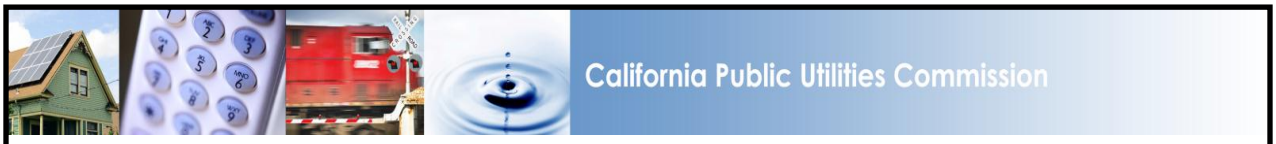

Annual Report to the Governor and the Legislature

California Smart Grid

May 2014

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Executive Summary

A 21st century clean energy economy demands a 21st century electric grid. Much of the traditional electricity infrastructure has changed little from the design and form of the electric grid as envisioned by Thomas Edison and George Westinghouse at the end of the 19th century.

National Institute of Standards and Technology

Pursuant to Public Utilities Code Section 8367[1], this annual report provides an overview of the 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. This report will detail the following:

- Commission Smart Grid-related activities in 2013.
- IOUs' Smart Grid project reports and overall ratepayer costs and benefits.
- Overview of Smart Grid activities that are expected in the coming year.

2013 Smart Grid Activities: CPUC and Utilities

- Substantially completed (99%) electric smart meter rollout providing customer and ratepayer benefits.
- Smart Grid developments funded via General Rate Case decisions and pilot project applications.
- CPUC approved enhanced customer data privacy protections. Considered policies for allowing access to data for research and analysis.
- Issued a decision enabling enhanced third-party access to customer data.
- Increased expenditures for automation in the distribution system for improved safety and reliability.
- Improved utility back office systems for greater reliability.
- Home Area Network customers being connected to their smart meters.

What is the Smart Grid vision?

The Smart Grid, as articulated at a national level by the Energy Independence and Security Act of 2007, and in the State of California by Senate Bill (SB) 17 (Padilla, 2009), is a fundamental re-architecting and modernization of the existing electricity infrastructure. The objectives in California are clear:

- Create a more secure, reliable and resilient electricity supply.
- Reduce the carbon footprint and environmental impact of energy production, distribution and transmission.
- Enable customers to more intelligently manage their energy use, and give them more opportunities for participation in electric markets, both as consumers and as producers.

[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)

- Create more market opportunities for electric service delivery through "smart markets."

The CPUC has been working with California's IOUs on numerous fronts, as well as with legislators, throughout 2013 to move grid modernization forward. The CPUC has approved General Rate Case (GRC) expenditures related to Smart Grid development, has approved several pilot projects that are testing new technologies, and has been facilitating new safety and reliability standards that are related to interconnection of distributed energy resources and utilization of storage. All of these initiatives are oriented toward realizing Smart Grid capabilities in California.

Where we are in the grid modernization process

Although the State of California is still in the early stages of Smart Grid development conducted under the rubric of SB 17, "Smart Grid" is actually another name for grid modernization. The grid modernization efforts have arguably been a part of utility practices for decades. However, SB 17, federal American Recovery and Reinvestment Act (ARRA) funding and the nexus of storage proceedings, distributed generation and renewable energy have accelerated these activities. The Smart Grid in California exploits advances and cost reductions in digital control and communications technology to improve grid reliability and resilience. For example, systems are now being installed by the IOUs (Outage Management Systems, synchrophasors, Supervisory Control and Data Acquisition (SCADA) systems) that provide greater situational awareness to grid operators. These installations result in improved response times for restoration of service after an outage. Grid operators are able to more rapidly detect, and take actions to correct, conditions that might lead to prolonged outages or hazardous grid instability.

The overall grid modernization project is still very much in investment mode, and putting dollar amounts on direct benefits is still sketchy in the IOU reporting for 2013.

Further investments in grid modernization will be required for increased reliability and safety risk reductions, as well as to meet policy goals for higher penetrations of distributed generation and other technologies.

Improved Maintenance Capabilities

Continuous monitoring of conditions inside critical transmission and distribution grid components such as transformers enable the utilities to proactively replace these components before they fail (condition-based maintenance). New power electronics technologies allow grid operators to switch out circuits that are experiencing reliability problems and reroute power to affected areas, without having to send utility crews to the location to determine the source of the problem.

Support for Renewables

Support for high penetration of distributed intermittent renewable energy sources is a key driver for grid modernization. Equipping such distributed energy resources as solar photovoltaic (PV) and energy storage systems with automated controls can provide faster and easier interconnection, as well as more reliable operation. Distributed energy systems and automated demand response can also provide grid services at a much lower cost than traditional resources.

Cybersecurity and Privacy

As the grid becomes more automated, it becomes more vulnerable to cyber-attack, unless steps are taken to ensure cybersecurity is maintained. Personal information regarding energy use and billing data is also threatened by cyber-attackers. Keeping California's electric grid – as well as energy customers – secure from attack and maintaining privacy and security of personal data is a top priority for the CPUC during 2014.

Using Data to Quantify and Evaluate Benefits

As new systems reach deployment and new services evolve, there is more information available about the benefits of Smart Grid technologies. In 2014 and beyond, the focus for CPUC activities will be directed toward quantifying and evaluating customer and system benefits, so that the promises of a Smart Grid can be realized by Californians.

Smart Meters

The Advanced Metering Infrastructure (AMI, aka smart meters) rollout is substantially complete. The following table is based on figures provided by the three IOUs in their Smart Grid status update reports. These figures are as of October 2013. Escalated complaints are customer complaints regarding smart meters that have gone through the complaint process and reached resolution.

IOU (a/o Oct. 2013)	Electric Meters Installed/Active	Electric Meters Remaining	Percent Complete	Opt-out	Customer Complaints (escalated)
PG&E	5.26M/3.171M	371,000	93%	35,300	1,846
SDG&E	2.281M/2.278M	4,000	99.8%	2,141	1,032
SCE	4.97M	0	100%	21,137	3,486

Source: IOU Smart Grid Annual Reports to CPUC, October, 2013

Home Area Networks (HAN)

The HAN is integrated with the smart meter to provide two way communications with the customer. It allows the customer to use an In Home Display device to receive meter data, in real time, directly from the meter. It can also be used by the IOU to communicate demand response signals or pricing. The IOUs are still in the early stages of rolling out the program for enrolling customers, and are simplifying and refining the enrollment process.

IOU (a/o Oct. 2013)	HAN Activation Requests (Customer/Pilot)	Devices Validated/Available
PG&E	364	5
SDG&E	230	14/9
SCE	128/922	9

Source: IOU Smart Grid Annual Reports to CPUC, October, 2013

Home Area Network (HAN) rollout, by design, has not moved into the mass market as it has been in a pilot phase with limited rollout of programs until now. The utilities are looking to begin widespread marketing, which is expected to raise the visibility of the HAN.

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, as of the 2013 report, PG&E has still included some program costs cumulatively from program inception. 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, 2012 through June 30, 2013. Direct benefits from investments made during these early years of Smart Grid development are starting at relatively low levels and will accrue over many years.

IOU	Smart Grid Costs (millions) (July '12-June '13)	Smart Grid Benefits (millions) (July '12-June '13)
PG&E	$264.7	$51.7
SDG&E	$144	$34
SCE	$132.8	$214

Note: PG&E costs exclude some costs that were reported from program inception, not annual cost

From creating policy platform to authorizing, monitoring and evaluating

CPUC work is transforming from establishing a policy platform for Smart Grid development to authorizing expenditures, monitoring progress and evaluating benefits:

- Authorizing General Rate Case (GRC) and pilot Smart Grid expenditures;
- Monitoring Home Area Network rollout;
- Evaluating reliability and customer-facing improvements.

Ongoing Commitment to Improving Safety and Reliability

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. There was some concern regarding fires in smart meters, but this was investigated by CPUC staff in 2013. Staff determined that, of reported fires involving smart meter installation, none were actually caused by the smart meter.

The CPUC has also started to consider implementation of Assembly Bill 66 (Muratsuchi, 2013), which 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, either health care, communications, refrigeration and heating or cooling, depend on reliable electric supply. To the extent that 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, these technologies fit into the safety mission of the CPUC.

What to expect in 2014

- Changing rate structures may play into Smart Grid development
- AB 327 (Perea, 2013) activities including distribution resource planning
- Interconnection and smart inverter activities
- Storage integration
- Electric Vehicle integration
- Demand Response

As stated above, the Smart Grid project is still in its early stages, which could be characterized as "investment mode." Direct benefits are still difficult to quantify, as the Smart Grid is a platform for other technologies that have a direct benefit. Further, Many Smart Grid investments are designed to improve reliability through decreasing outage response times and anticipating equipment failures. However, worsening system reliability trends due to aging "non-smart" infrastructure such as poles, wires and transformers are countering the improved ability to anticipate and respond to outages. It is vitally important that as investments are made in Smart Grid, that accompanying investments are made in physical infrastructure modernization.

Notwithstanding the opposing trends described above, 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 intended benefits of the original Smart Grid vision articulated in PUC §8360-8369, should become measurable and evident.

2013 Commission Activities Related to Smart Grid

Deployment Plan Final Decision

SB 17[2] established the state policy of grid modernization through implementation of the "Smart Grid[3]." 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)"[4], issued in June 2010. This Decision specified that the Deployment Plans include the following eight elements:

- Smart Grid Vision Statement
- Deployment Baseline
- Smart Grid Strategy
- Grid Security and Cyber Security Strategy
- Smart Grid Roadmap
- Cost Estimates
- Benefits Estimates
- Metrics

The three 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 General Rate Case of each of the three IOUs. Further, D.13-07-024 adopted criteria (a template) for the Annual Reports that the IOUs are required to file to demonstrate they are making progress on Smart Grid deployment. The Deployment Plans were adopted as filed and without imposing additional requirements.

Technology is rapidly changing in the various areas of grid modernization. Indeed, policies such as the energy storage procurement mandate[5] will affect grid architecture and systems. Given these factors, D.13-07-024 affirmed that the Deployment Plans will be updated and supplemented by the Annual Reports.

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

[3] 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.

[4] D. 10-06-047.

[5] D.13-10-040; Decision Adopting Energy Storage Procurement Framework and Design Program; 10/21/2013.

The Deployment Plans authorized by the D.13-07-024 provide a baseline that will enable oversight of grid modernization activities by the IOUs. D.13-07-024 affirmed that the Vision Statement in the Plans addresses how the Smart Grid deployment will support a "smart energy market, smart consumers and a smart utility."[6]

A less obvious but important feature of D.13-07-024 was that it declined to set a demarcation point for Smart Grid development. The demarcation point on the grid is a line beyond which the utility would be prohibited from making investments.

PG&E Pilots

The CPUC provided analytical support and implementation follow-through for Pacific Gas & Electric's Smart Grid Pilots proceeding, which authorized $80.8 million for three Distribution Projects including a Line Sensor pilot, a voltage and reactive power optimization pilot, and a detect and locate outages and faulted circuits pilot, as well as a fourth pilot to enhance short-term load forecasting techniques.

D.13-03-032 approved PG&E's application and adopted a Pilot Plan methodology proposed by the Commission, in which PG&E will conduct its pilots in phases, informing the Commission of progress through a series of advice letters which must be reviewed and approved by the CPUC in order to authorize spending for the next phase of each pilot. The revised Pilot Plan approach was approved via AL 4227-E in June. Advice letter reports from the first phase of these pilots are expected in 2014.

Privacy

In 2013, the CPUC reviewed IOUs' initial reports on breaches of customer privacy, as well as authorized releases of customer generation and financial information to law enforcement agencies and legal process demands, in compliance with D.11-07-056. This review led to additional data requests seeking information about the nature of legal process requests. The responses were made publicly available along with the initial reports.

[6] D.10-06-047 at 33.

Third-Party Access to Customer Data with Customer Approval

The Commission has established a process for review of utilities rules to allow third-parties to access electric consumption data, with customer approval. D. 13-09-025 adopted Commission policy on access to "backhaul" data, and directed IOUs to file advice letters to create tariff terms and conditions.

Separately, the Commission is exploring appropriate conditions and policies for allowing third parties to access aggregated customer data. The proposed decision on this matter was released for comment in March 2014.

Home Area Network (HAN)

In 2014, with the large body of advanced meters in place, the Commission turns its focus toward activating the ability of customers to employ Home Area Networks (HAN) to monitor energy consumption in real-time and potentially control appliances and thermostats. The Commission is monitoring aspects of HAN implementation, including: certification of third-party HAN devices, automation of network registration with the utility, customer outreach and marketing programs and use of the HAN for demand response.

The Commission is interested in identifying and removing barriers to HAN activation due to technical incompatibility between certain Smart Meters and HAN network interfaces, which have limited the ability of some Net Energy metering customers and some small business & commercial (SBC) customers to activate HAN capabilities. This work will continue through the year with the affected utility.

Interconnection Policy[7]/Advanced Inverters

Continuing efforts to streamline and automate the process for customers and small generators to interconnect with the utility distribution system, the Commission is considering changes to the Rule 21 process to automate utility permitting practices, standardize data gathering and reporting, provide cost certainty for applicants, and reduce regulatory hurdles by allowing "clustered" group studies on the potential impacts of new interconnections.

Advanced Inverters – The CPUC established the groundwork for processes regarding Advanced Inverters with the publication of a Staff white paper on Advanced Inverter Technologies in January 2013[8].

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

Working in close coordination with the California Energy Commission, the Commission established a stakeholder process which is exploring advanced inverters. The intent is to authorize utility studies into new functionalities that will enhance reliability while preserving safety for utility workers and customers.

Energy Storage

The Energy Storage Procurement Rulemaking (R.10-12-007) resulted in a landmark decision establishing a target for utilities and other load-serving entities to build, buy, contract or otherwise procure 1,325 MW of energy storage capacity by 2020 (D.13-10-040).

The Commission held joint workshops including stakeholders in the Long-Term Planning Proceeding (LTPP, R.12-03-014) which helped lead to a mandate for Southern California Edison to procure at least 50 MW of energy storage to meet local capacity requirements in the Los Angeles Basin (D.13-02-015).

Together, these two decisions made California the first state in the nation to adopt targets for the utility use and procurement of energy storage in order to improve grid operations, support renewable energy integration and contribute to the reduction of greenhouse gas emissions.

In addition, the Commission's storage activities coordinate closely with other proceedings to identify and remove barriers to customer and utility use of energy storage, including supporting the Resource Adequacy proceeding's[9] efforts to define a qualifying capacity value for energy storage, assisting the Distributed Generation proceeding[10] in removing barriers to joint storage/photovoltaic generation systems participating in Net Energy Metering programs, and resolving interconnection problems encountered by applicants to the Self-Generation Incentive Program.

The Commission will continue to support implementation of the storage procurement process, including coordinating utilities' storage procurement plans and bid evaluation tools, fostering common reporting

[8] Advanced Inverter Technologies Report: http://www.cpuc.ca.gov/NR/rdonlyres/6B8A077D-ABA8-449B-8DD4-CA5E3428D459/0/CPUCAdvancedInverterReport2013FINAL.pdf

[9] R.11-10-023, Order Instituting Rulemaking to Oversee the Resource Adequacy Program, Consider Program Refinements, and Establish Annual Local Procurement Obligations, October 20, 2011

[10] R. 12-11-005, Order Instituting Rulemaking Regarding Policies, Procedures and Rules for the California Solar Initiative, the Self-Generation Incentive Program and Other Distributed Generation Issues, November 8, 2012

and benchmarking methods, guiding development of applications for bid authorization and rate recovery, and conducting their initial solicitations.

Demand Response

Although it is being addressed by the Commission in its own proceeding[11], demand response (DR) is an integral part of Smart Grid functionality. One of the major challenges in developing greater demand response capacity is entering the residential and small business space. The technical capability for enabling residential and small business DR has been put in place through deployment of the Home Area Network that is built into smart meters. Using the HAN, utilities will be able issue demand response commands and pricing information to enabled devices. These devices are selected and installed by customers who wish to participate in demand response programs.

Another area of demand response capability being explored by utilities and DR aggregators is the Open Automated Demand Response[12] communications protocol. This digital communications system allows the development of standardized interfaces for equipment that can respond to triggers to reduce its demand in response to grid conditions or prices.

These topics, along with enabling DR resources to be dispatched through bids in the wholesale market (CAISO) will be explored in depth in R.13-09-011.

Smart Meter Opt-Out

The Commission continues to monitor utility efforts to finalize their installation of smart meters for residential and small commercial customers, which as of the end of 2013 are over 99 percent complete. Although customer and media concerns about perceived hazards of smart meters linger, the number of customers participating in "opt-out"[13] programs remains very low in relation to the total number of meters installed, and customer complaint calls to the Commission have dropped substantially.

[11] R.13-09-011, Order Instituting Rulemaking To Enhance The Role Of Demand Response In Meeting The State's Resource Planning Needs And Operational Requirements, September 25, 2013.

[12] www.openadr.org

[13] In 2012, the CPUC approved the advice letters of the three IOUs that established programs to enable customers to "opt-out" of receiving a smart meter. These programs allow customers to choose to retain their existing analog meter by paying an additional fee. These programs have had an uptake of one percent or less since they have been established.

The Commission still has a pending Phase 2 of the opt-out proceeding, which is considering whether entire communities would be allowed to opt-out of smart meter installations, along with setting the cost basis for the opt-out programs.

Smart Grid Projects in California

San Diego Gas & Electric (SDG&E), Southern California Edison (SCE) and Pacific Gas and Electric Company (PG&E) have all filed their Smart Grid Deployment Status Reports for 2013. This section lists some of the activities as well as early estimates on total costs and benefits for each utility.[14]

The IOUs were directed to report on their Smart Grid-related activities using the following standard classifications:

- Customer Empowerment and Engagement
- Distribution Automation and Reliability
- Transmission Automation and Reliability
- Asset Management, Safety and Operational Efficiency
- Security
- Integrated and Cross-Cutting Systems

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. The Commission expects to work with utilities in 2014 to make reported costs and benefits more consistent across utilities. 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 2013 IOU annual update reports, which is July 1, 2012 through June 30, 2013.

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.

[14] Data and descriptions adapted from Smart Grid Deployment Plan Updates, October, 2013. All available at http://www.cpuc.ca.gov/PUC/energy/smartgrid.htm

SDG&E

Costs

Estimated Spend During the Reporting Period July '12 – June '13	Reporting Period Value
Customer Empowerment and Engagement	$ 54,443,000
Distribution Automation and Reliability	$ 36,676,000
Transmission Automation and Reliability	$ 5,865,000
Asset Management, Safety and Operational Efficiency	$ 25,142,000
Security	$ 12,825,000
Integrated and Cross-Cutting Systems	$ 9,115,000
Total Estimated Costs	**$ 144,066,000**

Benefits

Estimated Benefits During the Reporting Period July '12 – June '13	Reporting Period Value
Economic Benefits	$ 22,970,000
Reliability Benefits	$ 6,301,000
Environmental Benefits	$ 2,882,000
Societal Benefits	$ 1,443,000
Total Estimated Benefits	**$ 33,596,000**

- SDG&E's mass deployment of Smart Meters provided benefits that are included above.
- The deployment of projects under the Asset Management, Safety and Operational Efficiency program also generated economic and reliability benefits in addition to the existing projects. These projects include the Geographic Information System, the Outage Management/Distribution Management systems and Condition-based Maintenance.
- Environmental benefits were seen from the integration of renewable energy generation resources, both centralized and distributed, supported by Smart Grid developments. These environmental benefits primarily consist of avoided emissions associated with displacing conventional generation with distributed renewable energy resources and the integration of centralized renewable energy for compliance with the Renewable Portfolio Standard (RPS).

SDG&E Example Projects[15]

- **Green Button Connect My Data –** Third party access to customer data
- **Connected...To The Sun –** Program for Customers to sign up for solar power who can't install their own systems
- **Home Area Network (HAN) projects –** Demand Response
- **Electric Vehicle Charging Management –** Smart Charging Stations
- **Community and Stakeholder Engagement -** Smart City San Diego
- **Advanced Energy Storage Project –** Community Energy Storage systems
- **Borrego Springs Microgrid Demonstration –** High Reliability, distributed energy resource integration at a community scale
- **Distribution Automation projects –** Distribution-level Phasor Measurement Units for higher reliability
- **Automated Fault Location –** Transmission level fault location reduces time for service restoration after an outage

[15] Partial list from the SDG&E Smart Grid Status Update Report, October 1, 2013.

SCE

Costs

Estimated Spend During the Reporting Period July '12 – June '13	Reporting Period Value
Customer Empowerment and Engagement	$ 44,544,398
Distribution Automation and Reliability	$ 41,017,643
Transmission Automation and Reliability	$ 23,897,490
Asset Management, Safety and Operational Efficiency	$ 216,262
Security	$ 6,417,293
Integrated and Cross-Cutting Systems	$ 16,695,183
Total Estimated Costs	**$ 132,788,269**

Benefits

Estimated Spend During the Reporting Period July '12 – June '13	Reporting Period Value
Operational Benefits	$ 46,100,000
Reliability Benefits[16]	$ 158,900,000
Demand Response/Conservation Benefits	$ 9,600,000
Total Benefits	**$ 214,600,000**

Operational benefits received from several areas including

- reduced operations and maintenance costs resulting from SCE's smart meter program,
- peak demand reduction from smart meter and auto DR-enabled DR resources,
- energy conservation enabled by customer tools such as budget assistant and in-home displays, and
- faster crew response to outages enabled by circuit automation technologies.

Reliability benefits come primarily from SCE's circuit automation program, which shortens the amount of time required to restore power to a portion of customers during an outage. This is not a new program, and *the benefits accrue from roughly two decades of deployment.*[17]

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

Demand Response/Conservation benefits are associated with two types of DR resources: (1) resources available through AutoDR-enabled program participants; and (2) demand reduction achieved by residential customers participating in the Save Power Day program (e.g. Peak Time Rebate) through the use of the smart meter.[18]

The report characterizes environmental benefits as a reduction in greenhouse gas emissions due to lower energy consumption, primarily due to peak demand reduction and energy conservation programs. Reduced vehicle usage due to the smart meter program has also reduced emissions. This report places a monetary value on these benefits.

Quantifying certain kinds of Smart Grid benefits is difficult. These benefits include a reduction in employee safety incidents due to the circuit automation program, higher customer satisfaction resulting from improved outage response, and the availability of better customer data and options for managing energy use.

SCE Example Projects[19]

- **Edison Smart Connect HAN Field Trials –** Field trials of capabilities of the HAN related to In Home Displays, real time pricing and demand response
- **Home Battery Pilot –** Deployment of residential battery storage units
- **Irvine Smart Grid Demonstration –** End-to-end demonstration of Smart Grid technologies from substation automation to the customer home.
- **Geographic Information System (GIS) and Distribution Management System –** These systems, along with the Outage Management system enable the utility to more rapidly respond to outages, and automate various parameters of the distribution system.

[17] For purposes of this report, the benefit was estimated using a Value-of-Service (VOS) reliability model developed by the Lawrence Berkeley National Laboratory. A rough estimate for VOS was based on this model and SCE's specific customer class mix.

[18] The MW of these resources are derived from the average ex post load impacts from 2012, which are based on the Load Impact Protocols adopted in D.08-04-050.

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

- **Wide Area Monitoring, Protection and Control -** Enabling operators to anticipate, prevent and more rapidly respond to failures in the transmission system.

PG & E

Costs

PG&E Reported Smart Grid Costs July '12 – June '13	Reporting Period Value
Customer Empowerment and Engagement	$ 53,423,000[20]
Distribution Automation and Reliability	$ 112,800,000[21]
Transmission Automation and Reliability	$ 27,300,000[22]
Asset Management, Safety and Operational Efficiency	$ 42,000,000
Security	$ 10,000,000
Integrated and Cross-Cutting Systems	$ 19,220,000
Total Estimated Costs	$ 264,743,000

Benefits[23]

PG&E Reported Smart Grid Project Benefits July '12 – June '13	Annual Savings
Direct Customer Savings	$ 36,300,000
Avoided Costs	$ 8,100,000
Avoided Environmental Costs	$ 200,000
Customer Reliability Costs	$ 2,100,000
Total Cost Savings	$ 10,000,000
Reliability	Avoided 1.66 million outage minutes
Greenhouse Gas Emissions	Avoided 31.4 million pounds of CO2 emissions

[20] Does not include Smart Meter project cost ($2,319 million) since inception.

[21] Does not include Distribution Substation SCADA program cost ($249.7 million) since inception.

[22] Does not include Transmission Substation SCADA program cost ($150 million) or Modular Protection Automation and Control Installation program cost ($350 million) since inception

[23] 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.

PG&E Example Projects:

- **PG&E's SmartMeter™ project**
- **PG&E's SmartMeter™ outage information improvement**
- **PG&E's SmartRate™ program**
- **PG&E's advanced distribution automation project**
- **PG&E's Home Energy Reports project**
- **PG&E's automated demand response program**
- **PG&E's FLISR project PG&E's SmartMeter™ outage information improvement**
- **PG&E's Modular Protection and Automation Control (MPAC) project**

From PG&E's Smart Grid Status Update Report: "PG&E's benefit calculations are based on actual accrued benefits. PG&E is continuing to work on enhancing its direct benefit measurement where feasible. Additionally, PG&E is working with San Diego Gas & Electric Company (SDG&E) and Southern California Edison Company (SCE) on benefit measurement so that there is more of an apples-to-apples comparison between the California electric investor owned utilities."

Conclusion

Smart Grid implementation is at the forefront of energy policy and energy system development worldwide. California energy policies spearheaded by the CPUC on multiple fronts ensure that our State remains a leader in improving the power grid for all ratepayers and for the environment. 2014 promises to bring in more landmark actions in moving forward and transforming our grid into one that brings more reliability, more efficiency, more choice, and more for the energy dollar to all Californians.

> The Smart Grid is a component of almost every rulemaking at the Commission. Its capabilities improve safety, reliability, and cyber security. Its potential allows us to plan the sophisticated long term procurement we need in light of the San Onofre nuclear outage. The Smart Grid is the integrating force in our vision for California's energy grid.
>
> - **CPUC President Michael Peevey**