Annual Report to the Governor and the Legislature

California Smart Grid per Senate Bill 17 (Padilla, 2009)

January 2015

www.cpuc.ca.gov/PUC/energy/smartgrid.htm

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1. Executive Summary

Pursuant to Public Utilities Code Section 8367, this Annual Report on California's Smart Grid activities provides an overview of the California Public Utility Commission's (CPUC's) recommendations for a Smart Grid, the plans and deployment of Smart Grid technologies by the state's Investor-Owned Utilities (IOU), and the costs and benefits to ratepayers.[1] This report will detail the following:

- CPUC's Smart Grid-related activities in 2014. (See Section 1.2.1.)
- IOUs' Smart Grid project reports and overall ratepayer costs and benefits. (See Section 3.1.)
- Overview of Smart Grid activities that are expected in the coming year. (See Section 1.2.3.)

Highlights:

- First round of 1,325 MW of Energy Storage procurement approved and issued.
- At present, total of over 2,000 MW of customer solar photovoltaic systems installed in the three IOU service territories.
- Final approval of the Customer Data Access system.
- Distribution system planning modernization proceeding initiated in response to AB 327.
- Supply-side demand response proceeding launched for bidding demand response as a resource.
- New interconnection rules adopted to allow use of smart inverters.
- Continuing customer uptake of Home Area Network enabled devices to improve energy use management.

1.1. What is the Smart Grid?

The Smart Grid, as defined in the State of California by Senate Bill (SB) 17 (Padilla, 2009), is a fundamental change in the existing electricity infrastructure that utilizes advances in technology to create a better, safer, greener electricity supply.[2] The objectives in California are clear:

- Provide more secure and reliable electricity that is better suited for a 21st century economy.
- Reduce the carbon footprint and environmental impact of energy production, distribution and transmission with continuing affordable service for all ratepayers.
- Enable customers to intelligently manage how their energy is used and to continue to give them choices for the source of their electricity.
- Create more market opportunities for customer choice of electric service delivery models through "smart markets."

[1] "…the commission shall report to the Governor and the Legislature on the commission's recommendations for a Smart Grid, the plans and deployment of Smart Grid technologies by the state's electrical corporations, and the costs and benefits to ratepayers." (PUC Section 8367)

[2] Chapter 327, Statutes of 2009, codified at California Public Utilities Code § 8360-69.

The CPUC has been working with California's IOUs on numerous fronts, as well as with legislators, throughout 2014 to advance grid modernization. All of these initiatives are oriented toward making the grid in California smarter and safer, with reduced carbon emissions.

1.2. California's Continuing Grid Modernization

The topics addressed below are:

- Smart Grid Costs and Benefits
- Ongoing Commitment to Improving Safety and Reliability
- What to Expect in 2015 at the CPUC
- Summary of IOU Activities in 2014

1.2.1. Smart Grid Costs and Benefits

The three IOUs are required to report on Smart Grid program costs and associated benefits. Although progress has been made on standardizing reporting requirements among the three IOUs, there is still some divergence on how to monetize environmental and some customer benefits. The costs and benefits shown are for the reporting period of the Smart Grid Update Reports from the IOUs, which covers fiscal year July 1, 2013, through June 30, 2014. (See Table 1 IOU's Costs and Benefits for Fiscal Year July 1, 2013 through June 30, 2014Table 1 IOU's Costs and Benefits for Fiscal Year July 1, 2013 through June 30, 2014.)

Table 1 IOU's Costs and Benefits for Fiscal Year July 1, 2013 through June 30, 2014

IOU	Smart Grid Costs [3] (millions) (July '13-June '14)	Smart Grid Benefits (millions) (July '13-June '14)
PG&E	$816.0[4]	$79
SDG&E	$114.5	$54
SCE	$110.0	$183[5]

Note: PG&E also reports 33.3 million avoided customer outage minutes and 36.5 million pounds of avoided CO^2 emission. SCE monetizes avoided outage minutes using a Value of Service model.

[3] Some costs represent a total since program inception, rather than what was incurred during the reporting period.

[4] Unlike other IOUs, PG&E reports costs of ongoing distribution and transmission automation and reliability projects incurred since program inception. These costs were not included as part of the annual totals in last year's report.

[5] Includes avoided customer outage minutes that are monetized using a Value of Service model.

Grid modernization in some form has been an ongoing practice of the utilities, where economically feasible and supported via CPUC authorization in the General Rate Case (GRC). New developments in technology, as well as direction from regulators, have emphasized some trends, however. For example, Smart Grid development in California has built upon smart meters, cost reductions in digital control and communications technology, power electronics, and advanced automation technology to improve the customer experience of electric reliability and resilience.[6]

The accelerating adoption of customer-side intermittent renewable generation, primarily solar and wind has produced new operational challenges for the grid. In addition, greatly increased small-scale distributed generation is creating more pressure on utilities to change their business models to provide "plug and play" support for these resources. Providing an infrastructure platform for customer choice is becoming a priority.

A planned approach to further investments in grid enhancement is required to maintain and increase reliability and to reduce safety risk. This strategic planning must also meet policy goals for the higher penetrations of distributed generation and other technologies mentioned above. The required level of planning has proven to be a challenge for the utilities. The new distribution resources planning effort now underway will guide new investment requests in future GRCs to meet these challenges. [7] Distribution Resources Plans will enable much greater use of distributed energy resources (DER) than traditional processes have previously allowed.[8] If properly planned and deployed, DER can potentially improve reliability, particularly for essential emergency response and disaster recovery services.

1.2.2. Ongoing Commitment to Improving Safety and Reliability

The CPUC is committed to maintaining and improving the safety, reliability and economic value of the electric supply, as well as reducing the environmental impact of electricity production, transmission and distribution. To date, safety issues with grid modernization have been minimal.

[6] This experience is measured in reduced number of outages and reduced outage duration.

[7] Pursuant to Section 769 of the Public Utilities Code, the IOUs are required to file Distribution Resources Plans by July 1, 2015. These plans will describe, among other things, "optimal locations" for the deployment of distributed energy resources. The CPUC is conducting rulemaking R. 14-08-013 to "approve or modify and approve" the Plans.

[8] Distributed Energy Resources are defined in the statute as, renewable distributed generation, energy storage, demand response, energy efficiency and electric vehicles.

The CPUC began implementation of Assembly Bill 66 (Muratsuchi, 2013), with a new rulemaking open in December 2014.[9] The new rulemaking requires reliability reporting on a more local basis by the IOUs than historically reported. Although this activity is not directly Smart Grid related, several of the new Smart Grid systems deployed by the utilities such as Geographic Information Systems (GIS), and Outage Management Systems, are expected to produce more targeted, information rich reliability reporting.

Reliability and safety are not the same, although they are related. Numerous mission-critical applications, such as health care, communications, refrigeration and heating or cooling, depend on reliable electric supply. Smart Grid technologies can improve reliability and provide greater confidence to the general public that their mission critical applications are based on a dependable electric supply, thereby supporting the safety mission of the CPUC.

The Commission in 2014 adopted a new approach to incorporating safety risk assessment in utilities' GRCs.[10] The new framework will assist the utilities, interested parties and the Commission to evaluate ways to assess safety risks, and to manage, mitigate, and minimize such risks. For the three large energy utilities, the assessment will take place through two new procedures. The results of these procedures will feed into each utility's GRC application in which the utilities may request funding for safety-related investments.

1.2.3. What to Expect in 2015 at the CPUC

Below is a list of some of the projects to watch in 2015.

- Distribution Resources Plan applications to be filed by utilities for approval in July 2015;
- Integrated Demand Side Management (IDSM) rulemaking R. 14-10-003;
- Interconnection reform and smart inverter activities in R. 11-09-011;
- Storage Roadmap activities;
- Electric Vehicle integration in R.13.11-007;
- Demand Response policy advancements in R.13-09-011; and
- Enhanced reliability reporting in R.14-12-014.

[9] R.14-12-014, December 18, 2014.

[10] Decision (D.) 14-12-025 in R. 13-11-006

As the utilities get communications and monitoring functionalities in place more broadly in their systems, and adapt their planning processes to incorporate more distributed energy resources (as envisioned by AB 327, now PUC §769), more of the original Smart Grid vision will be ready to implement, and will require funding. For example, Distribution Resource Plan implementation by the utilities will require greater situational awareness, monitoring and control sensors and systems to support high penetrations of DER. Investment to support further development of these systems is now required. GRC cycles have begun to incorporate more spending on automation and grid enhancements to further the Smart Grid goals.

2. 2014 Commission Activities Related to Smart Grid

2.1. Deployment Plan Background

SB 17 established the state policy of grid modernization through implementation of the "Smart Grid."[11] The IOUs were required to file Smart Grid Deployment Plans in the "Decision Adopting Requirements For Smart Grid Deployment Plans Pursuant to Senate Bill 17 (Padilla)", issued in June 2010.[12] This Decision specified that the Deployment Plans include the following eight elements:

1. Smart Grid Vision Statement
2. Deployment Baseline
3. Smart Grid Strategy
4. Grid Security and Cyber Security Strategy
5. Smart Grid Roadmap
6. Cost Estimates
7. Benefits Estimates
8. Metrics

The three large IOUs filed their Deployment Plans on July 1, 2011, as required by SB 17. The Deployment Plans were approved by D.13-07-024 on July 25, 2013. This approval cleared the way for implementation of the deployment plans as part of the GRC of each of the three IOUs. Further, D.13-07-024 adopted criteria (a template) for the Smart Grid Annual Reports that the IOUs are required to file to

[11] Smart Grid refers to the use of digital communications and control technology to improve the efficiency and reliability as well as reduce the environmental impact of the electric supply through integration of renewable resources and other new technologies.

[12] D.10-06-047.

demonstrate they are making progress on Smart Grid deployment. The template was used for the first time for the 2014 report.

2.2. Historic Smart Grid Proceeding Closed

The CPUC's Smart Grid proceeding, formally known as the *Rulemaking to Consider Smart Grid Technologies Pursuant to Federal Legislation and on the Commission's own Motion to Actively Guide Policy in California's Development of a Smart Grid System*, closed in 2014 after it produced a number of significant decisions.[13] These decisions accomplished the following:

- require the utilities to deploy smart meters and provide customers with their usage data, collected by the smart meters;
- require the filing of Smart Grid Deployment Plans and set the requirements for what the plans must address;
- determine rules to protect the privacy and security of customer data generated by smart meters;
- order the utilities to provide HAN capability on the smart meters;
- order the utilities to offer computer downloading of usage data by customers and authorized third parties (Customer Data Access or CDA);
- adopt metrics to measure the effectiveness of smart grid investments;
- adopt rules for making customer data available to researchers, universities and state agencies; and
- require the formation of an Energy Data Access Committee to determine ongoing access policies and resolve issues.

Having concluded this ambitious agenda of activities, the Smart Grid proceeding was closed by D.14-12-004.

2.3. Third-Party Access to Customer Data with Customer Approval (Customer Data Access)

In D.11-07-056, the CPUC ordered the IOUs to file applications "to propose tariff changes to provide third-parties access to a customer's usage data via the utility's backhaul - an electronic path from the utility to the third party – when authorized by the customer."

[13] R.08-12-009

In 2014, the Commission approved tariffs for the three IOUs that allow third parties to access customer usage data with customer approval. The Customer Data Access (CDA) program allows third parties to access customer data in the utility system using the Electric Service Provider Interface (ESPI) standard that has been codified by the North American Energy Standards Board (NAESB). The tariffs specify how the third parties are registered and certified to access customer data, and how customers authorize a third party to access the data. The authorized third party can then use an automated process to download the customer interval usage data from the utility server.

2.4. Interconnection Policy[14]/Advanced Inverters

Interconnection policies set the processes by which utilities approve the connection of distributed generation, and now storage devices, to the electric grid. The Commission's Rule 21 proceeding, R.11-09-011, is working to streamline the interconnection processes, as well as make the costs associated with interconnection more certain. Developers of distributed generation systems (primarily solar photovoltaic) and their customers desire a simpler, less costly process that has greater certainty of ultimate approval by the utilities. In contrast, the utilities are primarily responsible for maintaining the safety and reliability of their systems, while enabling the customer to choose their own energy system. These two objectives are sometimes in conflict. The Rule 21 proceeding attempts to balance these concerns.

The Commission's decisions in the Rule 21 rulemaking have adopted new rules to ease some of the problems of interconnection, including:

- Pre-application report containing distribution system engineering information
- Updated Fast Track process and Supplemental Review
- Financial deposits
- Group study process

Inverters are used in distributed generation and storage systems to convert direct current to alternating current. They are usually connected directly to the distribution grid, and thus are subject to restrictions and standards in terms of how they can operate in conjunction with the grid. Advanced, or "smart" inverters, provide functions that are more compatible with grid operations than the earlier generation of inverters. In fact, advanced inverters can provide services to grid operators that were previously unavailable. It is also possible to equip advanced inverters with communications functions so they can be remotely controlled, and can also provide monitoring data. All of the functions of smart inverters currently under discussion can provide increased reliability and power quality at the distribution system

[14] Rule 21; R.11-09-011

level. In December 2014, the Commission adopted modifications to Rule 21 to allow for advanced inverter capabilities. These policies were developed via the Smart Inverter Working Group, a collaborative effort of CPUC and California Energy Commission (CEC) staff. The utilities are now ready to allow for the incorporation of smart inverters on the distribution grid.[15]

The CPUC and the CEC have been jointly working with the Institute of Electric and Electronics Engineers (IEEE) and other standards organizations to develop related standards for the functionalities of smart inverters that are allowed to be interconnected with the electric distribution system.

2.5. Energy Storage

Significant developments related to energy storage included workshops held by CPUC staff throughout 2014. These workshops led to approval of the IOUs' energy storage procurement plan applications.[16] The IOUs launched the first round of Requests For Offers (RFO) for energy storage procurement by December 1, 2014.

The California Independent System Operator (CAISO), the CPUC. and the CEC are partnering to develop a joint energy storage roadmap to advance energy storage in California. This roadmap will propose actions and venues to address identified barriers related to storage, and it builds on inputs gathered from stakeholders through a public outreach effort that was completed in August and a workshop held on September 4 at the CAISO. The final roadmap was completed by the end of 2014.[17] The primary issues addressed in the roadmap are:

- Define and communicate grid needs
- Clarify existing wholesale market products
- Refine existing and evaluate the need for new wholesale market products
- Identify gaps in rate treatment and identify existing or new rules that could address issues
- Define multiple-use applications of storage
- Determine hybrid storage configurations
- Assess existing methodologies for evaluating storage and identify or develop a preferred common methodology

[15] Approved via D. 14-12-035, December 18, 2014.

[16] D.14-10-045

[17] http://www.caiso.com/informed/Pages/CleanGrid/EnergyStorageRoadmap.aspx

2.6. Smart Meter Opt-Out

The Commission has issued a final Decision in the Smart Meter Opt-Out proceeding that establishes permanent fees and charges for IOU customers who do not wish to receive a wireless smart meter and "opt-out" of the program.[18] The decision also determines the cost allocation of maintaining the opt-out program for the utilities. In order to lessen the financial impact on opt-out customers, the final decision allows for ending a monthly meter reading charge after three years. Future costs for reading these meters will be shared by all utility customers.

[18] D.14-12-078 in A.11-07-020

3. Smart Grid Projects in California

3.1. Summary of IOU Activities in 2014

The State of California and the California IOUs continue with Smart Grid development begun in 2009 pursuant to SB 17.[19] "Smart Grid" falls into several categories of activities, which were standardized by the approval of the Smart Grid Deployment Plans at the end of 2013. These categories are:

1. Customer Empowerment
2. Transmission and Distribution Automation/Utility Operations
3. Cyber and Physical Grid Security
4. Integrated and Cross-Cutting Smart Grid Activities
5. Smart Meters
6. Home Area Networks (HAN)

[19] From California Public Utilities Code §8360 "…the following, which together characterize a smart grid:

(a) Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.

(b) Dynamic optimization of grid operations and resources, including appropriate consideration for asset management and utilization of related grid operations and resources, with cost-effective full cyber security.

(c) Deployment and integration of cost-effective distributed resources and generation, including renewable resources.

(d) Development and incorporation of cost-effective demand response, demand-side resources, and energy-efficient resources.

(e) Deployment of cost-effective smart technologies, including real time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices for metering, communications concerning grid operations and status, and distribution automation.

(f) Integration of cost-effective smart appliances and consumer devices.

(g) Deployment and integration of cost-effective advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air-conditioning.

(h) Provide consumers with timely information and control options.

(i) Develop standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid.

(j) Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.

(Added by Stats. 2009, Ch. 327, Sec. 1. Effective January 1, 2010.)"

Utility activities in these categories as reported in the Smart Grid Annual Reports are summarized in the sections below. [20]

The IOUs were also asked to report the monetary value of the benefits of these activities. The methodology for calculation of benefits is similar among the three IOUs. However, there are still some differences in methodology between PG&E, SDG&E and SCE. Evaluation of the monetary value of certain environmental benefits such as reduced greenhouse gas emissions still needs to be defined. The spend and benefits shown below were accrued during the reporting period of the 2014 IOU annual update reports, which is July 1, 2013, through June 30, 2014.

The IOUs generally note in their reports that the smart meter rollout was a large, front-loaded investment in smart grid functionality, and that it is the foundation for other projects such as demand response expansion and Time of Use pricing. There are also many investments having to do with making the grid "smarter" that are much harder to quantify, in terms of direct benefit. They may translate into reliability improvements or realizing other, longer term, objectives, like renewables and storage integration.

1.Customer Empowerment

A primary driver of Smart Grid development continues to be providing customers with tools to better understand and manage their energy use. Based primarily on the Smart Meter rollout, largely completed by all three utilities, customers are provided with access to their energy usage data, as well as a variety of web-based tools to understand how they can use energy more efficiently and at a lower cost.

The IOUs have been pursuing both pilot activities and full deployment of HAN technologies. HAN, integrated with the smart meters, allows connected customer devices (primarily In Home Displays and thermostats) to provide information and control. Some deployed HAN devices also have demand response functions to enable management of energy use by the utility. Although the smart meters installed by the utilities provide HAN capabilities, the utilities are also developing support for third-party, Internet-based solutions for energy management.

2.Transmission and Distribution Automation/Utility Operations

Transmission and distribution automation projects use wide-area monitoring and control to enhance the resiliency of these systems. "Situational awareness" enables operators to respond preventatively to emerging system stability threats. On the transmission system side, projects are designed to safely and reliably incorporate utility-scale, intermittent generation resources. Within the distribution system,

[20] The Smart Grid Annual Reports are filed by the three IOUs in October of each year, pursuant to D.10-06-047.

utilities deploy technologies to accommodate high penetrations of customer distributed energy resources, including electric vehicles. Projects also provide advanced outage management and power quality management, through automated fault detection and isolation, self-healing circuits and Volt/Var optimization.

Utility operations projects involve asset management, safety and operational efficiency. These projects enable management of maintenance and infrastructure replacement that is based on the health of the equipment, rather than a scheduled approach. This helps to avoid energy infrastructure failures and manage costs.

3.Cyber and Physical Grid Security

As the smart grid development becomes more widespread, vulnerability to attack, both cyber and physical, increases. Systems put in place for communications and control must be properly secured in order to reduce this vulnerability. The IOUs have security programs that involve a wide range of measures and controls to protect utility systems from attack. The security projects associated with Smart Grid developments are placed throughout the network, from the transmission system to the grid edge. These projects implement security services and policies that protect electronic information, and communications and control systems that manage security risks throughout utility operations.

4.Integrated and Cross-Cutting Smart Grid Activities

This category of projects includes activities that cross multiple areas of utility operations and may involve several overlapping systems. Grid communications, application platforms, data management and analytics, advanced technology testing and workforce development/technology training can be more cost-effectively managed by using an integrated approach. In the longer term, integrated systems could enable information exchange among the IOUs, service partners and customers. Utilizing large amounts of data generated by sensor networks and smart meters will require new data management and analytics technologies. These new technologies could help manage operations, assets and customer service more efficiently.

5.Smart Meters

The Advanced Metering Infrastructure (AMI, aka smart meters) rollout is complete. Over 12 million meters have been installed throughout the three large IOU service territories. Remaining smart meter installations have been transferred to operations, and expense tracking accounts have been closed. Customers have been allowed to opt-out of receiving a smart meter, but the percentage of customers opting-out remains relatively small. The data in Table 2 Advanced Metering Infrastructure (aka Smart Meters) Rollout was provided by the three IOUs in their Smart Grid status update reports and is current as

of October 2014.

Table 2 Advanced Metering Infrastructure (aka Smart Meters) Rollout

IOU (as of Oct. 2014)	Opt-out	Customer Complaints (escalated) [21]	Total Number of Electric Smart Meters (millions)
PG&E	51,622[22]	135	5.4
SDG&E	2,569[23]	5	1.4
SCE	22,587	528	5

Source: IOU Smart Grid Annual Reports to CPUC, October 2014, and data provided by the IOUs

6.Home Area Networks (HAN)

The HAN is integrated with the smart meter to provide two way communications between the utility and the customer. Providing the HAN capabilities was a key benefit in the business case for the smart meter deployment. (See Table 3 HAN Deployment in Support of Smart Meters.) This integration allows the customer to use an In Home Display device to receive meter data, in real time, directly from the meter. Vendors have developed innovative applications that use the data obtained through the HAN to provide an unprecedented level of visibility for the customer into their energy use and ways to reduce it.

The HAN, along with appropriate customer devices, can be used by the IOU to communicate demand response signals or pricing directly to the devices. The IOUs are either piloting or have deployed devices that can respond to demand response signals, primarily thermostats. In 2014 all three IOUs offered a new, streamlined, online process to allow customers to add devices without any need for manual back office support.

Table 3 HAN Deployment in Support of Smart Meters

IOU (as of Oct. 2014)	HAN Activation Requests (Customer/Pilot)	Devices Validated/Available
PG&E	808	5
SDG&E	4,226	14/9
SCE	567	9

Source: IOU Smart Grid Annual Reports to CPUC, October, 2014

[21] Escalated complaints are customer complaints regarding smart meters that have gone through the complaint process and reached resolution, and the number of escalated complaints has been reduced from last year's level.

[22] Electric Meters only. 34,935 Gas Meter opt-outs.

[23] Electric Meters only. 1,560 Gas Meter opt-outs.

HAN customer uptake has been slow. PG&E is still in the pilot phase with its HAN offerings. San Diego Gas and Electric has deployed HAN devices (programmable communicating thermostats or PCTs) as part of its air conditioner cycling program. Southern California Edison is primarily working with third parties on Wi-Fi-connected solutions that don't necessarily involve the use of the smart meter HAN.

3.2. SDG&E

This section provides information on SDG&E's estimated expenditures made and benefits realized during the reporting period and it highlights some of SDG&E's projects.

Costs

Table 4 SDG&E's Estimated Costs for Fiscal Year July 1, 2013 through June 30, 2014

Task	Value
Customer Empowerment and Engagement	$40,708,000
Distribution Automation and Reliability	$28,002,000
Transmission Automation and Reliability	$ 3,312,000
Asset Management, Safety and Operational Efficiency	$16,235,000
Security	$ 8,002,000
Integrated and Cross-Cutting Systems	$18,296,000
Total Estimated Costs	$114,536,000

Benefits

Table 5 SDG&E's Estimated Benefits Realized for Fiscal Year July 1, 2013 through June 30, 2014

Benefit	Value
Economic Benefits	$26,219,000
Reliability Benefits	$12,667,000
Environmental Benefits	$ 9,136,000
Societal Benefits	$ 6,052,000
Total Estimated Benefits	$54,074,000

- Completed smart meter deployment continuing benefits included above. These include elimination of meter reading activities, including avoided truck rolls, facilitation of Reduce Your Use, a demand response program.

- Asset management, Safety and Operational efficiency projects put in service include the Geospatial Information System and the Outage Management System/Distribution Management System. These systems helped avoid catastrophic failures.
- Distribution Automation and Reliability improves customer experience by reducing outage time. In addition unnecessary dispatch of personnel to the field is avoided by automated switching devices.
- Environmental benefits due to increased integration of renewable distributed and centralized generation were seen during the reporting period. Increased integration of electric vehicles into the electric system also provides environmental benefits due to reduced emissions.

3.2.1. SDG&E Example Projects[24]

- **Smart Grid Demand Response Programs** – Provide customers with pricing plan options and incentives to vary their load in response to price or other signals
- **EV Education and Outreach** – Provide customers information on EV time-of-use rates
- **Customer Privacy Program** – Ensure that customer privacy is fully integrated into the way SDG&E does business and that customer privacy controls are in place and working effectively.
- **Digital Roadmap** – Provides initiatives that supply customers with greater accessibility to information and easier navigation for more effective communications in addressing energy-related information needs.
- **Phasor Measurement Units: Distribution** - Installing synchrophasor equipment (Phasor measurement units or PMU) at key locations to enhance the safety, efficiency, operability and reliability of the distribution system.

[24] Partial list from the SDG&E Smart Grid Status Update Report, October 1, 2014.

3.3. SCE

This section provides information on SCE's estimated expenditures made and benefits realized during the reporting period and it highlights some of SDG&E's projects.

Costs

Table 6 SCE's Estimated Costs for Fiscal Year July 1, 2013 through June 30, 2014

Task	Value
Customer Empowerment and Engagement	$24,900,000
Distribution Automation and Reliability	$41,430,000
Transmission Automation and Reliability	$27,934,000
Asset Management, Safety and Operational Efficiency	$ 4,642,000
Security	$ 8,801,000
Integrated and Cross-Cutting Systems	$ 2,324,000
Total Estimated Costs	$110,076,000

Benefits

Table 7 SCE's Estimated Benefits Realized for Fiscal Year July 1, 2013 through June 30, 2014

Benefits	Value
Operational Benefits	$ 4,257,000
Reliability Benefits[25]	$167,300,000
Demand Response/Conservation Benefits	$11,500,000
Total Benefits	$183,057,000

- Completed smart meter deployment benefits are not included above. Operational benefits include primarily mobile work management tools.
- Reliability benefits stem mainly from the ongoing circuit automation program.
- Demand Response and conservation benefits primarily relate to AutoDR- enabled programs and smart meter-enabled demand response and energy conservation programs.

25 Estimated using Value of Service Model based on circuit automation reliability improvements in all circuits automated since program inception approximately two decades ago.

- Environmental benefits due to increased integration of renewable distributed and centralized generation were seen during the reporting period. Increased integration of electric vehicles into the electric system also provides environmental benefits due to reduced emissions.

3.3.1. SCE Example Projects[26]

- **Summer Discount Plan HAN pilot** – Provide customers with pricing plan options and programmable communicating thermostats to automatically vary their usage in response to price or other signals.
- **EV Education and Outreach** – Provide customers information on EV time-of-use rates.
- **Integrated Audit Tool/Home Energy Advisor** – Online tools to ask questions of customers and provide analysis and suggestions

[26] Partial list from the SCE Smart Grid Status Update Report, October 1, 2013.

3.4. PG & E

This section provides information on PG&E's estimated expenditures made and benefits realized during the reporting period and it highlights some of SDG&E's projects.

Costs

Table 8 PG&E's Estimated Costs for Fiscal Year July 1, 2013 through June 30, 2014

Task	Value
Customer Empowerment and Engagement	$35,300,000
Distribution Automation and Reliability[27]	$288,370,000
Transmission Automation and Reliability[28]	$416,900,000
Asset Management, Safety and Operational Efficiency	$42,550,000
Security	$16,000,000
Integrated and Cross-Cutting Systems	$17,320,000
Total Estimated Costs	$816,440,000

Benefits[29]

Table 9 PG&E's Estimated Benefits Realized for Fiscal Year July 1, 2013 through June 30, 2014

Benefits	Value
Direct Customer Savings	$21,200,000
Avoided Costs	$11,000,000
Avoided Environmental Costs	$210,000
Customer Reliability Costs	$42,100,000
Total Cost Savings	$79,010,000
Avoided Outage Minutes	33.3 million minutes
Greenhouse Gas Emissions	36.5 million pounds

[27] Includes $99.2 Million for the Distribution SCADA program and $145.2 Million for the Cornerstone Improvement project, which are total costs since project inception. These costs were not included in the total costs in last year's report.

[28] Includes $80.9 Million for the Transmission SCADA program and $284 Million for the Modular Protection and Control Installation Program, which are the total costs since project inception. These costs were not included in the total costs in last year's report.

[29] Measured as incremental savings where customers receive direct financial, environmental, reliability and societal benefits from the projects and benefits to the utility that improve safety and reduce operational cost.

Projects that contribute to PG&E's Smart Grid project benefits include:

- SmartMeter project.
- SmartMeter outage information improvement.
- SmartRate program.
- Home Energy Reports project Energy Alerts, and My Energy Site
- Automated Demand Response program.
- Fault Location and Service Restoration project
- Modular Protection and Automation Control project

3.4.1. PG&E Example Projects:

- **Intermittent Renewable Resource Management** – Testing how demand response (DR) customers can provide fast responsive DR to aid in grid balancing.
- **Plug-in Hybrid Electric Vehicle/Electric Vehicle Smart Charging Pilot** – supports the adoption and penetration of electric vehicles and the ability to bill customers with electric vehicles
- **Distribution Management System Project** – Electronic wall maps to assist in distribution operations control center consolidation.
- **Volt/Var Optimization System Pilot** – Enables more efficient procurement and supply of electricity and potentially enable increased penetration of distributed renewable generation.
- **Transmission substation SCADA project** – Provides PG&E's Electric Operations and the California Independent System Operator (CAISO) with full visibility into the transmission system.
- **Transformer Load Management project** – Enables Transmission and Distribution planning engineers and estimators to access actual customer usage data from SmartMeters for analysis in equipment sizing and voltage analysis.

4. Conclusion

The Smart Grid program is continuing to generate benefits for California ratepayers. The program expenditures overall have been as originally budgeted. However, there is more work ahead to fully realize the original program objectives, in particular, the achievement of a carbon-free energy system. California, because of its rich and deep tradition of entrepreneurship and technological innovation, stands ready to lead the nation into a low carbon future.

> "In 2008, the CPUC launched California's development of the 21st century grid with the Rulemaking to Consider Smart Grid Technologies. Now, at the end of 2014, we have seen our utilities deploy greater levels of automation that are leading to a more efficient and reliable electric grid for Californians. This work has also laid the foundation for energy storage, plug-in electric vehicles and distributed energy resources. We are proud of what we have done in California, but see the next great challenge still ahead of us: achievement of a net zero carbon footprint. We are optimistic that California will lead the way in this historic endeavor."
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> - CPUC President Michael Peevey