited roof space and orientation) - Customers don't know what new energy saving technologies are available
Strategy to Overcome Roadblocks	- Find new and better ways to engage customers using 1) social gaming 2) personalized energy reports 3) a customer preference center that will allow customers to select their preferred channel of communication for energy related information - Act as a trusted energy advisor by promoting programs (and pricing options as they come available) - Understand customer segments and how they want to be engaged - Provide green rate options and programs using local solar generation

Table 9: Customer Engagement Initiative - Customer Premise Devices

Related Projects	Smart Meters, Home Area Networks (HAN)
Project Description	- Enable customers to have an unprecedented understanding of their energy usage - Ensure that the home-area-network (HAN) capabilities in Smart Meters continue to be tested and developed
Target Audience	- All customers across SDG&E service territory with a Smart Meter - HAN devices are primarily residential and small commercial customers (< 20 kW peak load)
Sample Message	- Smart Meters will help save energy and money - Smart Meters allow for two-way communication between the customer and the utility - This new technology will also help you make smart choices to save energy and money on your bill
Source of Messaging	- Utility
Current Roadblocks	- Customers are not aware of how much energy they use, when they use it, or how much it costs - Customers may opt-out of Smart Meters in growing numbers - Energy Usage is a low-engagement activity where many customers would rather not spend time thinking about their energy usage or costs - Most residential and small commercial customers (< 20 kW peak load) are not financially rewarded for shifting their energy use to off peak periods – especially on critical days - Some customers desire information services providers other than the utility - Customer HANs may be more about security and entertainment, not energy usage - Customers who might benefit from reducing use on critical days have a low awareness level

Related Projects	Smart Meters, Home Area Networks (HAN)
Strategy to Overcome Roadblocks	- Ensure that energy usage information is available in the premise on a near real-time basis supporting smart appliances and other in-home devices - Allow energy usage information to be available over the air and, therefore, part of the mix as customer in-home wireless networks develop - Enable relevant technology solutions to support EE/DR signals (such as programmable communicating thermostats) for customers opting in or transitioning to time variant rates - Provide up to two years of bill protections to allow customers to try these technologies and new pricing options risk free - Continue to explain the benefits of having a Smart Meter (enabling real-time usage data) and integrate with the applications being developed to view that data and technologies to engage participation in programs that benefit the customer

Table 10: Customer Engagement Initiative - Rates and Programs

Related Projects	Smart Grid Demand Response, Smart Pricing Program, PEV Rate Experiment, Clean Transportation Outreach and Education, Digital Roadmap, Smart Grid Enabled Energy Efficiency, Customer Privacy Program, Community and Stakeholder Engagement
Project Description	- Provide customers greater pricing plan options that better meet their needs – including time-variant rates - Provide incentives and capabilities for customers, if they choose to participate, to vary their load in response to price or other signals (demand response) - Give customers the information they need as they contemplate and purchase PEVs - Ensure that customer privacy is fully integrated into the way SDG&E does business and that customer privacy controls are in place and working
Target Audience	- All customers across SDG&E service territory with a Smart Meter that could

Related Projects	**Smart Grid Demand Response, Smart Pricing Program, PEV Rate Experiment, Clean Transportation Outreach and Education, Digital Roadmap, Smart Grid Enabled Energy Efficiency, Customer Privacy Program, Community and Stakeholder Engagement**
	benefit from load shifting with the proper pricing plan options - In the case of electric vehicle-related messages, also includes car dealers and manufacturers as well as fleet and workplace charging providers - Policy makers (legislators, CPUC, CARB, CEC) - Communities and local stakeholders
Sample Message	- Save Energy between 11 a.m. and 6 p.m. on Reduce Your Use days and you'll be rewarded with a credit on your SDG&E bill. - SDG&E believes privacy is a fundamental right of every customer. SDG&E has a strong commitment to protecting customer data and takes the issue of customer privacy very seriously. We are doing our part to advocate for privacy on behalf of our customers and our community. - Call SDG&E First – Support the adoption of PEVs while ensuring safe, reliable, and efficient load integration with the grid. - Support energy independence and reduce petroleum imports; PEVs help achieve these goals. - Assist California in meeting its goals to reduce 13 million tons of greenhouse gasses by 2020 – 39% come from transportation.
Source of Messaging	- Utility
Current Roadblocks	- Most customers are not aware of new rate choices - Customers who want to install a PV system but cannot due to multiple factors - Some customers are becoming more concerned with privacy as it relates to the operations of the electric and gas utility (collection and sharing of usage and other data) - Small commercial customers (<20 kW peak load) that transition to TOU pricing by default are not aware how this will impact their bill based on current usage patterns - Residential customers with TOU rate options, do not have the tools available

Related Projects	**Smart Grid Demand Response, Smart Pricing Program, PEV Rate Experiment, Clean Transportation Outreach and Education, Digital Roadmap, Smart Grid Enabled Energy Efficiency, Customer Privacy Program, Community and Stakeholder Engagement**
	or are not aware of their options - Small business customers in particular are not able to deal with TOU pricing generally in many cases due to the nature of their business (hours of operation)
Strategy to Overcome Roadblocks	- Drive customer enrollment in My Account and encourage customers to engage with the new Energy Management Tool - Act as a trusted energy advisor by promoting programs (and pricing options as they become available) - Implement a Reduce Your Use program with financial incentives for energy savings below baseline use. - Utilize mass media and individual's preferred channel to communicate when Reduce Your Use Days are called - Weave Reduce Your Use Day messages into a wide range of company communications to raise customer awareness levels - Provide green rate options using local solar generation - Provide tools to conduct a meaningful analysis of new rate choices - Provide up to two years of bill protections to allow customers to try these technologies and new pricing options risk free

Table 11: Customer Engagement Initiative - Pilot Deployment Projects

Related Projects	Vehicle to Home, Solar to EV, Borrego Springs Microgrid, EV Demand Response (G2V)
Project Description	- Ensure, if and when current CPUC policy changes, that PEV charging is readily available to customers who need it - Give customers the information and tools they need to contemplate and purchase PEVs
Target Audience	- Primarily residential and small commercial customers (< 20 kW peak load); some medium and large commercial customers with vehicle fleets and multiple locations
Sample Message	- Call SDG&E First – Support the adoption of PEVs while ensuring safe, reliable and efficient load integration with the grid
Source of Messaging	- Utility - Third-party partners
Current Roadblocks	- SDG&E expects the rate of growth/adoption of PEVs in its service territory to increase dramatically during this period, and that customers who purchase PEVs will not contact the utility to inform them of such purchases in many cases - Point of PEV purchase opportunities with manufacturers and dealerships tend to preclude messaging about low-cost electric fuel benefits and the importance of planning charging needs with the utility - Limited EV customer notification to utility regarding EV purchase limits the opportunity to educate customer about EV rate and electric vehicle service equipment (EVSE) options - Potential PEV owners are concerned about range and where they will charge - Customers are not aware of the environmental or societal benefits of PEVs, the metering, rates, or other programs associated with PEVs

Related Projects	Vehicle to Home, Solar to EV, Borrego Springs Microgrid, EV Demand Response (G2V)
Strategy to Overcome Roadblocks	- IOUs are currently prohibited from owning PEV charging equipment[27] - Conduct outreach to alleviate PEV customer range anxiety - Work with manufacturers and dealerships to encourage customer communication with the utility early in the PEV purchase process - Continue to grow multiple methods of identifying and communicating with EV customers

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2.6 KEY RISKS BY CATEGORY

The following table discusses key Smart Grid risk categories and their likelihood, potential impact, and actions taken by SDG&E to reduce or mitigate risks in these areas.

Table 12: Risk Assessment Information by Category

Key Risk Category	Likelihood/Probability	Impact/Consequences	Actions Taken
1. **Reliability**	High Many factors, including the intermittency of renewable generation sources, changes in load patterns, breaches of system security, and other impacts of new technologies, have the potential to negatively affect system and local distribution reliability.	High Particularly where intermittent distributed renewables, electric vehicles, and other new technologies are concentrated into clusters, the impacts of intermittent supply or demand can be significant.	Many Smart Grid projects undertaken by SDG&E are designed to maintain or improve overall and distribution system reliability, including projects in each of the six program areas addressed in this *Annual Report*.
2. **Rates**	High The probability that current retail rate designs will trigger significant consequences to the deployment of renewables and require Smart Grid technologies is high.	High Current electric rate policies, such as AB1X and NEM statutes, provide unsustainable and inaccurate pricing signals to customers. AB1X forces increases in fixed system costs to be allocated only into tiers 3 and 4, because of statutory protections that cap increases to tier 1 and 2 rates.	SDG&E is advocating for changes in NEM and other residential rate structures that would more equitably allocate the costs for electric reliability services provided by the utility.

Key Risk Category	Likelihood/Probability	Impact/Consequences	Actions Taken
3. **Security**	High No networked system can be perfectly secure, thus the probability that some security-related issue will affect the operation of the system is high.	High Security-related threats to Smart Grid systems have the potential to impact the reliability of the transmission and/or distribution networks, and could affect worker and public safety.	SDG&E has a robust and comprehensive risk-based security program that addresses and mitigates these risks, employing defense-in-depth and other strategies.
4. **Safety**	Medium While the Smart Grid has the potential to introduce new safety risks, the well-established safety culture of the utility and robust processes that help maintain workforce and public safety diminish the probability that new safety risks will be realized.	High The consequences of safety risks that are realized can be devastating.	SDG&E works to continually improve its safety standards, education and awareness, and has a number of Smart Grid and other projects that contribute to maintaining or improving safety of its workforce and the public.
5. **Technology**	High Smart Grid deployment involves a great deal of new or emerging technologies, many of which lack consistent, interoperable industry standards. It is highly probable that a lack of or inconsistency in standards will impact deployments.	Medium Many other major technology deployments have been similarly affected in the past. Mitigation efforts can keep these risks from having high impacts on Smart Grid deployments.	SDG&E participates in the development of key technical standards, and focuses on those standards that are implemented at key interfaces – that is, the points of integration between systems where interoperability matters most.

2.7 SECURITY RISK AND PRIVACY THREAT ASSESSMENT UPDATES

In its *SGDP*, SDG&E discussed its vision for physical and cyber security as well as its strategy for achieving its security goals. Its vision for the security of Smart Grid stated:

> *"… by 2020 all Smart Grid participants, from customers to service providers, to regulators, to utilities, must be able to rely on the availability of the system; trust the integrity of the information produced by the system; and be confident that sensitive information is secure from unauthorized access or disclosure. SDG&E's Smart Grid must be resistant to physical and cyber security threats, as well as resilient to attack and natural disasters. It must be aligned with industry standards and best practices. Because resources are finite, it must be built on a security program that uses well-established risk management methodologies to maximize its security investments."*

The approach to fulfilling the vision and strategy continues to be refined as progress is made demonstrating key technologies. During the initial deployment years, the focus is on building the infrastructure necessary to support a resilient, distributed grid system and adapting existing tools and processes to the Smart Grid.

2.7.1 THREAT LANDSCAPE

Cyber security threats continue to evolve, targeting critical infrastructure. Computerized systems continue to be integrated in new ways while threat agents learn about controls systems, communications infrastructure, and other potentially vulnerable components. Attacker tools are adding modules designed to be used against SCADA system, embedded systems, and communication protocols that could potentially reveal vulnerabilities before they can be remediated.

With the national visibility on the issue, new products and technologies are becoming available to improve the security posture of the SDG&E Smart Grid. These include quantum encryption, network anomaly attack detection, advanced persistent threat protection, and substation gateway technologies marketed towards ensuring NERC CIP version 5 compliance.

2.7.2 GOVERNANCE, RISK AND COMPLIANCE

An example of how SDG&E is addressing risks through its implementation of Governance, Risk, and Compliance processes and solutions. Compliance, and transparency of compliance activities, is recognized internally at SDG&E as an important part of its Information Security program. Meeting legal, regulatory, and company requirements should be a by-product of good security and privacy programs. SDG&E has been deploying Governance, Risk, Compliance Management (GRCM) tools that enhance the ability to track information assets and map them to security controls.

The first phase of this effort has developed the infrastructure for identifying and tracking the information and cyber assets used within the Smart Grid, incorporated security operations activities, such as vulnerability management and incident response, into a dashboard-style executive view as well as technical reports for control owners. Control frameworks are used to support periodic compliance reviews. Any deficiencies are tracked and managed via corrective action plans or risk exceptions within the GRCM solution. Vulnerability management processes integrate with compliance activity to provide visibility into progress reducing risks due to technology or processes.

2.7.2.1 RESEARCHING AND LOOKING AHEAD

SDG&E recognizes that security is not an end state, but a continual process of improvement, which will continue as long as SDG&E is in business. With that said, looking ahead and planning for the future to ensure SDG&E's strategic security goals are met is extremely important. One example of where security-related efforts are focused is in improving threat and vulnerability management capabilities. SDG&E is establishing a threat intelligence service focused specifically on Smart Grid and Industrial Control System (ICS) threats. This will allow SDG&E to communicate creditable threats against its systems to affected asset owners and operators so proactive actions can occur.

2.7.2.2 CUSTOMER PRIVACY

Over the last year, energy data privacy has remained a common topic in Smart Grid forums. SDG&E takes customer energy privacy very seriously, and in 2013, made great strides in implementing customer privacy company-wide. What began as a simple customer privacy program in 2012 has become the SDG&E Office of Customer Privacy (OCP). This year, SDG&E selected the Generally Accepted Privacy Principles (GAPP) as its privacy framework and developed its first set of privacy controls that combines elements of this framework with other regulatory obligations, and Privacy by Design. The OCP built a Privacy Impact Assessment methodology that is used by project teams and process owners to assess privacy risk in their activities. It has automated its internal process for sharing customer data with third parties to allow for better tracking and information assurance.

The OCP continues to build its program and prepare the company, its partners, and its customers for future privacy risks. In particular, the desire by a growing number and variety of third parties to have access to customer energy data represents a considerable risk to customer privacy. Providing better awareness and guidance to third parties around the protection of customer privacy is a key consideration and has been built into GRCM. Another risk is conflicting legislation between governmental organizations that require utilities to take steps to protect customer privacy, and others that demand customer usage data for their broad environmental agendas. The OCP will remain engaged with federal, state and local legislators to help manage the balance between reasonable and effective customer privacy and these important environmental goals.

2.7.3 CONCLUSION

Security and privacy remain high priorities for SDG&E. SDG&E continues to execute the strategy laid out in its *Smart Grid Deployment Plan* by building the centralized management systems to support future distributed security solutions necessary to support the field technologies.

Advanced cybersecurity capabilities provide support to new Smart Grid solutions from both the information technology (IT) and operational perspectives. The Governance, Risk, and Compliance solution gathers risk information for different projects and business areas and provides a broader enterprise view. The creation of the Office of Customer Privacy formalizes processes and procedures to protect customer information in an increasingly interconnected system.

Next year, SDG&E will continue to build upon these foundational components to both expand the oversight activities and implementing additional security capabilities extending into the field.

2.8 COMPLIANCE WITH NERC SECURITY RULES AND OTHER SECURITY GUIDELINES

SDG&E is a NERC registered Transmission Owner (TO) and Transmission Operator (TOP). NERC's Critical Infrastructure Protection Reliability Standards (often referred to as Cyber Security) are applicable to those entities that are registered Transmission Owners and Transmission Operators. The NERC Critical Infrastructure Protection Reliability Standards have been mandatory and enforceable since June of 2009, and SDG&E has certified its TO and TOP annual compliance each year since June 2009.

3 SMART GRID METRICS

In SDG&E's reporting of metrics in the following section, Reporting Period is defined as the period from July 1, 2012 through June 30, 2013. Metrics are reported per the definitions in D-12-04-025, retrievable at http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/164808.PDF.

A. Customer / AMI Metrics

1. Number of advanced meter malfunctions where customer electric service is disrupted, and the percentage this number represents of the total of installed advanced meters.

Metric	Units	Reporting Period Value
Number of meters	Meters	1
Percentage of meters	%	.00007 %

SDG&E experienced one mis-operation of the service switch, resulting in customer electric service disruption due to disconnect operation due to control circuit component failure in the 2012-2013 reporting time period.

2. Load impact in MW of peak load reduction from the summer peak and from winter peak due to Smart Grid-enabled, utility-administered demand response (DR) programs (in total and by customer class).

Metric	Units	Reporting Period Value
Residential	MW	19
C&I < 500 kW	MW	12
C&I > 500 kW	MW	5
Other	MW	4
Total		39
Load Impact of Peak Load Reduction from the winter peak:		
Residential	MW	n/a
C&I < 500 kW	MW	n/a
C&I > 500 kW	MW	n/a
Other	MW	n/a
Total		n/a

***Note**: Some SDG&E DR programs are available in the winter months, but SDG&E did not call an event during the winter of 2012-13. Therefore, there is no load reduction from the winter peak to report.*

3. Percentage of demand response enabled by AutoDR (Automated Demand Response) in each individual DR impact program.

Metric	Units	Reporting Period Value
Percentage of demand response enabled by AutoDR – Capacity	%	2%
Percentage of demand response enabled by AutoDR – Critical Peak	%	13%

4. The number and percentage of utility-owned advanced meters with consumer devices with HAN or comparable consumer energy monitoring or measurement devices registered with the utility (by customer class, CARE status, and climate zone).

Metric	Units	Reporting Period Value
By Customer Class		
Residential	# / %	1243 / 0.88%
C&I < 500 kW	# / %	121 / .009%
C&I > 500 kW	# / %	0 / 0%
Other	# / %	0 / 0%
Total by Customer Class		**1364 / 0.097%**
CARE	# / %	342 / .024%
Non-CARE	# / %	1022 / .073%
Total by CARE/non-CARE		**1364 / 0.097%**
Coastal	# / %	652 / .046%
Inland	# / %	645 / .046%
Mountain	# / %	20 / .001

Metric	Units	Reporting Period Value
Desert	# / %	47 / .003
Total by Climate Zone		**1364 / 0.097%**

Due to the conclusion of one of SDG&E's HAN pilot projects, approximately 800 HAN devices (ones that were no longer useful without a back-end vendor software contract that was discontinued at the conclusion of the pilot) were unregistered and decommissioned during the Reporting Period.

5. Number and percentage of customers that are on a time-variant or dynamic pricing tariff (by type of tariff, by customer class, by CARE status, and by climate zone).

Metric	Units / Percentage	Reporting Period Value
By Type of Tariff		
Critical Peak Pricing (CPP)	# / %	1,130 / .08%
Time of Use (TOU)	# / %	26,469 / 1.884%
Enrolled in Peak Time Rebate[28] (PTR) Notifications	# / %	56,755 / 4.039%
Separately Metered Plug-in Electric Vehicle (PEV) Rates	# / %	1,659 / .118%
By Customer Class		**# / % of Customer Class**
Residential	# / %	3,467 / .277%
C&I < 500 kW	# / %	23,975 / 15.648%
C&I > 500 kW	# / %	672 / 98.824%
Other	# / %	n/a
By CARE Status		
CARE	# / %	179 / .013%

[28] SDG&E's PTR program is branded as "Reduce Your Use".

Metric	Units / Percentage	Reporting Period Value
Non-CARE	# / %	27,935 / 1.988%
By Climate Zone		**# / % of Climate Zone Customers**
Coastal	# / %	17,375 / 2.172%
Inland	# / %	10,229 / 1.749%
Mountain	# / %	397 / 2.346%
Desert	# / %	103 / 3.004%

6. **Number and percentage of escalated customer complaints related to (1) the accuracy, functioning, or installation of advanced meters or (2) the functioning of a utility-administered HAN with registered consumer devices.**

Metric / Category of Complaints	Units	Reporting Period Value
AMI Meter complaints	# / % of all escalated complaints	0
AMI Program complaints	# / % of all escalated complaints	2 escalated of 39 total (Reduce Your Use)
Device Registration (HAN)	# / % of all escalated complaints	0
Communication Issues (HAN)	# / % of all escalated complaints	0
HAN, other (primarily opting out of the various HAN pilots)	# / % of all escalated complaints	10

7. **The number and percentage of advanced meters replaced before the end of their expected useful life during the course of one year, reported annually, with an explanation for the replacement.**

Metric	Units	Reporting Period Value
Replaced due to hardware/component failures:	# / %	1,557 / .111%
Replaced due to firmware related failures:	# / %	1,611 / .115%
Replaced due to environmental related failures:	# / %	96 / .007%
Replaced due to unknown or communication related failures:	# / %	1,315 / .094%

8. **Number and percentage of advanced meters field tested at the request of customers pursuant to utility tariffs providing for such field tests, and the number of advanced meters tested measuring usage outside the Commission-mandated accuracy bands.**

Metric	Units	Reporting Period Value
Number / percentage of advanced meters field tested (at the request of customers):	# / %	800 / .057%
Number / percentage of advanced meters field tested at the request of customers with results outside accuracy band:	# / %	3 / .0002

9. Number and percentage of customers using a utility web-based portal to access energy usage information or to enroll in utility energy information programs or who have authorized the utility to provide a third-party with energy usage data.

Metric	Units	Reporting Period Value
Number/Percentage of customers using a web-based utility portal to access energy usage information[29]	# / %	219,388/36.7%
Number/percentage of customers using a web-based portal to enroll in utility energy information programs[30]	# / %	522,615/37.3%
Number / percentage of customers using a utility web-based portal to authorize the utility to provide a third party with energy usage data[31]	# / %	1962/.14%

B. Plug-in Electric Vehicle Metrics

1. Number of customers enrolled in time-variant electric vehicles tariffs

Metric	Units	Reporting Period Value
Number of customers	Customers	1,659

For SDG&E, the applicable tariffs for this metric are EV-TOU, EV-TOU-2, EPEV-X, EPEV-Y, and EPEV-Z

[29] This number represents "unique customers" using SDG&E MyEnergy Portal, of the 597,306 active My Account users, or 36.7%.
[30] This number includes all active users of My Account, SDGE.com and Mobile apps.
[31] This represents the total number of customers authorizing SDG&E to share directly with a designated third party.

C. Storage Metrics

1. MW and MWh per year of utility-owned or operated energy storage interconnected at the transmission or distribution system level, as measured at the storage device electricity output terminals.

Metric	Units	Reporting Period Value
Grid connected energy storage: pumped stored hydro[32]	MW	40
Grid connected energy storage: pumped stored hydro	MWh	37,839 pump load 32,236 generated
Grid connected energy storage: non-hydro	MW	3.473
Grid connected energy storage: non-hydro	MWh	449 charged 391.8 discharged

[32] The pumped stored hydro system referred to here is the Lake Hodges pumped storage facility. The non-hydro energy storage systems are batteries.

D. Grid Operations Metrics

1. **The system-wide total number of minutes per year of sustained outage per customer served as reflected by the System Average Interruption Duration Index (SAIDI), Major Events Included and Excluded for each year starting on July 1, 2011 through the latest year that this information is available.**

Metric	Units	Reporting Period Value
SAIDI - Major Events Included	SAIDI index	63.03
SAIDI - Major Events Excluded	SAIDI index	62.79

2. **How often the system-wide average customer was interrupted in the reporting year as reflected by the System Average Interruption Frequency Index (SAIFI), Major Events Included and Excluded for each year starting on July 1, 2011 through the latest year that this information is available.**

Metric	Units	Reporting Period Value
SAIFI - Major Events Included	SAIFI index	0.5339
SAIFI - Major Events Excluded	SAIFI index	0.5330

3. **The number of momentary outages per customer system-wide per year as reflected by the Momentary Average Interruption Frequency Index (MAIFI), Major Events Included and Excluded for each year starting on July 1, 2011 through the latest year that this information is available.**

Metric	Units	Reporting Period Value
MAIFI - Major Events Included	MAIFI index	0.2663
MAIFI - Major Events Excluded	MAIFI index	0.2663

4. **Number and percentage of customers per year and circuits per year experiencing greater than 12 sustained outages for each year starting on July 1, 2011 through the latest year that this information is available.**

SDG&E Customers / Circuits Experiencing >12 Sustained Outages		
Metric	**Units**	**Reporting Period Value**
Number of customers	Customers, # / %	0

Number of circuits	Circuits, # / %	8 / 0.8%

5. System load factor and load factor by customer class for each year starting on July 1, 2011 through the latest year that this information is available.

Metric	Units	Reporting Period Value
System Load Factor	% load factor	53%
Load Factor - Residential	% load factor	47%
Load Factor - C&I < 500 kW	% load factor	50%
Load Factor - C&I > 500 kW	% load factor	80%
Load Factor - Other[33]	% load factor	53%

6. Number of and total nameplate capacity of customer-owned or operated, grid-connected distributed generation facilities.

Metric	Units	Reporting Period Value
Distributed generation facilities - solar	Number of units / Capacity of units - MW	25,100 / 196.6 MW
Distributed generation facilities – non-solar	Number of units / Capacity of units - MW	97 / 209 MW
Distributed generation facilities – solar and non-solar total	Number of units / Capacity of units - MW	25,197 / 405.6 MW

Distributed generation facilities include those under NEM tariffs as well as non-NEM DG owned by the utility or third parties.

[33] Other is composed of small agriculture.

7. Total electricity deliveries from customer-owned or operated, grid-connected distributed generation facilities, reported by month and my ISO sub-Load Aggregation Point.

Metric	Units	Reporting Period Value
Total annual electricity deliveries from customer-owned	GWh	1,122.5

Source: California Energy Demand 2012-2022 Staff Final Forecast – Mid Demand Case, File 04 SDGE Low.xls, Form 1.2; retrieved from http://www.energy.ca.gov/2012_energypolicy/documents/demand-forecast/low_case/

8. Number and percentage of distribution circuits equipped with automation or remote control equipment, including Supervisory Control and Data Acquisition (SCADA) systems.

Metric	Units	Reporting Period Value
Number of circuits	Circuits	801
Percentage of circuits	%	80%

If the definition of remote control equipment is considered broadly, one interpretation of the term could match to the turn on/turn off functionality within SDG&E's Smart Meters. In that more general case of remote control, 100% of SDG&E's distribution circuits have Smart Meters, and therefore remote control capabilities.