

# Energy Division Central Files Document Coversheet

<p><b>A. Document Name</b></p> <p>Today's Date (Date of Submittal): 11/13/2017</p> <p><b>Name:</b></p> <ol style="list-style-type: none"> <li>Utility Name: SDG&amp;E</li> <li>Document Submission Frequency (Annual, Quarterly, Monthly, Weekly, Once, Ad Hoc): Annual</li> <li>Report Name: Smart Grid Deployment Plan</li> <li>Reporting Interval (the date(s) covered by the data, e.g. 2015 Q1): 2016 Q3 – 2017 Q2</li> <li>Name Suffix: <b>Cov</b> (for an Energy Division Cover Letter), Conf (for a confidential doc), Ltr (for a letter from utility)</li> <li>Document File Name (format as 1+2 + 3 + 4 + 5): SDG&amp;E Annual Smart Grid Deployment Plan 2016 Q3-2017 Q2 Cov</li> <li>Identify whether this filing is <input type="checkbox"/>original or <input checked="" type="checkbox"/>revision to a previous filing. <ol style="list-style-type: none"> <li>If revision, identify date of the original filing: 10/01/2017</li> </ol> </li> </ol>
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<p><b>D. Document Summary</b></p> <p>Provide a Document Summary that explains why this report is being filed with the Energy Division. This information is often contained in the cover letter, introduction, or executive summary, so you may want copy it from there and paste it here.</p> <p>This report has been prepared in response to CPUC Decisions 10-06-047 and 14-12-004, and provides a status update on SDG&amp;E's Smart Grid metrics, deployment costs, and benefits for the reporting period.</p>
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# SDG&E Smart Grid Deployment Plan

2017 ANNUAL REPORT

## TABLE OF CONTENTS

<b>SDG&amp;E Smart Grid Deployment Plan</b>	<b>iii</b>
<b>Table of Tables</b>	<b>v</b>
<b>Table of Projects</b>	<b>vi</b>
<b>1 Key Takeaways and Highlights</b>	<b>1</b>
1.1 Customer Drivers	5
1.2 Customer Value	6
<b>2 Smart Grid Deployment Plan Update</b>	<b>8</b>
2.1 Changes to the Deployment Plan Resulting from Regulatory Action or Legislation	8
2.2 Changes to SDG&E's Deployment Plan resulting from IOU Initiatives	8
<b>Table 1: Changes to SDG&amp;E's SGDP from Utility Initiatives</b>	<b>8</b>
2.3 Project Updates	8
2.3.1 Project Costs	8
<b>[Table 2: Estimated Smart Grid Deployment Costs for the Reporting Period]</b>	<b>9</b>
2.3.2 Estimated Benefits	9
<b>[Table 3: Estimated Smart Grid Benefits in the Reporting Period]</b>	<b>10</b>
2.3.3 Project Summaries and Updates by Program Area	11
2.3.3.1 Customer Empowerment/Engagement	12
2.3.3.2 Distribution Automation and Reliability	17
2.3.3.3 Transmission Automation and Reliability	23
2.3.3.4 Asset Management, Safety and Operational Efficiency	26
2.3.3.5 Security	32
2.3.3.6 Integrated and Cross-Cutting Systems	35
<b>2.4 Customer Roadmap</b>	<b>40</b>
2.4.1 Introduction / Background	40
2.4.2 Customer Outreach and Engagement Plans	41
2.4.3 Customer Engagement Timeline	41
<b>Table 4: Customer Outreach and Engagement Timeline by Initiative</b>	<b>41</b>
2.4.4 Overview of the Customer Engagement Plan	42
2.4.5 Smart Grid by Engagement Initiative	42
<b>Table 5: Customer Engagement Initiative - Enablement Tools</b>	<b>42</b>

<b>Table 6: Customer Engagement Initiative - Customer Premise Devices</b>	<b>43</b>
<b>Table 7: Customer Engagement Initiative - Rates and Programs</b>	<b>44</b>
<b>Table 8: Customer Engagement Initiative - Pilot Deployment Projects</b>	<b>45</b>
<b>2.5 Key Risks by Category</b>	<b>46</b>
<b>Table 9: Risk Assessment Information by Category</b>	<b>46</b>
<b>2.6 Security Risk and Privacy Threat Assessment Updates</b>	<b>48</b>
2.6.1 Threat Landscape	48
2.6.2 Governance, Risk, and Compliance	49
2.6.2.1 Customer Privacy	49
2.6.3 Conclusion	50
<b>2.7 Compliance with NERC Security Rules and Other Security Guidelines</b>	<b>51</b>
<b>3 Smart Grid Metrics</b>	<b>52</b>
<b>A. Customer / AMI Metrics</b>	<b>52</b>
<b>B. Plug-in Electric Vehicle Metrics</b>	<b>57</b>
<b>C. Storage Metrics</b>	<b>58</b>
<b>D. Grid Operations Metrics</b>	<b>58</b>

**Table of Tables**

Table 1: Changes to SDG&E’s <i>SGDP</i> from Utility Initiatives.....	8
Table 2: Estimated Smart Grid Deployment Costs for the Reporting Period .....	9
Table 3: Estimated Smart Grid Benefits in the Reporting Period .....	10
Table 4: Customer Outreach and Engagement Timeline by Initiative .....	42
Table 5: Customer Engagement Initiative - Enablement Tools.....	43
Table 6: Customer Engagement Initiative - Customer Premise Devices.....	43
Table 7: Customer Engagement Initiative - Rates and Programs .....	44
Table 8: Customer Engagement Initiative - Pilot Deployment Projects.....	45

Table 9: Risk Assessment Information by Category.....	46
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## Table of Projects

Project 1: Connected...to the Sun .....	12
Project 2: Green Button Connect My Data .....	13
Project 3: Centralized Calculation Engine (CCE) .....	13
Project 4: Demand Response Management System (DRMS) .....	14
Project 5: Smart Pricing Program (Dynamic Pricing).....	15
Project 6: Smart Meter Operations Center (SMOC) .....	15
Project 7: Community and Stakeholder Engagement.....	16
Project 8: Advanced Energy Storage (AES) – Expedited Storage Projects .....	18
Project 9: Solar Energy Project .....	18
Project 10: Borrego Springs Microgrid.....	19
Project 11: Phasor Measurement Units (PMU) – Distribution and Fire Threat Zone Area Protection (FTZAP) .....	19
Project 12: Supervisory Control and Data Acquisition (SCADA) Capacitors .....	20
Project 13: SCADA Expansion – Distribution.....	20
Project 14: Wireless Fault Circuit Indicators.....	21
Project 15: Power Your Drive (PYD).....	21
Project 16: Distributed Energy Resource Management System (DERMS).....	22
Project 17Automated Fault Location.....	25
Project 18: Phasor Measurement Units (PMU) – Transmission .....	25
Project 19: SCADA Expansion – Transmission.....	26
Project 20: Advanced Ground Fault Detection.....	27
Project 21: Condition-Based Maintenance (CBM) – Substation Transformers .....	27

Project 22: Smart Transformers..... 28

Project 23: Advanced Distribution Management System (ADMS) ..... 28

Project 24: Solar Power Prediction ..... 29

Project 25: Distribution Interconnection Information System (DIIS)..... 30

Project 26: Condition-Based Maintenance (CBM) – Gas Breakers ..... 30

Project 27: Smart Grid Enabled Energy Efficiency ..... 31

Project 28: Cybersecurity Projects ..... 33

Project 29: Customer Privacy Program ..... 33

Project 30: Substation Physical Security Hardening ..... 35

Project 31: Integrated Test Facility ..... 36

Project 32: Electric Program Investment Charge (EPIC) Program and GRC 2012 RD&D Projects ..... 36

Project 33: Unmanned Aircraft System (UAS) ..... 36

Project 34: Workforce Development ..... 37

Project 35: Data Management and Analytics ..... 38

Project 36: The California Systems for the 21st Century Collaboration (CES-21)..... 39

## 1 KEY TAKEAWAYS AND HIGHLIGHTS

Customer adoption of technologies and the state’s energy policy goals continue to drive the development and deployment of Smart Grid in the San Diego region. San Diego Gas and Electric strives to be the cleanest, safest and most reliable utility in America.

Customers are choosing renewable energy technologies, electric vehicles (EVs), energy management tools, energy storage, and information services at an increasingly faster pace. That said, challenges remain for the cost-effective realization of California’s ambitious energy policy goals.

Changes to San Diego Gas & Electricity’s (SDG&E) power supply resource mix are impacting nearly every aspect of the region’s electricity system. Substantial growth in centralized and distributed renewable energy resources place new demands on system planners, engineers, and operators to ensure reliability and power quality in a very dynamic environment. Today, during days of peak production from renewable generation, the San Diego region has over 2,000 megawatts (MW<sup>1</sup>) of solar and wind energy flowing to SDG&E customers.

At the same time, SDG&E’s customers are installing rooftop solar energy systems on their homes and businesses in greater numbers, resulting in 24% overall growth in Net Energy Metering (NEM) generation capacity to nearly 758 MW during the 12 months ending June 30, 2017 (the “Reporting Period”). SDG&E has nearly 114,000 NEM customers and continues to encourage growth by providing innovative customer solutions, like the renewable meter adapter which can significantly lower the costs for some customers to install solar.

*SDG&E is delivering 43% renewables to their customers.*

SDG&E is engaging customers who now have many more choices in the tools available to help them manage their energy use. In 2016, SDG&E opened the SDG&E Marketplace, an online store that helps customers make energy efficient changes in their home by making it easy to learn about rebate-eligible and energy-efficient products. SDG&E Marketplace offers one-stop-shop for customers to research and purchase energy-efficient products across 19 product categories. Marketplace offers rebates across five product categories and customers can file for a rebate in as little as five minutes with majority of the rebates settled in zero to eight days. The SDG&E Marketplace can also provide personalized energy savings recommendations based on the

<sup>1</sup> Unless otherwise noted, power capacity values (megawatt/MW and kilowatt/kW) are shown as alternating current (AC) nameplate ratings.



customer's Smart Meter data<sup>2</sup>. Since its inception in January 2016, Marketplace had over 900,000 site visits and over 15,000 residential rebates and incentives processed through the portal.

SDG&E believes energy storage is an area that holds great promise for providing higher levels of reliability and meeting peak energy demand. SDG&E has been operating energy storage for the past several years. Today, there are more than 100 MWs of energy storage connected to our local power grid including the world's largest lithium-ion battery facility. The 37.5MW/150MWh installation was built in eight months following an emergency order by Governor Brown to add storage to enhance local energy reliability. Since its commissioning, the facility has been bid into the day-ahead and real-time markets and dispatched as needed by California's power grid operator to meet energy needs.

As SDG&E looks for new opportunities, it will focus on installations that provide resiliency and energy security to complement the increasing amounts of renewable energy powering our region. SDG&E expects to add over 200MW of energy storage, and currently has applications pending approval for five new energy storage projects totaling over 83MW.

Electric vehicle adoption continues in the region with the number of plug-in electric vehicles (PEVs) and plug-in hybrid electric vehicles (PHEVs) operated by San Diego drivers growing to over 25,260 during the Reporting Period.<sup>3</sup> Because of their unique load characteristics, Smart Grid solutions are essential to the reliable integration of PEVs and PHEVs into the electric grid while minimizing capital infrastructure costs. SDG&E continues to promote electric vehicles for employees. Over 372 employees own electric vehicles and the company has installed 222 charging stations at its facilities at the end of the Reporting Period. The chargers and systems deployed via our Smart Grid projects continue to provide insights that are leveraged by the company's overall PHEV adoption programs.

This *Smart Grid Deployment Plan – 2017 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 toward a smarter and cleaner energy future.

Similar to the previous issuances in 2012-2016, this *Sixth Annual Report* provides a status update on SDG&E's Smart Grid metrics, deployment costs, and benefits for the Reporting Period.

Highlights of SDG&E's Smart Grid deployment update for the Reporting Period include:

- Overall estimated Smart Grid costs of ~\$169 million and ~\$93 million in benefits
- 36 Smart Grid and related enterprise<sup>4</sup> projects completed, in progress or planned

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<sup>2</sup> <https://marketplace.sdge.com/>

<sup>3</sup> Neighborhood electric vehicles (street legal plug-in vehicles with a maximum speed of 35mph) are excluded from this count.

<sup>4</sup> “Enterprise” projects are those that meet the broader needs of SDG&E's business but are also related to Smart Grid.

- Leading EV adoption by example with 372 SDG&E employees driving electric vehicles, over 220 EV workplace chargers at SDG&E facilities.
- PEV growth to more than 25,000 total vehicles connecting to SDG&E's system, adding nearly 4,000 vehicles<sup>5</sup>
- Strong growth in NEM distributed generation (DG) with customers connecting nearly 21,000 new systems (primarily solar), for a new total of nearly 114,000 residential and commercial DG systems interconnected with the SDG&E grid
- Rapid growth in customer energy storage deployments continues in the commercial/industrial sector and is anticipated to occur in the near future in residential as more products enter the market and time-of-use rates go into effect.
- Today, there are more than 100 MWs of energy storage connected to our local power grid including the world's largest lithium-ion battery facility.

## PROGRESS TOWARD CALIFORNIA'S ENERGY POLICY GOALS

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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, AB2868 (Gatto), AB 2514 (Skinner), AB 327 (Perea), the state's distributed generation (DG) and demand response (DR) 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 SDG&E undertakes are designed to fulfill the utility's role in realizing the state's goals or complying with mandatory standards.

On September 14, 2016 CPUC issued the "Assigned Commissioner's Ruling Regarding the Filing of the Transportation Electrification Applications Pursuant to Senate Bill 350" (ACR or Rulemaking 13-11-007), authorizing the IOUs to propose programs that would accelerate transportation electrification and align with other state goals. SDG&E submitted its application on January 20, 2017 for authorization to establish and implement six priority review projects and one standard review residential charging program, all of which are designed to accelerate widespread transportation electrification in SDG&E's service territory, while maximizing grid efficiency with proper rate design.

The CPUC opened the Distribution Resources Planning (DRP) Rulemaking proceeding in August 2014 to establish policies, procedures, and rules to guide California investor-owned electric utilities (IOUs) in developing their Distribution Resources Plan Proposals, which were required by Public Utilities Code Section 769 to be filed by July 1, 2015.<sup>6</sup> This new rulemaking also will evaluate the IOUs' existing and future electric distribution infrastructure and planning procedures with respect to incorporating

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<sup>5</sup> 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.

<sup>6</sup> <http://www.cpuc.ca.gov/General.aspx?id=5071>

Distributed Energy Resources (DER) into the planning and operation of their electric distribution systems. The DRP proceeding is comprised of three concurrent tracks that focus on enhanced distribution planning tools and methodologies, related demonstrations, and data access (Track 1); address field demonstrations and associated funding (Track 2); and address new policy issues (Track 3). There are three new policy issue sub-tracks: 1) providing grid modernization investment guidance; 2) developing a distribution investment deferral framework; and 3) developing DER adoption and scenario forecasting methodologies.

The CPUC issued a Decision [D.15-09-022] in September 2015 that expanded the scope of the existing Integrated Demand-Side Management proceeding [R14-10-003] that was initiated in October 2014 to include considering a framework based on the entire energy production and delivery system from the customer side to the utility side.<sup>7</sup> The scope of this proceeding includes determining how best to source distributed energy resources needed by the utilities based on the determinations made in the DRP proceeding. Sourcing mechanisms will also consider the issue of localized incentives. Four distinct scoping issues identified in a February 2016 Ruling include:

1. Development of a competitive solicitation framework targeting the reliability needs within the areas identified by the Integration Capacity Analysis and the Locational Net Benefits Analysis performed in R.14-08-013.
2. Continued development of technology-neutral cost-effectiveness methods and protocols.
3. Leveraging the work being performed through the Distribution Resource Plans Demonstration Projects where practical for the purpose of advancing the development of a competitive solicitation framework for distributed energy resources.
4. Utility role, business models, and financial interests with respect to distributed energy resources deployment.

SDG&E made significant progress procuring renewables, both centralized and distributed, during the Reporting Period. In June 2015, SDG&E reached the state's goal of 33% RPS, a full five years ahead of the state-mandated target.<sup>8</sup> At the end of June 2016, SDG&E was the first major California utility to hit the NEM cap of 5% of SDG&E's peak load.<sup>9</sup> In 2017, SDG&E now delivers 43% of clean energy resources to their customers. 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.

During the Reporting Period, SDG&E issued the 2016 Preferred Resource Local Capacity Requirements Request for Offers (RFO) soliciting a variety of resources and technologies, such as energy efficiency (EE), demand response, renewables, energy storage, and distributed generation. The 2016 Preferred Resource RFO was the second solicitation issued by SDG&E in response to D.14-03-004 (Decision Authorizing Long-Term Procurement for Local Capacity Requirements due to the Permanent

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<sup>7</sup> <http://www.cpuc.ca.gov/General.aspx?id=10710>

<sup>8</sup> "SDG&E Sets Renewable Energy Record" <http://www.kpbs.org/news/2015/aug/25/sdge-sets-renewable-energy-record/>

<sup>9</sup> <http://www.utilitydive.com/news/sdge-becomes-first-california-utility-to-hit-net-metering-cap/421819/>

Retirement of the San Onofre Nuclear Generation Station). That decision indicated that 25 MW must be procured from energy storage technology and a minimum of 200 MW from preferred resources<sup>10</sup>. In March 2017, SDG&E submitted the applications for approval of 83.5MW of energy storage.

## STAKEHOLDER ENGAGEMENT

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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 improve productivity and scope during the past year.

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

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 privacy.

## OPPORTUNITIES TO WORK WITH DIVERSE BUSINESS ENTERPRISES

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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. For the year ending in 2016, 43% of SDG&E's purchases were from DBEs. Smart Grid-related DBE purchases were accomplished through focused efforts that included DBE requirements in requests for proposals and identification of qualified DBEs for logistics, warehousing, installation, software, and other products and services.

SDG&E anticipates there will be many opportunities in the coming years for business owners from diverse backgrounds to be a part of this exciting effort.

### 1.1 CUSTOMER DRIVERS

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

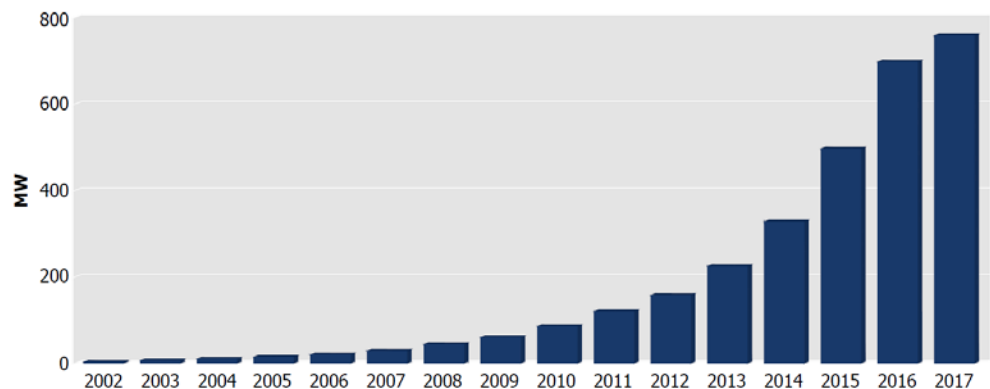
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<sup>10</sup> Decision (D.) 14-03-004 – Decision Authorizing Long-Term Procurement for Local Capacity Requirements due to Permanent Retirement of the San Onofre Nuclear Generation Station

- 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); and
- Adoption of electric vehicles and energy storage.

As shown in Figure 1, SDG&E customers are continuing their investments in distributed generation systems, primarily PV technology, with SDG&E's customers generating nearly 758MW (peak) from almost 114,000 systems installed at

**Figure 1 - Cumulative Capacity of NEM Customer Generation: Growth in Net Energy Metered Distributed Generation Capacity of Residential and Commercial and Industrial (C&I) Customers of SDG&E as of June 30, 2017**



their premises at the end of the Reporting Period. This trend demonstrates the immediacy driving SDG&E's development of Smart Grid solutions, which are necessary to integrate and manage the ever increasing number of small intermittent generators, while maintaining the level of system reliability that customers expect.

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.

## 1.2 CUSTOMER VALUE

Many of SDG&E's Smart Grid projects are 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 continue. For example, SDG&E's Smart Meter infrastructure provides residential and small commercial customers with their hourly (residential) or 15-minute (small commercial) 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. Use of commercially available network gateways allows customers to update their consumption

information online nearly instantaneously. Actively managing energy consumption can provide value for customers if coupled with rate design that encourages off-peak energy use.

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<sub>2</sub>e) and particulate emissions associated with fossil fuel 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

There were no changes in this Reporting Period. 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>.

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

While other changes to the *Smart Grid Deployment Plan* are possible due to new information or understanding of issues, solutions, and market and technology developments; SDG&E had no such changes during this Reporting Period as shown in Table 1: Changes to SDG&E's *SGDP* from Utility Initiatives:

**Table 1: Changes to SDG&E's *SGDP* from Utility Initiatives**

Project	Change from Original <i>SGDP</i>	Reason for Change
<b>Critical Peak Pricing Default (CPP-D) for Medium Commercial Customers</b>	Removed	Completed
<b>Sustainable Communities Programs</b>	Removed	Completed
<b>Managing PEV Charging</b>	Removed	Completed
<b>Smart Isolation and Reclosing</b>	Removed	Completed
<b>SDG&amp;E Grid Communications Systems (SGCS)</b>	Removed	Completed

### 2.3 PROJECT UPDATES

#### 2.3.1 PROJECT COSTS

During the Reporting Period, SDG&E’s estimated expenditures of \$169.374 million breakdown as listed in Table 2: Estimated Smart Grid Deployment Costs for the Reporting Period<sup>11</sup>:

**Table 2: Estimated Smart Grid Deployment Costs for the Reporting Period**

Estimated Spend During the Reporting Period Amounts in Thousands of USD	Reporting Period Value
<b>Customer Empowerment/Engagement</b>	\$ 9,390
<b>Distribution Automation/Reliability</b>	\$ 109,371
<b>Transmission Automation/Reliability</b>	\$ 4,283
<b>Asset Management, Safety &amp; Operational Efficiency</b>	\$ 7,915
<b>Security</b>	\$ 32,520
<b>Integrated &amp; Cross-Cutting Systems</b>	\$ 5,895
<b>Total Estimated Costs</b>	<b>\$ 169,374</b>

Expenditures are estimated and based on total spend, including operations and maintenance (O&M) and capital, excluding Contribution in Aid of Construction (CIAC) and net of grant-based reimbursements from the California Energy Commission (CEC) and Department of Energy (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*.

The framework of this methodology is primarily based on the benefits evaluation model that the Electric Power Research Institute (EPRI) included in the report titled, “Methodological Approach for Estimating the Benefits and Costs of Smart Grid Demonstration Projects.”<sup>12</sup> 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,<sup>13</sup> and environmental and societal benefits based on a model developed by SDG&E in collaboration with the Environmental Defense Fund<sup>14</sup>. As with any utility and technology investment, 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

<sup>11</sup> Refer to <http://www.cpuc.ca.gov/general.aspx?id=4693> for expenditure information from previous reporting periods.

<sup>12</sup> Final Report No. 1020342, “Methodological Approach for Estimating the Benefits and Costs of Smart Grid Demonstration Projects”, January 2010.

<sup>13</sup> Final Report No. LBNL-6941E, “Updated Value of Service Reliability Estimates for Electric Utility Customers in the United States”, January 2015.

<sup>14</sup> For further details on the methodology for environmental and societal benefits see <http://docs.cpuc.ca.gov/PublishedDocs/EFILE/RESP/140924.PDF>.



example, a particular investment may drive costs for three years, but provides a benefit 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 costs incurred during the Reporting Period due to these time differences. However, some Smart Grid projects with phased implementations, such as Smart Meters or Condition-Based Maintenance (CBM) of gas breakers and transformers, may also accrue benefits during the course of project implementation.

Another aspect to consider when evaluating benefits is that many Smart Grid projects are undertaken to meet requirements and/or energy policy goals. While the specific solutions chosen to meet these mandated requirements and goals will be the least-cost, best-fit response, the quantifiable benefits associated with these solutions may not always exceed their project costs.

Economic benefits are primarily the result of 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 or helicopters are used as alternatives.

During the Reporting Period, SDG&E continued to realize benefits from previously completed projects in addition to new projects that were completed during the Reporting Period. It is important to note that these projects generated benefits not only for SDG&E's operations but also for its customers, the environment, and society in general. Table 3 provides a summary of the estimated benefits identified during the Reporting Period<sup>15</sup>:

**Table 3: Estimated Smart Grid Benefits in the Reporting Period<sup>16</sup>**

Estimated Benefits During the Reporting Period Amounts in Thousands of USD	Reporting Period Value
<b>Economic Benefits</b>	\$ 33,545
<b>Reliability Benefits</b>	\$ 34,626
<b>Environmental Benefits</b>	\$ 11,400
<b>Societal Benefits</b>	\$ 13,888
<b>Total Estimated Benefits</b>	<b>\$ 93,458</b>

<sup>15</sup> Refer to <http://www.cpuc.ca.gov/general.aspx?id=4693> for benefit information from previous reporting periods.

<sup>16</sup> 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.

SDG&E's Smart Meter deployment 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 the reduction of meter reading and customer services field activities remained at normalized levels compared to the previous period, continuing to provide environmental benefits to the region.

During the Reporting Period, various completed and in progress Distribution Automation and Reliability projects provided benefits to customers, markets, and the utility. Customers benefit from the reduction in outage time experienced since SCADA devices can be controlled remotely without the requirement of sending field personnel to switch devices while improving customer service. Projects such as SCADA Expansion, SCADA Capacitors, and Fault Location Isolation and Service Restoration (FLISR) generated these types of benefits through the increase in the use of distribution automation on 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 in SDG&E's case 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 the RPS.<sup>17</sup> The avoided emissions reduction for distributed resources is based on the energy load forecast included in the recent California Energy Demand 2016-2027 Forecast prepared by the CEC 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 interconnection time with this system while contractors supporting these customers achieved their own savings resulting from an improved workflow process. The integration of over 25,000 electric vehicles into SDG&E's electric grid also generated additional benefits to the environment and the community. This translates into a positive environmental impact to the region by reducing net emissions, the difference between vehicles powered by liquid fuels and electricity generation. In addition, electric vehicle owners also benefited from the avoided fuel cost of the gallons of liquid fuels displaced.

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### 2.3.3 PROJECT SUMMARIES AND UPDATES BY PROGRAM AREA

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

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<sup>17</sup> Estimated benefits based on the assumption that the system can accommodate a 20% RPS without Smart Grid technologies.

### 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 and social media 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 and changing to time variant rate structures.

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 also provide customers with transparent and relevant pricing information and enable utility and non-utility service providers to offer products and services that provide customer value.

#### COMPLETED PROJECTS

<b>Project 1: Connected to the Sun</b>	
<b>Funding Source: Decision ("D.") 15-01-051</b> <b>Project Timeframe: Complete</b>	Reporting Period Estimated Costs: \$1,098
<b>Description:</b> 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. Under these programs, EcoChoice and EcoShare, the customer would be able to purchase up to 100% local solar energy if they choose. Customers	

<b>Project 1: Connected to the Sun</b>	
could “lock in” their solar energy cost and take solar service with them if they relocate within SDG&E’s service area.	
<u>Update:</u> Both products are released and available to the public.	

<b>Project 2: Green Button Connect My Data</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: Completed</b>	Reporting Period Estimated Costs: \$135
<u>Description:</u> Green Button Connect My Data is the automated transfer of energy usage data to third parties (per customer request/consent) via a standard interface North American Energy Standards Board Energy Services Provider Interface (NAESB/ESPI). Customers’ data is sent using one of two models: One and done (one-time data transmission of customer consumption) and Ongoing with or without a specified end-date (data transmitted on an ongoing basis as long as customer is enrolled with third party, or until a date selected by customer for up to 36 months).	
<u>Update:</u> The Customer Energy Network (CEN) Phase 4 Project concluded in April 2016. All work associated with CEN aka “Green Button Connect Platform” was then conducted solely via O&M production support. As of June 30, 2017, there are 29 active, registered Green Button Connect Third Parties that customers can authorize to share energy usage data via Green Button Connect. Nine are for residential-use only, 13 are for commercial use only and seven are both residential and commercial. In addition, the Green Button Connect Platform was also used by the Demand Response Auction Mechanism Pilot (DRAM) to send data to six DRAM Third Parties.	

## IN-PROGRESS PROJECTS

<b>Project 3: Centralized Calculation Engine (CCE)</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: In Progress</b>	Reporting Period Estimated Costs: \$2,313

<b>Project 3: Centralized Calculation Engine (CCE)</b>	
<p><u>Description:</u> The development of a centralized calculation engine will incorporate multiple data sources and provide price and cost calculations as output. The calculation engine will be flexible and incorporate all comprehensive rate, price, and cost modeling, as well as the ability to manipulate curves, 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.</p>	
<p><u>Update:</u> The CCE is live and providing benefits to multiple teams across the company. It has completed thousands of runs and produced close to one billion bills. The project has entered the final phase which will add additional functionality to the current system.</p>	

<b>Project 4: Demand Response Management System (DRMS)</b>	
<b>Funding Source: GRC and Smart Meter Decision (D.12-04-019)</b> <b>Project Timeframes: 08/2010 to 12/2018</b>	Reporting Period Estimated Costs: \$3,824
<p><u>Description:</u> The DRMS Project will enable the management of SDG&amp;E's entire demand response portfolio with the following integrated capabilities: program management, enrollment, eligibility, device management, event management, forecasting, settlement, analytics/reporting, and workflow. The full project implementation will take two to three years to complete with a phased approach. The first phase will implement the functionality necessary to retire a high-cost application; automate manual processes for ongoing benefits; and provide the functionality needed to send text messaging, two-way demand response load control, and price signals to meter-connected HAN devices, and monitor device connectivity. The subsequent phases will cover the rest of the portfolio of Demand Response programs and add the additional integrations necessary for an enterprise solution.</p>	
<p><u>Updates:</u> To ensure CPUC compliance, the project team enabled wholesale market integration, also known as Rule 32 - Direct Participation Demand Response (DPDR). DRMS Phase 2 is underway will be deployed in Q3 of 2017. DRMS Phase 2 plans to deliver Demand Response post-event settlement capabilities for the capacity bid program and business reporting.</p>	

<b>Project 5: Smart Pricing Program (Dynamic Pricing)</b>	
<b>Funding Source: Application D.12-12-004 and D.14-12-036</b> <b>Project Timeframe: 09/2010 to 12/2016</b>	Reporting Period Estimated Costs: \$1,681
<p><u>Description:</u> SDG&amp;E’s Smart Pricing Program (SPP) 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 adopted by the CPUC in D.12-12-004 describes SDG&amp;E’s plans to implement various time of use (TOU) and dynamic rates, along with the necessary information technology (IT) and billing system upgrades as well as the customer outreach and educational efforts necessary for residential and small business customers to be aware of the new rates and have the tools to make informed rate decisions. In December 2014, the CPUC adopted D.14-12-036, which grants SDG&amp;E’s Petition for Modification of D.12-12-004 to extend the implementation deadline for the outreach and education activities for residential and small business customers to December 31, 2016.</p>	
<p><u>Update:</u> SDG&amp;E completed the transition of its small business customers to TOU rates (approximately 72,000) in May 2016. As of June 30, 2016 over 61,000 were enrolled in the TOU Plus plan which contains a critical peak pricing component. In the summer of 2016, SDG&amp;E implemented a small business communication campaign to continue awareness and understanding of Time of Use and critical peak pricing. One critical peak pricing event day was called on September 26, 2016.</p>	

<b>Project 6: Smart Meter Operations Center (SMOC)</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: Phase 1, SMOC NMV:07/2013 to 06/2014;</b> <b>Phase 2, SMOC EM: 07/2014 and 09/2016</b>	Reporting Period Estimated Costs: \$339
<p><u>Description:</u> Phase 2 of the Smart Meter Operations Center, Exception Management (SMOC EM) will provide a solution that will improve Advanced Metering Operations’ (AMO) operational efficiency and reduce device downtime by providing analysts with results rather than raw data needed for exception management and troubleshooting processes to optimize network performance. SMOC EM will provide a centralized information repository of Smart</p>	

<b>Project 6: Smart Meter Operations Center (SMOC)</b>	
Meter data, accessible to other initiatives supporting Customer Service and other company initiatives associated with Smart Grid.	
<p><u>Update:</u> Smart Meter Operations Center – Exception Management (SMOC EM) concluded with a final content release in September 2016. The Operations group has gained operational efficiencies and analytical awareness on the health, performance, and network activities of network and metering devices. More informative and timely decisions can be made when fielding devices or performing back office corrective action based on a variety of key analytical data points. The application has yielded many new additional use cases and automation processes to be developed in upcoming (future) phases.</p>	

## ENTERPRISE PROJECTS

<b>Project 7: Community and Stakeholder Engagement</b>	
<b>Funding Source: Various</b>	
<b>Project Timeframe: Ongoing</b>	
<p><u>Description:</u> SDG&amp;E’s community and stakeholder engagement effort is intended to provide 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&amp;E’s Smart Grid efforts. SDG&amp;E has actively worked with business associations, international counterparts, and residential groups to educate them on the changing landscape of the energy industry. SDG&amp;E is working hard to ensure its stakeholders – in particular, customers – look to SDG&amp;E as a trusted energy advisor.</p>	
<p><u>Update:</u> During the Reporting Period; SDG&amp;E, Sumitomo Electric Industries, Ltd., and New Energy and Industrial Technology Development Organization of Japan (NEDO) commissioned a 2MW/8MWh demonstration project utilizing a megawatt scale system of vanadium redox flow battery.<sup>18</sup> The project will analyze the technological and economic efficiency of the system.</p>	

<sup>18</sup> <https://www.energy-storage.news/news/sdge-and-sumitomo-unveil-largest-vanadium-redox-flow-battery-in-the-us>

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### 2.3.3.2 DISTRIBUTION AUTOMATION AND RELIABILITY

Distribution Automation and 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 provides the ability to safely and reliably incorporate high penetrations of distributed energy resources by mitigating voltage fluctuations resulting from intermittent power generation. DAR projects also provide the ability to safely and reliably incorporate the increasing load of charging EVs. DAR detects and isolates faults when they occur, immediately restoring service to customers, and providing 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 also provides 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

<b>Project 8: Advanced Energy Storage (AES) – Expedited Storage Projects</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: Completed</b>	Reporting Period Estimated Costs: \$87,030
<u>Description:</u> In order to address the lack of supply of natural gas and the resulting risk of outages, the CPUC issued Emergency Resolution E-4791, ordering SDG&E to quickly procure, design and construct energy storage facilities in the local resource adequacy markets. In the summer of 2017, SDG&E submitted an advice letter for approval of the project and the project began. In eighth months, the projects were commissioned and actively participating in the markets.	
<u>Update:</u> The two energy storage systems are located in Escondido and El Cajon and were commissioned in March of 2017. The facility in Escondido is the largest lithium-ion energy storage system in the world with 30MW/120MWh. The El Cajon facility is 7.5MW/30MWh. Today, both facilities are participating in the CAISO markets. <sup>19</sup>	

## IN-PROGRESS PROJECTS

<b>Project 9: Solar Energy Project</b>	
<b>Funding Source: Application (A.08-07-017)</b> <b>Project Timeframe: 01/2008 to 06/2017</b>	Reporting Period Estimated Costs: \$9,771
<u>Description:</u> The CPUC approved this 100MWdc solar project in 2010. It includes a program to develop up to 26MWdc of utility-owned solar generation and 74 MWdc of merchant-owned generation, to be delivered via power purchase agreements. The utility-owned portion calls for SDG&E to install multiple PV systems, as large as 5MW, on the distribution system. SDG&E anticipates employing smarter inverters, like those advocated by the Western Electric Industry Leaders, at these sites with specific capabilities dependent upon local grid needs and size of the PV installation. Eight projects will be built on existing utility owned property for a total of 17MWdc.	
<u>Update:</u> The two remaining sites entered in to the construction phase of this project in Q2 2016. The EPC Contractor was delayed at the 2.2 MW Pala site, resulting in a three month delay before it could resume. By Q4 2016, The Ramona Solar Project was 90% completed while	

<sup>19</sup> <https://www.energy-storage.news/news/sdge-and-aes-complete-worlds-largest-lithium-ion-battery-facility>

Pala was 15% complete. Due to failure to meet project deadlines on both projects, the EPC contracts were terminated. In April 2017, the Ramona Solar Project went in to commercial operation. The Pala project has yet to be resumed.

<b>Project 10: Borrego Springs Microgrid</b>	
<b>Funding Source: DOE, CEC and GRC</b> <b>Project Timeframe: 04/2014 to 04/2018</b>	Reporting Period Estimated Costs: \$3,241
<u>Description:</u> 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/outage event conditions. The second phase of the Borrego Springs Microgrid project will enhance the existing Borrego Springs Microgrid, by increasing operational flexibility and automation to better respond to a variety of potential outage situations, and leverage various new technologies and resources for increased microgrid capabilities.	
<u>Update:</u> The cells in Borrego 1 Energy Storage System were upgraded and the total output has increased from 500kW to 550kW. The Distributed Energy Resource Management System (DERMS) Wave controller was successfully deployed for Island 1 (Borrego 12kV Cir 170), the cable trays for both generators were upgraded, the UltraCapacitor was installed on the southeast corner, the Real-Time Digital Simulation (RTDS) models have been refined and validated with System Planning's models, and the batteries for the Uninterruptible Power Systems (UPS) have been upgraded to accommodate a five day outage.	

<b>Project 11: Phasor Measurement Units (PMU) – Distribution Fire Threat Zone Area Protection (FTZAP)</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: 06/2012 and ongoing</b>	Reporting Period Estimated Costs: \$4,800
<u>Description:</u> Advanced SCADA Devices (ASD) installed on electric distribution circuits are high fidelity, high resolution, data and control devices connected via high speed Internet Protocol (IP) data transport. ASD provides all the functionality of current legacy SCADA devices, with all the advancements of a PMU: GPS time stamped/time aligned devices, high speed data	

<p><b>Project 11: Phasor Measurement Units (PMU) – Distribution Fire Threat Zone Area Protection (FTZAP)</b></p>	
<p>transport providing advanced data accuracy with multiple data formats from a single device, enables enhanced cyber security, nanosecond accuracy for timed operations, and sequence of events (true system state) displayed on advanced visualization tools.</p>	
<p><u>Update:</u> Distribution PMU deployment activity focused on deployment of Falling Conductor Devices and related algorithms in Fire Threat Zones and High Risk Fire Areas in support of de-energizing a conductor within seconds, reducing risk of contact with persons or property. Device and application installations are done in conjunction with other fire hardening projects as a standard deployment.</p>	

<p><b>Project 12: Supervisory Control and Data Acquisition (SCADA) Capacitors</b></p>	
<p><b>Funding Source: GRC</b> <b>Project Timeframe: 03/2011 and ongoing</b></p>	<p>Reporting Period Estimated Costs: \$544</p>
<p><u>Description:</u> The objective of this project is to convert existing distribution line capacitors to SCADA control 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.</p>	
<p><u>Update:</u> Between June 20, 2016 and July 30, 2017, ten capacitors were installed and energized to replace ten older overhead and pad-mounted non-SCADA capacitors.</p>	

<p><b>Project 13: SCADA Expansion – Distribution</b></p>	
<p><b>Funding Source: GRC</b> <b>Project Timeframe: 01/2012 and ongoing</b></p>	<p>Reporting Period Estimated Costs: \$1,496</p>
<p><u>Description:</u> This project will install 300 SCADA line switches to promote a minimum of one and a half 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 providing faster isolation of faulted electric distribution circuits that in turn will result in faster load restoration when system disturbances occur.</p>	

<b>Project 13: SCADA Expansion – Distribution</b>	
<p><u>Update:</u> During the reporting period, SDG&amp;E installed SCADA at Carlton Hills substation. Jobs are in construction and design to address adding SCADA to Descanso, Rancho Santa Fe, Warners, Poway, and Pendleton substations. Capistrano substation will be rebuilt with SCADA as part of the Southern Orange County Reliability Enhancement project recently approved by the CPUC. Additionally, SCADA capabilities on C313, C461, C595, and C593 have been implemented.</p>	

<b>Project 14: Wireless Fault Circuit Indicators</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: 09/2011 and ongoing</b>	Reporting Period Estimated Costs: <\$100
<p><u>Description:</u> The objective of this project is to install as many as 10,000 wireless fault indicator (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.</p>	
<p><u>Update:</u> SDG&amp;E is working to resolve technical issues associated with the latest firmware update. The project is in the process of upgrading the equipment, which will include enhanced fault location indicating ability even when the continuous current on the line is less than five amps. New equipment will be installed over the next few years.</p>	

<b>Project 15: Power Your Drive (PYD)</b>	
<b>Funding Source: A. 14-04-014</b> <b>Project Timeframe: 09/2011 and ongoing</b>	Reporting Period Estimated Costs: \$2,196
<p><u>Description:</u> Power Your Drive was established by San Diego Gas &amp; Electric (SDG&amp;E) and approved by the California Public Utilities Commission (CPUC) as a pilot program. It is designed to integrate the charging of electric vehicles (EVs) with the grid through an hourly rate. Power</p>	

<p><b>Project 15: Power Your Drive (PYD)</b></p>	
<p>Your Drive seeks to satisfy this objective through the installation of up to 3,500 EV charging stations at 350 apartments, condominiums and places of work.</p> <p>Under the terms of Power Your Drive, SDG&amp;E maintains ownership of the infrastructure to simplify the experience for customers installing chargers and to ensure the reliability of the charging network. Customers that participate in the program are assessed a nominal one-time participation payment unless the site is within a designated disadvantaged community, in which case, the participation payment is waived.</p> <p>Power Your Drive sites are either multifamily dwellings or workplaces with an overall goal to reach at least 40% of installations in multifamily communities. Additionally, the program aims to provide deployment in areas that have higher than average levels of pollution by setting a target of at least 10% of installations in designated disadvantaged communities.</p>	
<p><u>Update:</u> SDG&amp;E had focused on customer outreach while developing and implementing a planning and engineering process, and soliciting and awarding construction contracts. SDG&amp;E has contracted all of its 118 contracted sites during this reporting period, totaling more than 1,350 charging ports. Over 350 potential customers have indicated interest in Power Your Drive participation during this reporting period, for a total of 661 customers.</p> <p>SDG&amp;E submitted its first required semi-annual report to the CPUC on the progress of the vehicle-grid integration (VGI) program in March 2017, and the second semi-annual report to the CPUC will be filed in September 2017. Four projects sites are completed, with bills being generated utilizing the grid-integrated hourly program rate, the first of its kind for a utility EV charging program. The first vendor has completed all required Solutions Acceptance Testing, information security and meter testing, allowing the program to continue to start construction at more sites with eager to charge EV drivers. Power Your Drive is on track to finish out the year strongly with continued vendor testing, site construction and site contracting.</p>	

<p><b>Project 16: Distributed Energy Resource Management System (DERMS)</b></p>	
<p><b>Funding Source: GRC</b></p>	<p>Reporting Period Estimated Costs: \$2,461</p>

<b>Project 16: Distributed Energy Resource Management System (DERMS)</b>	
<b>Project Timeframe: 04/2013 and ongoing (currently estimated to complete Q2 2018)</b>	
<p><u>Description:</u> The purpose of the DERMS project is to develop a software solution to monitor, control, and optimize distributed energy resources.</p> <ol style="list-style-type: none"> <li>1. Integrates and aggregates batteries, solar, generators, and other distributed energy resources (DER) for reliability and market participation</li> <li>2. Uses load forecasting, day-ahead price signals, DRMS, etc. to give multiple options for optimization and scenario-based operations</li> <li>3. Ability for future integration with DMS, GIS, DRMS, etc.</li> </ol>	
<p><u>Update:</u> During the Reporting Period, the project has deployed its third version of DERMS application the Borrego Springs Microgrid, as well as the first application at the Carmel Valley energy storage site (April 2017). This release, which includes three apps—Monitor and Control, Advanced Energy Storage and Microgrid—provides the user with the ability to create reservations for SDG&amp;E’s battery operations, view/modify scheduled operations as well as operate in real time. Additionally, the Microgrid app provides improved visibility of operational constraints of the microgrid (e.g. time to live) and functionality based on user-selected objectives (e.g. least cost), which simplifies and dramatically improves microgrid operations. The upcoming release (scheduled to deploy in October 2017) will incorporate additional DER (ultracapacitor, PV plant, energy storage) and provide enhanced usability and functionality. The AES application allows operators to manage, schedule and dispatch fleets of battery systems in a uniform and consistent manner.</p>	

### 2.3.3.3 TRANSMISSION AUTOMATION AND RELIABILITY

Transmission Automation and Reliability (TAR) includes projects that 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 mitigate voltage fluctuations resulting from integrating intermittent resources.

The wide-area capabilities of TAR provides 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 includes projects for coordination of high-speed communicating transmission protection equipment that detects events or conditions in the transmission systems and automatically responds to stabilize the system.

## IN-PROGRESS PROJECTS

<b>Project 17: Automated Fault Location</b>	
<b>Funding Source: FERC</b> <b>Project Timeframe: 04/2012 and ongoing</b>	Reporting Period Estimated Costs: \$248
<p><u>Description:</u> This project implements a system that automatically retrieves event reports from relays on all affected transmission lines and distribution feeders and stores the events in a central server. The TEAM software calculates the fault location and type from the retrieved data, and sends out email notifications within seconds. It also synchronizes the events with Wide Area Situational Awareness (WASA) visualization display for the operators and engineers to view details of the fault for immediate crew dispatch, and post-event analyses. The fault calculation is performed with greater accuracy than the single ended calculation performed by the relays today. The project will avoid truck rollouts to physically dispatch technicians to download relay event records, and avoid line patrols and helicopter dispatches. The project will assist in rapid service restoration and minimize outage duration, post event analyses, and regulatory reporting.</p>	
<p><u>Update:</u> During the reporting period, installation was completed at 58 substations. Currently the events are being retrieved remotely at a minimum once daily. A solution to reduce retrieval time to five minutes after the event occurs is being deployed in a pilot at five substations. Additional functionalities are being added/planned as below:</p> <ol style="list-style-type: none"> <li>1. Implement Travelling Wave Fault location</li> <li>2. Retrieve (Digital Fault Recorder) DFR and (Power Quality) PQ events into the TEAM Server</li> <li>3. Develop and install software to display events from relays, DFRs and PQ meters in a unified display instead of separate software for each type of device. This will make post-event analysis and decision making faster</li> <li>4. Develop Geospatial display with GIS map and weather data to visually provide fault location and type of fault and disturbance.</li> </ol>	

<b>Project 18: Phasor Measurement Units (PMU) – Transmission</b>	
<b>Funding Source: FERC</b> <b>Project Timeframe: 2010 and ongoing</b>	Reporting Period Estimated Costs: \$2,175
<p><u>Description:</u> The objective of this project is to install high-speed and high precision GPS time synchronized PMUs in SDG&amp;E's bulk power transmission lines and renewable interconnections.</p>	



<b>Project 18: Phasor Measurement Units (PMU) – Transmission</b>	
<p>PMUs take real-time synchronized phasor measurements (synchrophasors) at 30 to 60 samples per second compared to the current EMS (Energy Management System) at every 4 seconds. This information can provide accurate and high time resolution snapshots of the grid conditions for the entire Western Interconnected System. The information will be used to provide the operators, engineers, and planners with Wide Area Situational Awareness (WASA) that will help in understanding and mitigating system outages to avoid system instability. The WASA system based on synchrophasors will provide the System Operators with applications / tools to quickly assess the dynamic system conditions and events and enable them to take quick actions to avoid wide area system blackouts, the real-time Voltage Stability and Oscillation detection capability and offer corrective actions.</p>	
<p><u>Update:</u> The project deployed an extensive and robust synchrophasor network consisting of an array of PMUs covering the entire 500 &amp; 230 KV system and transmission level renewable interconnections. A new network architecture for future CIP compliance and production grade hardware and software for Grid Operations in both Primary and Backup Control Centers and Data Centers was also installed. Wide area situational awareness system has been deployed at Grid Operations as a non-operational tool. Work has begun on engineering and design for PMU installation at critical 138 &amp; 69kV substations.</p>	

<b>Project 19: SCADA Expansion – Transmission</b>	
<b>Funding Source: FERC</b> <b>Project Timeframe: 09/2011 and ongoing</b>	Reporting Period Estimated Costs: \$1,860
<p><u>Description:</u> This project will install SCADA at existing substations. This automation will allow for faster isolation of faults, result in faster load restoration, and enhance customer satisfaction when system disturbances occur.</p>	
<p><u>Update:</u> During the reporting period, SDG&amp;E completed the implementation of SCADA at the Carlton Hills and San Ysidro substations. This implementation will increase reliability in the surrounding areas.</p>	

#### 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 based approach. This functionality helps to avoid critical energy infrastructure failures as well as manage costs associated with maintaining and replacing equipment.

#### COMPLETED PROJECTS

<b>Project 20: Advanced Ground Fault Detection</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: Completed</b>	Reporting Period Estimated Costs: \$220
<p><u>Description:</u> 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.</p> <p><u>Update:</u> Installation of the remaining equipment sites was completed during the Reporting Period.</p>	

<b>Project 21: Condition-Based Maintenance (CBM) – Substation Transformers</b>	
<ul style="list-style-type: none"> <li>• <b>Substation Advanced Analytics (SAA)</b></li> </ul>	
<b>Funding Source: GRC and FERC</b> <b>Project Timeframe: Completed</b>	Reporting Period Estimated Costs: \$295
<p><u>Description:</u> The objective of this project is to extend the useful life and improve utilization of distribution substation transformers. The project will utilize technology to monitor the performance/condition of system assets and will provide actionable alerts when attention is required. Substation Advanced Analytics technology includes:</p> <ol style="list-style-type: none"> <li>1. Advanced analytical features for substation assets to use in business planning, operations, and engineering</li> <li>2. Improved dissolved gas analysis (DGA) software for both the main tank of a transformer, and a transformer's load tap changer (LTC)</li> </ol>	

<p><b>Project 21: Condition-Based Maintenance (CBM) – Substation Transformers</b></p> <ul style="list-style-type: none"> <li>• <b>Substation Advanced Analytics (SAA)</b></li> </ul>	
<p>3. Automated calculations required to determine the real-time loading capability of a transformer (What If/Load Spike Software) and determine a transformer’s true remaining life utilizing existing CBM data (Loss of Life Software)</p>	
<p><u>Update:</u> The software platform was chosen to analyze the health and risk of every transformer, circuit breaker, and battery within SDG&amp;E substations. The software was installed, tested, and put into production in September of 2016. Efforts are ongoing to enhance the analytics behind the scenes, but all major components are functioning. This project is complete with only minor enhancements and maintenance ongoing.</p>	

<p><b>Project 22: Smart Transformers</b></p>	
<p><b>Funding Source: GRC</b> <b>Project Timeframe: Completed</b></p>	<p>Reporting Period Estimated Costs: \$&lt;100</p>
<p><u>Description:</u> The objective of the Smart Transformers 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.</p>	
<p><u>Update:</u> During the Reporting Period, SDG&amp;E reviewed data from previously installed monitors.</p>	

<p><b>Project 23: Advanced Distribution Management System (ADMS)</b></p>	
<p><b>Funding Source: GRC</b> <b>Project Timeframe: Completed</b></p>	<p>Reporting Period Estimated Costs: \$2,943</p>
<p><u>Description:</u> The scope of the ADMS project is to implement new functions within the new Outage Management System/Distribution Management System (OMS/DMS) system to support current and future Smart Grid initiatives for managing the electric distribution grid. The purpose of phase 2 is to model and integrate DER into DMS. This phase will model the capabilities of these assets in the Network Management System (NMS), improve power flow</p>	

<b>Project 23: Advanced Distribution Management System (ADMS)</b>	
<p>forecasts, enhance DMS functionality, and provide transparency to the impacts of these assets on the electric distribution grid. Phase 3 will focus on further optimization of power flow and other DMS functions, provide better visualization to the operators, as well as the roll out Fault Location Isolation and Service Restoration (FLISR) in automatic mode to the entire eligible SDG&amp;E service territory.</p>	
<p><u>Update:</u> During the reporting period, Phase 3 was completed which provides additional functionalities such as optimal power flow results, the ability to view feeder load management results for any device on the system, and improved Fault Location Isolation and Service Restoration (FLISR) configurations for the utility and expanded automatic FLISR functions to the entire eligible SDG&amp;E service territory.</p>	

<b>Project 24: Solar Power Prediction</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: Completed</b>	Reporting Period Estimated Costs: <\$100
<p><u>Description:</u> The Solar Power Prediction Engine (SPEE) website is active and data for 12 sites is refreshed daily. Files contain Day Ahead (DA), standard solar power generation prediction data which is provided up to five days ahead at one-hour granularity. Solar power generation prediction data is provided up to two hours ahead at five-minute granularity.</p>	
<p><u>Update:</u> The project team continues to provide daily forecast and work on development of the Solar Potential Index (SPI). New internal groups have begun to leverage this data including the Procurement, Customer Pricing, and Grid Modernization departments.</p>	

**IN-PROGRESS PROJECTS**

<b>Project 25: Distribution Interconnection Information System (DIIS)</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: 09/2008 to 06/2017</b>	Reporting Period Estimated Costs: <\$100

<p><b>Project 25: Distribution Interconnection Information System (DIIS)</b></p>	
<p><u>Description:</u> DIIS was implemented in February 2013 and is used for solar contractors and self-installers to submit and track their Net Energy Metering (NEM) applications. DIIS phases 2 and 3 enhanced the Remote Meter Configuration (RMC) automated process to reduce back-end supporting activities, in order to reduce the cost of supporting the NEM program. The projects also implemented CPUC mandated additional questions to the online NEM application forms, and made several user interface improvements benefitting the external end-users as well as internal support staff. In addition, changes were made to simplify and streamline the NEM application “fast track” option. The program has been recognized by the CPUC as the best method for processing NEM applications and the application received a patent in 2017.</p>	
<p><u>Update:</u> DIIS Phase 3 delivered a tool to calculate the loading on transformers, forms for NEM Paired (solar paired with advanced energy storage) applications, replacement of the existing My Partners web portal, improvement to the Remote Meter Configuration (RMC) for changing meters over-the-airways, auto approval of applications within certain parameters, enhancements to improve business process efficiency and customer experience.</p>	
<p>DIIS Phase 4 expanded the DIIS system to include automation of City/County inspection process, Renewable Meter Adapter (RMA) application and payment collection, expanded automation for Rule 21 applications, increased data sent to the Engineering Data Warehouse (EDW) for easier regulatory reporting, digital forms for the Backup Generator process, and the creation of performance scripts to help isolate and resolve technical bottlenecks.</p>	

<p><b>Project 26: Condition-Based Maintenance (CBM) – Gas Breakers</b></p>	
<p><b>Funding Source: FERC</b> <b>Project Timeframe: 09/2013 to 12/2019</b></p>	<p>Reporting Period Estimated Costs: \$2,011</p>
<p><u>Description:</u> This project aims to extend the useful life and make greater utilization of the transmission sulfur hexafluoride (“SF6”) gas insulated substation circuit 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. The project scope is to comply with 1% SF6 Emissions Regulations in 2020 and reduce major overhaul periodicity related to contact interrupter wear. The deployment of gas</p>	

<p><b>Project 26: Condition-Based Maintenance (CBM) – Gas Breakers</b></p>	
<p>circuit breaker SF6 monitoring equipment will enhance the tracking and “manual” CBM program. This technology will also monitor the gas within the circuit breaker allowing for early detection of any leaks to ensure compliance with applicable environmental regulations.</p>	
<p><u>Update:</u> During the Reporting Period, the team continued to install and commission monitors in the field. These monitors are producing benefits immediately by "providing information on the health of the circuit breaker's contacts/interrupters, thus allowing major overhaul maintenance to be deferred from 10 years to 18 years. Rather than performing intrusive maintenance by opening the breaker to determine the health of its contacts, we are able to obtain this info from the monitor and perform a minor (non-intrusive) overhaul. The savings realized is the cost differential between the two maintenance activities.</p>	

<p><b>Project 27: Smart Grid Enabled Energy Efficiency</b></p>	
<p><b>Funding Source: Energy Efficiency (D.14-10-046)</b> <b>Project Timeframe: 01/2015 and ongoing</b></p>	<p>Reporting Period Estimated Costs: \$192</p>
<p><u>Description:</u> SDG&amp;E has proposed two high opportunity programs; a multifamily program and retrocommissioning program. These programs would enable savings to be calculated based on customers’ existing conditions.</p>	
<p><u>Update:</u> For 2016, SDG&amp;E’s efforts resulted in savings of approximately 346 GWH, reduced energy demand by approximately 93 MW, and saved approximately 3.6 million therms. All together, these savings are enough to supply energy to over 63,000 homes annually. In addition to helping customers save energy and money, these gas and electric energy savings have reduced CO2 emissions by over 351,000 tons.</p> <p>For the first quarter of 2017, SDG&amp;E reported 43.8 GWH, 8.9 MW and 405,359 therms.</p> <p>SDG&amp;E filed its 2018 EE Application (A.17-01-014) describing its proposed EE Business Plan that will address the new goals resulting from SB 350. The CPUC also directed changes to program administration for statewide programs and increased the minimum threshold for third party program implementation to 60% by 2020. A final decision approving the application is expected by December 2017.</p>	

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### 2.3.3.5 SECURITY

Physical and cyber security protection of the electric grid is essential and becomes more so as more intelligent edge devices are 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 the application layers.

## IN PROGRESS PROJECTS

<b>Project 28: Cybersecurity Projects</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: Ongoing</b>	Reporting Period Estimated Costs: \$10,500
<p><u>Description:</u> SDG&amp;E's cybersecurity projects include efforts in risk and vulnerability management, operations, compliance, research, and improving the protection of customer privacy. Costs for the physical and cyber security of all Smart Grid systems are not isolated within these projects. Other Smart Grid projects also include additional, specific cybersecurity costs related to the project scope or technology. All other Smart Grid investments include additional security-related costs, particularly those that are specific to the project scope or technology.</p> <p>As this <i>Annual Report</i> is a public document, details of SDG&amp;E's security projects are omitted.</p>	

<b>Project 29: Customer Privacy Program</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: Ongoing</b>	Reporting Period Estimated Costs: \$2,720
<p><u>Description:</u> In March 2011, as the CPUC's decision to implement new privacy rules for the electric investor-owned utilities was being revised, SDG&amp;E developed its customer privacy program. This program established a cross-functional privacy committee reporting to a lead director on privacy and ultimately the Chief Customer Privacy Officer of the company. In October 2012, the Office of Customer Privacy took over formal responsibility for the company's privacy-related framework, controls workbook, impact assessments, employee training, and its process for sharing customer data with third parties. SDG&amp;E implemented Privacy GreenLight in response to the Data Request and Release Process (DRRP). Privacy GreenLight access assists third parties with requests for customer energy data that cannot be satisfied by public records. Privacy GreenLight helps ensure that authorized third parties are eligible to receive data, have a relevant business case for receiving the data, and can protect customer energy usage data while it is in their possession.</p>	



**Project 29: Customer Privacy Program**

Update: While Privacy GreenLight was developed in order to manage data-sharing transactions for which no customer consent is required, SDG&E is currently automating the process it uses to manage Letters of Authorization for sharing transactions that do require customer consent. Called Consent to ShareSM (CtS), this application will provide customers and third parties an online mechanism to submit, track, manage and revoke customer authorization to share their data with third parties. Further, it will automate several backend processes used to validate forms in an effort to reduce processing time, resulting in a better experience for customers and third parties who rely on customer authorization for data sharing purposes. CtS is expected to launch in Q4 2017.

<b>Project 30: Substation Physical Security Hardening</b>	
<b>Funding Source: FERC</b> <b>Project Timeframe: 01/2011 and ongoing</b>	Reporting Period Estimated Costs: \$19,300
<u>Description:</u> Project installs and upgrades physical and electronic security at substation locations in accordance with industry best practices, regulatory requirements, and changing geopolitical threat vectors. Technology installs and upgrades, physical deterrence implementations, revisions to business processes, and personnel training are included in scope. As this Annual Report is a public document, details of SDG&E's security projects are omitted.	

### 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 and 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 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 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.

## COMPLETED PROJECTS

<b>Project 31: Integrated Test Facility</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: 09/2012 and ongoing</b>	Reporting Period Estimated Costs: <\$100
<u>Description:</u> The SDG&E Integrated Test Facility (ITF) is used to support electric system and information technology integration for smart concept evaluation and testing for 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.	
<u>Update:</u> SDG&E continued to leverage the ITF facility during the Reporting Period. Project test results have provided valuable information to key areas of study. Each lab produced meaningful work that has been presented at industry events and shared with industry peers and stakeholders.	

## IN-PROGRESS PROJECTS

<b>Project 32: Electric Program Investment Charge (EPIC) Program</b>	
<b>Funding Source: EPIC and CPUC</b> <b>Project Timeframe: Ongoing</b>	Reporting Period Estimated Costs: \$5,800
<u>Description:</u> SDG&E's First and Second Triennial EPIC Triennial Applications have been approved by the CPUC. The EPIC projects are limited to pre-commercial demonstrations by order of the CPUC. SDG&E's currently approved projects fall into the following areas: Advanced Distribution Automation, Renewable and Distributed Energy Resource Integration, Grid Modernization and Optimization, and Integration of Customer Systems into Electric Utility Infrastructure. SDG&E's application for the third EPIC cycle has been filed and is under review by the CPUC.	
<u>Update:</u> Eleven projects are underway—five from the EPIC-1 triennial application and six more from the EPIC-2 triennial application. The projects are all nearing completion. Formal EPIC status reports are filed annually with the CPUC, as ordered by the CPUC. Comprehensive final project reports will be filed with the CPUC, as the projects are completed.	

<b>Project 33: Unmanned Aircraft System (UAS)</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: 01/2013 and ongoing</b>	Reporting Period Estimated Costs: <\$100

<b>Project 33: Unmanned Aircraft System (UAS)</b>	
<p><u>Description:</u> The objective of the program is to research and evaluate SDG&amp;E UAS use cases. The program will enhance the unmanned aircraft system to meet SDG&amp;E requirements (e.g., camera technologies, proximity sensors, on-board data storage, enhanced data streaming, Infrared, Gas sensors, multispectral), as well as investigate &amp; research capabilities of flight pattern software (preprogramed flight pattern), data storage, anomaly detection software and a customer notification system. The desired result would be to have the UAS technology available to use by field crews as another tool in their tool box.</p>	
<p><u>Update:</u> The FAA Part 107 rules have now been implemented, which now allows anyone to take a test to obtain a Remote Pilot Certificate, which is required for UAS Commercial Operations. Our Aviation Services Department created as UAS Training Program which will allow for internal employees to be trained and certified. Once the training has been completed, the employee is granted the permissions internally to utilize a UAS within their daily work operations as needed. SDG&amp;E began to deploy the units to employees within the company and have become the UAS Program Management group which oversees of all internal/contractor operations. As technology continues to improve, SDG&amp;E has purchased an Infrared(IR) Sensor which can be utilized as a radiometer data which is required to analyze “hot spot” within our ground base and overhead electric equipment. This allows IR data to be collected at a closer proximity which collects more accurate temperature reads. SDG&amp;E has tested and can successfully provide anyone a live stream of the video data being collected by the UAS.</p>	

## ENTERPRISE PROJECTS

<b>Project 34: Workforce Development</b>	
<b>Funding Source: GRC</b> <b>Project Timeframe: Ongoing</b>	
<p><u>Description:</u> This project focuses on internal employee development and external employee acquisition in locations like universities.</p>	
<p><u>Update:</u> Workforce development initiatives continue to ensure that existing employees’ skills advance and future hires have the necessary experience for a career at the smart utility. SDG&amp;E has utilized the Information Technology and Engineering intern programs to cross-train engineers. Internal employee development continues to build the future of the company.</p>	

<p><b>Project 35: Data Management and Analytics</b></p> <ul style="list-style-type: none"> <li>• Enterprise Analytics System (EAS)</li> <li>• Customer Analytics System (CAS)</li> <li>• Operational Analytics Systems (OAS)</li> <li>• Smart Grid Analytics (SGA)</li> </ul>	
<p><b>Funding Source: GRC</b></p> <p><b>Project Timeframe: Complete</b></p>	
<p><u>Description:</u> The Data Management and Analytics project will provide infrastructure to store and analyze the vast amounts of data generated by existing applications and 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.</p>	
<p><u>Update:</u> The Smart Grid Analytics (SGA) project made historical weather station data available for analytical use. This capability was put into service in December 2016. The project is complete.</p>	

<b>Project 36: The California Systems for the 21st Century Collaboration (CES-21)</b>	
<b>Funding Source: SB96 and CPUC Authorization Decision</b> <b>Project Timeframe: 10/2014 to 10/2019</b>	
<p><u>Description:</u> CES-21 involves the CPUC and California IOUs collaborating with Lawrence Livermore National Laboratory (LLNL) on two specific research objectives: Cybersecurity and Grid Integration. Cybersecurity will focus on Machine to Machine Automated Threat Response research and Grid Integration will focus on Flexibility Metrics and Standards research focused on renewables impact.</p>	
<p><u>Update:</u> During the Reporting Period the Idaho National Laboratory CES-21 test bed was operational with Southern California Edison (SCE) equipment and with San Diego Gas and Electric (SDG&amp;E) hardware installation being completed in Q4 2016. Pacific Gas and Electric (PGE) is in the process of completing the contractual effort with INL and is completing their bill of materials. Overall cybersecurity tasks continue to increase research momentum on industrial control system cybersecurity focused on Machine to Machine Automated Threat Response (MMATR). SDG&amp;E research on a Secure SCADA Protocol and Quantum Key Distribution using entangled photon technologies demonstrated a first ever breakthrough in this technology. The program continues outreach to other cybersecurity research efforts of national significance for leverage and non-duplication of effort visibility. Throughout Q1 and Q2 2017 cybersecurity engineers presented findings a cybersecurity conferences. The Grid Integration Project's five phases were completed. During Q2 2017 the final models took shape and a workshop was conducted in early Q3 2017 to share final results with stakeholders. The LLNL High Performance Computing (HPC) capability has been helpful in cutting down model run times speeding up the overall research</p>	

## 2.4 CUSTOMER ROADMAP

### 2.4.1 INTRODUCTION / BACKGROUND

SDG&E's overarching goals of Smart Grid customer marketing, education, and outreach are to enable and motivate customers' energy management through smart energy devices, new products and services, increased energy-efficiency/demand response, and adoption of plug-in electric vehicles and renewable resources. Those goals can be achieved with the use of in-home displays, control of individual appliances, and/or energy management systems and whole home controllers.

SDG&E's Customer Roadmap describes the customer outreach and engagement plans needed to support the 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.

## 2.4.2 CUSTOMER OUTREACH AND ENGAGEMENT PLANS

In its March 2012 *Smart Grid Workshop Report*, CPUC staff requested that the following information be included in utilities' *Smart Grid Annual Reports*:

- Timeline that connects specific projects with specific marketing, education, and outreach efforts
- Identification of current customer engagement roadblocks and strategies to overcome them

As requested by CPUC staff, SDG&E is providing marketing, education, and outreach information using the sample template in Appendix 1 to the March 2012 *Smart Grid Workshop Report*.

Timeline: SDG&E has adapted the CPUC staff's template to reflect the existing and planned work that is related to its various Smart Grid projects.

Customer Engagement: For each of the project initiative categories, SDG&E has provided details on existing or proposed marketing, education, and outreach in accordance with the proposed template from the CPUC's *Smart Grid Workshop Report*.

## 2.4.3 CUSTOMER ENGAGEMENT TIMELINE

The following table illustrates the customer engagement timelines based on the four initiative types: Enablement Tools, Customer Premise Devices, Rates and Programs, and Pilot Deployment Projects.

**Table 4: Customer Outreach and Engagement Timeline by Initiative**

	2016	2017	FY 2018
<b>Enablement Tools</b>			
Green Button Connect My Data	X	X	X
Green Button Download My Data			
<b>Customer Premise Devices</b>			
Smart Meters	X	X	X
HAN Projects	X	X	X
<b>Rates and Programs</b>			
Connected . . . to the Sun	X	X	X
Smart Grid Demand Response	X	X	X
Smart Pricing Program (Dynamic Pricing)	X	X	X
Digital Roadmap	X		
Community and Stakeholder Engagement	X	X	X
Smart Grid Enabled Energy Efficiency	X	X	X
Customer Privacy Program	X	X	X
<b>Pilot Deployment Projects</b>			
Borrego Springs Microgrid	X	X	X
Power Your Drive (PYD)	X	X	X



#### 2.4.4 OVERVIEW OF THE CUSTOMER ENGAGEMENT PLAN

Customer choice is a potent driver of SDG&E's Smart Grid deployment plan. SDG&E customers are adopting rooftop solar and plug-in electric vehicles at rates that are among the highest in the nation. They are seeking real-time information about their energy usage and rates in order to make more informed decisions. Some are looking for opportunities to participate in energy markets through demand response, TOU rates, distributed generation, and energy storage.

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."<sup>20</sup>

Through these projects, SDG&E will work with customers and service providers to increase customer 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."<sup>21</sup> 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.

#### 2.4.5 SMART GRID BY ENGAGEMENT INITIATIVE

In this section, SDG&E describes the customer engagement elements as requested by CPUC staff in its March 1, 2012 *Smart Grid Workshop Report*.

**Table 5: Customer Engagement Initiative - Enablement Tools**

	<b>Enablement Tools</b>
Project Description	Marketing, Education & Outreach (ME&O) to provide energy usage information directly to customers to help them manage their energy use and reduce their energy costs.
Target Audience	Primarily residential and small commercial customers (< 20 kW peak load).

<sup>20</sup> SDG&E *Smart Grid Deployment Plan* 2012 Annual Report, Oct. 1, 2012.

<sup>21</sup> Ibid.

	<b>Enablement Tools</b>
Sample Message	Download your electricity use data with the simple click of a button.
Source of Messaging	Utility and third-party partners.
Current Roadblocks	<ul style="list-style-type: none"> <li>- Customers are not aware of how much energy they use, when they use it, or how much it costs.</li> <li>- Energy usage is a low-engagement activity, and many customers would rather not spend time thinking about it or their costs.</li> <li>- Customers don't know what new energy-saving technologies are available.</li> </ul>
Strategy to Overcome Roadblocks	<ul style="list-style-type: none"> <li>- Find new and better ways to engage customers using personalized energy reports and energy usage alerts via email and text messages.</li> <li>- Understand customer segments and how they want to be engaged.</li> <li>- Act as a trusted energy advisor by promoting programs and pricing options as they become available.</li> </ul>

**Table 6: Customer Engagement Initiative - Customer Premise Devices**

	<b>Customer Premise Devices</b>
Project Description	ME&O to enable customers to have an unprecedented understanding of their energy usage and ensure the Home Area Network (HAN) capabilities in Smart Meters continue to be tested and developed.
Target Audience	<ul style="list-style-type: none"> <li>• All customers across the SDG&amp;E service territory with a Smart Meter.</li> <li>• Primarily residential and small commercial customers (&lt; 20 kW peak load).</li> </ul>
Sample Message	<ul style="list-style-type: none"> <li>- Smart Meters help save energy and money.</li> <li>- Smart Meters allow for two-way communication between the customer and the utility.</li> <li>- This new technology will also help you make smart choices to save energy and money on your bill.</li> </ul>
Source of Messaging	Utility
Current Roadblocks	<ul style="list-style-type: none"> <li>- Customers who might benefit from reducing use on critical days have a low awareness level.</li> <li>- Customer HAN devices might appear confusing to average customers, so adoption levels are low.</li> </ul>

Strategy to Overcome Roadblocks	<ul style="list-style-type: none"> <li>- Educate customers about TOU rates options as they are introduced.</li> <li>- Provide customers with information about Smart Meters, focusing on the benefits and simple energy management tools they enable.</li> </ul>
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**Table 7: Customer Engagement Initiative - Rates and Programs**

	<b>Rates and Programs</b>
Project Description	<ul style="list-style-type: none"> <li>• ME&amp;O to inform customers of TOU and tiered rate options to better meet their energy usage needs in a cost-effective way.</li> <li>• Connected... to the Sun program will give customers options to buy solar power even if they do not own a home, cannot afford the upfront costs, or do not have the ability to put solar panels on their roof.</li> <li>- Provide customers with information on EV TOU rates and help them understand the benefits of charging their car when prices are at their lowest.</li> </ul>
Target Audience	<ul style="list-style-type: none"> <li>• All customers across the SDG&amp;E service territory with a Smart Meter who could benefit from load shifting with the proper pricing plan options.</li> <li>• Connected... to the Sun: residential and business customers.</li> <li>• EV drivers, those looking to purchase or lease EVs, and fleet operators.</li> </ul>
Sample Message	<ul style="list-style-type: none"> <li>- Save energy during on-peak periods to reduce your energy costs and on Reduce Your Use days, you can be rewarded with a credit on your SDG&amp;E bill.</li> <li>- SDG&amp;E's EV TOU rates will help you pay the lowest price for your EV fuel when you charge from midnight to 5 a.m.</li> <li>- Assist California in meeting its goals to reduce 13 million tons of greenhouse gasses by 2020 – about 40% come from transportation.</li> </ul>
Source of Messaging	Utility
Current Roadblocks	<ul style="list-style-type: none"> <li>- Most customers are not aware of current or upcoming TOU rate options.</li> <li>- Small commercial customers that transition to TOU pricing by default may not be aware how this will impact their bill based on current usage patterns and might not be able to shift their usage due to their type of business.</li> <li>- Customers often have concerns about their privacy and how their data is being used by the utility or third parties. Third parties sometimes claim that it is difficult to obtain customer data that they are authorized to receive.</li> </ul>

	<b>Rates and Programs</b>
Strategy to Overcome Roadblocks	<ul style="list-style-type: none"> <li>- Sustained, ongoing outreach to customer segments about new rate options, along with bill comparison tools to enable customers to make informed choices.</li> <li>- Inform customers about the Reduce Your Use program with financial incentives for energy savings on critical days.</li> <li>- Use mass media and customer’s preferred channel to communicate when Reduce Your Use days are called.</li> <li>- Develop services that: a) provide customers with more control regarding the sharing of their data and make it easier for them to allow and revoke access to third parties; and b) allow authorized third parties to access customer data using more self-service mechanisms.</li> </ul>

**Table 8: Customer Engagement Initiative - Pilot Deployment Projects**

	<b>Pilot Deployment Projects</b>
Project Description	<ul style="list-style-type: none"> <li>- Develop microgrids to improve reliability and leverage renewable energy to power an entire remote community in SDG&amp;E’s territory.</li> <li>- Ensure that the VGI Pilot Program is readily available to customers who need it.</li> </ul>
Target Audience	Long duration parking opportunities such as multi-unit dwellings and workplaces where electric vehicle charging is not currently available.
Sample Message	<ul style="list-style-type: none"> <li>- Microgrid technologies can help improve electric system reliability and use abundant renewable resources.</li> <li>- Microgrids help charge EVs when energy costs are low and supply is plentiful, such as renewable resources.</li> </ul>
Source of Messaging	Utility
Current Roadblocks	<ul style="list-style-type: none"> <li>- Microgrid technologies can be complex and difficult to explain.</li> <li>- TOU and other dynamic rates can be challenging for some customers.</li> </ul>
Strategy to Overcome Roadblocks	<ul style="list-style-type: none"> <li>- Use direct interactions (e.g., community meetings) and easy-to-understand materials to explain benefits of microgrids, such as videos.</li> <li>- Develop easy-to-use tools for customers to simplify management of TOU and other dynamic rates.</li> </ul>

## 2.5 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. Each risk is assigned a residual risk level based on the exposure remaining after action is taken to mitigate the potential threat. The risks identified here are only Smart Grid related and should not be compared to SDG&E's enterprise level risks.

**Table 9: Risk Assessment Information by Category**

Key Risk Category	Likelihood/Probability	Impact/Consequences	Current Actions Taken
1. Reliability	<p>Medium</p> <p>Many factors, including the intermittency of renewable generation sources, changes in load patterns, breaches of system security, and new technologies, lend themselves to a high probability of having the potential to negatively affect system and local distribution reliability.</p>	<p>Medium</p> <p>Particularly where intermittent distributed renewables, electric vehicles, and other new technologies are concentrated into clusters, the impacts of intermittent supply or demand can be impactful.</p>	<p>Many of SDG&amp;E's Smart Grid projects are designed to maintain or improve overall and distribution system reliability, including projects in each of the six program areas addressed in this <i>Annual Report</i>.</p>
2. Rates	<p>High</p> <p>The probability that current retail rate designs will trigger significant consequences to the deployment of renewables and require Smart Grid technologies is high.</p>	<p>High</p> <p>Current electric rate policies provide inequitable and inaccurate pricing signals to customers.</p>	<p>SDG&amp;E is working with the CPUC and stakeholders to develop changes in residential rate structures that would more equitably allocate the costs for electric reliability services provided by the utility.</p>

Key Risk Category	Likelihood/Probability	Impact/Consequences	Current Actions Taken
3. Security	<p>High</p> <p>No networked system can be perfectly secure, thus the probability that some security-related issue will affect the operation of the system is high.</p>	<p>High</p> <p>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.</p> <p>Physical security risks related to damage of critical infrastructure resulting from illicit activities continues to be a concern for utilities.</p>	<p>SDG&amp;E has a comprehensive risk-based security program that addresses and mitigates these risks, employing defense-in-depth and other strategies.</p>
4. Safety	<p>Low</p> <p>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 any will be realized.</p>	<p>High</p> <p>The consequences of safety risks that are realized can be devastating.</p>	<p>SDG&amp;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. Strategic location of assets decreases likelihood of safety issues.</p>
5. Technology	<p>High</p> <p>Smart Grid deployment involves a great deal of new or emerging technologies, many</p>	<p>Low</p> <p>Many other major technology deployments have been similarly affected</p>	<p>SDG&amp;E continues to leverage its Integrated Test Facility to test</p>

Key Risk Category	Likelihood/Probability	Impact/Consequences	Current Actions Taken
	of which lack consistent, interoperable industry standards. It is highly probable that a lack of or inconsistency in standards will impact deployments. Potential issues with adequate workforce development also pose a risk to Smart Grid deployments.	in the past. Mitigation efforts can keep these risks from having high impacts on Smart Grid deployments.	interoperability and reduce technical risks in deployment projects. Workforce development programs are being proposed to transfer utility knowledge and develop employees for the future.

## 2.6 SECURITY RISK AND PRIVACY THREAT ASSESSMENT UPDATES

In its *Smart Grid Deployment Plan*, 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.

### 2.6.1 THREAT LANDSCAPE

Cybersecurity 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 systems, 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 toward ensuring NERC CIP version five compliance.

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## 2.6.2 GOVERNANCE, RISK, AND COMPLIANCE

An example of how SDG&E is addressing risks is through its implementation of governance, risk, and compliance processes and solutions. Compliance, including 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 byproduct of good security and privacy programs. SDG&E has been deploying governance, risk, and compliance management (GRCM) tools that enhance the ability to track information assets and map them to security controls.

This effort has continued to integrate cybersecurity processes into the GRCM tools to advance the infrastructure for identifying and tracking the information and cyber assets used within the Smart Grid and has incorporated security operations activities—such as vulnerability management, threat management, cybersecurity engineering, 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, and 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.

### Researching and Looking Ahead

SDG&E recognizes that security is not an end state, but a continual process of improvement that will continue as long as the utility 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 network anomaly detection capabilities. SDG&E is currently working to enhance its ability to monitor distribution SCADA systems and networks.

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#### 2.6.2.1 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 the Reporting Period, made great strides in continuing to implement its customer privacy initiatives company-wide. What began as a simple



customer privacy program in 2012 has become the SDG&E Office of Customer Privacy (OCP). Previously, SDG&E selected the Generally Accepted Privacy Principles (GAPP) as its privacy framework and developed its first set of privacy controls, which 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.

Smart Grid privacy mandates require SDG&E to complete an audit report of its privacy and security practices with its General Rate Case filings. In early 2014, SDG&E engaged in a comprehensive audit process in time for its 2014 GRC filing.

The OCP continues to build its program and prepare the company, its partners, and its customers for future privacy risks. In particular, the desire of 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 the company's enterprise GRCM system. In addition, SDG&E is working with partners like the Identity Theft Resource Center to improve its privacy program, and with Microsoft on conceptual tools to offer third parties access to customer information in a way that provides them more value while better protecting customer privacy.

Another risk to customer privacy 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.

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### 2.6.3 CONCLUSION

Security and privacy remain high priorities for SDG&E. The utility 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 IT and operational perspectives. SDG&E continues to invest in risk and vulnerability management, compliance, operations, research, and privacy solutions. The creation of the Office of Customer Privacy formalizes policies, processes, and procedures to help employees, contractors, authorized third parties, and customers safeguard 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 implement additional security capabilities extending into the field.

## 2.7 COMPLIANCE WITH NERC SECURITY RULES AND OTHER SECURITY GUIDELINES

SDG&E is an NERC-registered Transmission Owner (TO) and Transmission Operator (TOP). NERC's Critical Infrastructure Protection Reliability Standards (often referred to as cybersecurity) are applicable to entities that are registered TOs and TOPs. The NERC Critical Infrastructure Protection Reliability Standards have been mandatory and enforceable since June 2009, and SDG&E has certified its TO and TOP annual compliance each year since then.

### 3 SMART GRID METRICS

In SDG&E's metrics reporting in the following section, the Reporting Period is defined as the period from July 1, 2016 through June 30, 2017. 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](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.

	Units	Number of meters	% of meters
The number of advanced meter malfunctions where customer electric service is disrupted, and the percentage this number represents of the total of installed advanced meters	Number of meters / percentage	919	.063%

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

	Units	Residential	C&I < 500 kW	C&I > 500 kW	Other (a/c cycling, small commercial)	Total
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)	Winter MW	n/a	n/a	n/a	n/a	n/a
	Summer MW	8	5	2	1	16

**Note:** Some SDG&E DR programs are available in the winter months, but SDG&E did not call an event during the winter of 2016-17. Therefore, there is no load reduction from the winter peak to report.

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

	Units	Capacity Bidding Programm (CBP)	Critical Peak Pricing (CPP)
The percentage of demand response enabled by AutoDR (Automated Demand Response) in each individual DR impact program	%	9%	1%

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

	Units					
	By Customer Class	Residential	C&I < 500 kW	C&I > 500 kW	Other (a/c cycling, small commercial)	Total
The number and percentage of utility-owned advanced meters with consumer devices with Home Area Network (HAN) or comparable consumer energy monitoring or measurement devices registered with the utility (by customer class, CARE status, and climate zone)	Number of customers	18,113	226	14	0	18,353
	% of customers	98.69%	1.23%	0.08%	0.00%	100.00%
	By Care Status	Care	Non-Care	Total		
	Number of customers	1,427	16,926	18,353		0
	% of customers	7.78%	92.22%	100.00%		
	By Climate Zone	Coastal	Inland	Mountain	Desert	Total
	Number of customers	7,579	10,448	239	87	18,353
	% of customers	41.30%	56.93%	1.30%	0.47%	100.00%

5. The 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)

	Units						
The 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)	By Tariff	Critical Peak Pricing (CPP)	Time of Use (TOU)	Peak Time Rebate (PTR)	Plug In Electric Vehicle (PEV)	Total	
	Number of customers	131,509	40,036	78,347	296	250,188	
	% of customers	53%	16%	31%	0%	100%	
	By Customer Class	Residential	C&I < 500 kW	C&I > 500 kW	Total		
	Number of customers	29,181	142,017	643	171,841		
	% of customers	17%	83%	0%	100%		
	By Care Status	Care	Non-Care	Total			
	Number of customers	5,417	166,424	171,841			
	% of customers	3%	97%	100%			
	By Climate Zone	Coastal	Inland	Mountain	Desert	Customers without climate zone	Total
	Number of customers	100,933	3,437	684	66,689	98	171,841
	% of customers	59%	2%	0%	39%	0%	100%

6. The 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 Home Area Network with registered consumer devices

	Units					
The 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 Home Area Network with registered consumer devices	By Complaint Category	AMI Meters	AMI Programs	Device Registration (HAN)	Communication issues (HAN)	HAN, other
		Number of customers	0	0	0	0

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.

	Units				
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	By Customer Class	Replaced due to hardware/component failures	Replaced due to firmware related failures	Replaced due to environmental related failures	Replaced due to unknown or communication related failures
	Number of meters	493	366	14	46
	% of meters	.034%	.025%	.001%	.003%

8. 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.

	Units		
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		Field tested at the request of customers	Field tested at the request of customers with results outside accuracy band
	Number of meters	836	0
	% of meters	.058%	0

9. The 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

	Units			
The 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		Aclara/My Energy pages	RYU Alert signups	Number/percentage of customers using a utility web-based portal to authorize the utility to provide a third party with energy usage data
	Number of meters	393,095	938,899	5,473
	% of meters	41.85%	53.3%	.6%

10. Various Smart Meter related information<sup>22</sup>

Units	Total
Number of smart meters installed	1,439,387
Number of smart meters activated	1,439,387
Number of Opt-Outs	2,730
Number of non-smart meters manually read	2,730
Number of smart meters manually read	1,745

## B. Plug-in Electric Vehicle Metrics

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

	Rate	Number of Customers
Number of customers enrolled in time-variant electric vehicles tariffs	EV TOU	291
	EV TOU 2	9,525

For SDG&E, the applicable tariffs for this metric are EV-TOU and EV-TOU-2.

<sup>22</sup> Metric Requested by CPUC Energy Division in August 15, 2017 email.



### 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<sup>23</sup>.

	Units MW	MWh 'in'	MWh 'out'
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.	84	71,588	49,912

### 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 - SAIDI	Year	Major Events Included	Major Events Excluded
System-wide total number of minutes per year of sustained outage per customer served as reflected by SAIDI	7/1/11 - 6/30/12	574.03	60.59
	7/1/12 - 6/30/13	63.03	62.79
	7/1/13 - 6/30/14	87.41	66.16
	7/1/14 - 6/30/15	58.50	53.46
	7/1/15 - 6/30/16	84.28	65.64
	7/7/16 - 6/30/17	85.02	71.65

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23

6.15 MWs existing (D.14-10-045, Attach A.) + 37.5 MWs Aliso Canyon (Resolution E-4798).  
40 MWs existing (D.14-10-045, Attach A.).

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 - SAIFI	Year	Major Events Included	Major Events Excluded
How often system-wide average customer interrupted in reporting year as reflected by SAIFI	7/1/11 - 6/30/12	1.4583	0.4592
	7/1/12 - 6/30/13	0.5339	0.5330
	7/1/13 - 6/30/14	0.6797	0.5770
	7/1/14 - 6/30/15	0.5108	0.4954
	7/1/15 - 6/30/16	0.7498	0.5996
	7/7/16 - 6/30/17	0.6528	0.6117

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 - MAIFI	Year	Major Events Included	Major Events Excluded
Number of momentary outages per customer system-wide per year, as reflected by MAIFI, major events included and excluded	7/1/11 - 6/30/12	0.2671	0.2668
	7/1/12 - 6/30/13	0.2663	0.2663
	7/1/13 - 6/30/14	0.2099	0.2079
	7/1/14 - 6/30/15	0.2752	0.2587
	7/1/15 - 6/30/16	0.4931	0.4354
	7/7/16 - 6/30/17	0.3872	0.3585

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.

Metric	Year	Circuits > 12 Outages Major Events Included	Circuits > 12 Outages Major Events Excluded
Number of customers per year and circuits per year, experiencing greater than 12 sustained outages	7/1/11 - 6/30/12	12	10
	7/1/12 - 6/30/13	8	8
	7/1/13 - 6/30/14	6	5
	7/1/14 - 6/30/15	7	7
	7/1/15 - 6/30/16	12	9
	7/7/16 - 6/30/17	9	8

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

	Year	Residential	C&I <500 kW	C&I >500 kW	Other (Agricultural)	Total/System Load Factor
System load factor and load factor by customer class (%)	7/1/11 - 6/30/12	53%	48%	79%	44%	54%
	7/1/12 - 6/30/13	47%	50%	80%	53%	53%
	7/1/13 - 6/30/14	44%	54%	76%	49%	49%
	7/1/14 - 6/30/15	42%	53%	72%	46%	47%
	7/1/15 - 6/30/16	45%	49%	80%	29%	48%
	7/7/16 - 6/30/17	40%	63%	78%	83%	50%

6. The number of and total nameplate capacity of customer-owned or operated, grid-connected distributed generation facilities by program (7/1/11 - 6/30/2017)<sup>24</sup>

Metric	Number of Facilities	Capacity (MW)
Distributed generation facilities (Solar PV)	20,691	147.6
Distributed generation facilities (Non-Solar PV)	26	88.3
Distributed generation facilities (Solar and Non-Solar PV)	20,717	235.9

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

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

	Year	Month	Exports (GWh)
Total electricity deliveries from customer-owned or operated, grid-connected distributed generation facilities, reported by month and by ISO sub-Load Aggregation Point.	2016	Jul	1.96
	2016	Aug	1.97
	2016	Sept	2.54
	2016	Oct	3.27
	2016	Nov	3.62
	2016	Dec	3.88
	2017	Jan	3.88
	2017	Feb	3.38
	2017	Mar	4.51
	2017	Apr	3.62
	2017	May	3.75
	2017	Jun	4.42

<sup>24</sup> SDG&E does not have the disaggregated data requested by the CPUC available. SDG&E is committed to collecting this information on a going forward basis

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

	# of Automated Circuits	Total Circuits	% Automated
The number and percentage of distribution circuits equipped with automation or remote control equipment, including Supervisory Control and Data Acquisition (SCADA) systems.	814	1,048	77.67%

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.