



## California Public Utilities Commission



Report to the Governor & the Legislature

### 2011 Smart Grid Report

Submitted

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## California Smart Grid – 2011 Update

This is the California Public Utilities Commission's (CPUC) second annual report to the Governor and the Legislature, pursuant to Public Utilities Code Section 8367 (SB 17, Authored by Senator Padilla). Beginning in 2008, the CPUC embarked on a momentous path toward modernizing the state's electric grid from one grounded in industrial age technology to one running on the technology of the information age. Simply put, this modern, informed and technologically superior electric grid is a Smart Grid.

### California Benefits From Smart Grid

California's ageing electric grid has been operating in much the same way for over 100 years. The grid must now be modernized to take advantage of innovative technologies, accommodate new supply resources and meet increasing consumer demands. Without modernization, the existing grid is increasingly costly to maintain and is constrained to meet the growing demands that are being placed upon it. In addition, the design of the grid does not always take into practice the technological advances of the past decades. Creating a smarter grid will result in a safer, more reliable, efficient, affordable, and interoperable system.

#### Smart Grid Benefits:

- Customer choice and lower electricity bills.
- Fewer new fossil-fuel power plants, more electric vehicles and reduced greenhouse gas emissions.
- Shorter and less frequent power outages. Improved worker and public safety.
- New jobs and economic growth from creation of new markets and empowerment of new market players.

"Smart Grid is the foundation for the transformation of the electric industry from a passive and reactive system to one that is more reliable, efficient, and cost-effective for consumers. By using more advanced technology, a Smart Grid will empower consumers to manage their electricity use and save money, help utilities reliably deliver power, and increase our use of renewable resources."

- **CPUC President, Michael R. Peevey**

Among the many benefits consumers will see from a Smart Grid is the availability of more information and tools to manage their energy usage. Even now, consumers are beginning to benefit from a move towards a Smart Grid with access to near-real time information about their usage. These consumers have greater control over their utility bills if they log on to a utility's website and sign up for alerts, such as those that





signal when a customer moves to the next rate tier. The customer can use this information to change behavior and ultimately lower their monthly bills. This is just one example of the first step towards improved information from the point of view of the end user.

## California's Path Towards a Smart Grid

California has long established itself as a leader in energy issues and Smart Grid is no exception. Pursuant to State legislation, the CPUC established a framework and an overall vision for a Smart Grid in California that requires the state's investor-owned utilities (IOUs) to begin the transformation of the electric grid into a safer, more reliable, efficient, affordable, and interoperable system. This deliberate and strategic planning for grid modernization will ensure that California's utility customers realize the tremendous benefits of a Smart Grid.

### California's Accomplishments to Date:

- Pursuant to Senate Bill 17, the CPUC developed the requirements for a Smart Grid deployment plan.
- Pursuant to Senate Bill 1476, California became the first State to adopt privacy rules for customer data.
- California utilities in July 2011 filed with the CPUC their respective 10-year plans (i.e., Smart Grid Deployment Plans).

Pursuant to Public Utilities Code Section 8367, this annual report shall provide an overview of the CPUC's recommendations for a Smart Grid, the plans and deployment of Smart Grid technologies by the state's IOUs, and the costs and benefits to ratepayers. As such, the next sections of this report will detail the following:

- Privacy and Security of Electric Usage Data
- Giving Consumers Control
- Utility Smart Grid deployment plans
- National developments
- Federal stimulus funding for Smart Grid projects
- The CPUC's plan for 2012





## Privacy and Security of Electric Usage Data

Customer energy data is extremely valuable, as it is foundational to customer engagement, energy efficiency, demand response, enhanced outage management and grid operation. As such, customer energy data is vital for the realization of benefits from Smart Grid investments and stimulating the market. However, the potential for the data to be misused and legitimate customer privacy concerns makes it critical that the customer energy usage data is adequately protected.

In recognition of the importance of protecting of customer energy data, the CPUC adopted privacy and security rules for customer data generated by Smart Meters that are deployed by California's investor-owned utilities (IIOUs). The rules adopted implement the protections ordered by Senate Bill (SB) 1476 (Chapter 497, Statutes of 2010).

Notably, the CPUC was the first state regulatory agency in the United States to adopt privacy rules for customer data generated by Smart Meters. Other States are now following California's lead and implementing similar privacy rules. For example, the Colorado Public Utility Commission recently adopted similar privacy rules, and the Public Utility Commission of Ohio also opened a proceeding to address privacy.

"On July 28, the California Public Utilities Commission adopted groundbreaking privacy and security rules for Smart Grid energy usage data. The rules should be a model for other states as well as for federal Smart Grid initiatives.

All in all, the California Smart Grid privacy rule is a remarkable achievement that merits the attention of not only utility CPUCs in other states but also of stakeholders in other sectors, for it shows that a comprehensive privacy and data security framework can be crafted that supports both technology innovation and consumer protection."

- **Center for Democracy & Technology**

At the core of the privacy rules are the concepts set forth in the Fair Information Practice (FIP) principals which were adopted by the Department of Homeland Security (DHS), and are the basis for many other privacy rules.

- These rules apply to electrical corporations, electrical corporations' third-party contractors, and any other third-parties that access customer data directly from the electrical corporation (i.e., via a utility backhaul network).
- The rules require that electrical corporations provide customers with a privacy notice, detailing the purpose for which data is collected and shared, how the data may be used by the utility, how long the





data will be retained, how a customer can dispute errors in the data, and how a customer can authorize a third party to access their usage data.

- The rules require that upon a security breach affecting more than 1,000 customers, the electrical corporation notify customers within two weeks of such a breach.
- The rules require that electrical corporations file with the CPUC annually a report on all security breaches of customer information, as well as reports on the number of third-parties accessing customer data and the number of times the utility or third-party was not in compliance with the rules.

The California IOUs have filed Advice Letters with the CPUC, detailing their plans to comply with the decision and these Advice Letters are currently being reviewed. As the next step, the CPUC is considering the expansion of the privacy rules to address gas companies, electric service providers (ESPs), and community choice aggregators (CCAs).

## Giving Consumers Control

While ensuring customer energy data security and privacy is foundational to customer enablement, in order to realize the benefits of Smart Grid technologies being deployed it is important to ensure that the customers have timely access to information and a choice of tools to exercise their control over energy consumption.

To enable customer control, as part of the 2011 privacy decision, the CPUC also offered direction on providing additional information to customers, including bill-to-date, bill forecast data, projected month-end tiered rate, and notifications as the customers cross rate tiers. The decision also directed the utilities to work with the California Independent System Operator (ISO) to provide wholesale pricing information to customers in real-time to facilitate automated demand response. Furthermore, the decision directed the utilities to file with the CPUC a plan to

“The Smart Grid offers many opportunities for consumers to save energy and for utilities to operate the grid in a more efficient, effective, and reliable way. A smart consumer will ask, "What's in it for me?" And the answer is: money. Specifically, participating in these programs will earn consumers extra savings on their energy bills. And for people who generate their own power, it can even result in something you never thought you would see: your utility could mail a check to you.”

- Department of Energy (DOE)

allow authorized third parties to access customer data directly through the utility backhaul network. This access is expected to enhance the ability of third parties to provide additional services to customers to help





them use electricity more efficiently and manage costs. As part of this effort, the utilities are working with the United States Chief Technology Officer, Aneesh Chopra, to implement a “Green Button.” The Green Button will be a means by which a customer can download their usage information in one step, and be able to share it with a third-party, if the customer so chooses. The utilities expect to offer this functionality by January 2012.

The CPUC in 2011 also directed the filing of a utility plan to advance the activation of Home Area Network (HAN) capabilities. The HAN will allow customers, with the appropriate enabling technology, to get real-time usage information from their Smart Meters<sup>1</sup> and engage in demand response activities. The activation of HAN capabilities will provide customers with a tangible benefit from the installation of Smart Meters throughout the state. The availability of real-time information from the meter will give customers and any authorized third-parties additional opportunities to respond to prices or event signals in real-time, participate in other demand response products, and allow customers to set preferences around their usage patterns. While HAN enabling technology is built into Smart Meters, the initial roll-out is likely to be limited due to lack of final national standards and other challenges. However, the CPUC believes that there are initial benefits that can already be realized and expects a wide-spread roll-out of HAN technology to begin in the next several years.

## Smart Grid Deployment Plans

Pursuant to SB17, the utilities in July 2011 filed their respective deployment plans which are currently being

### Smart Customer

Smart Grid Deployment Plans should demonstrate a proactive approach to consumer education and outreach and draw on consumer research and past experiences. The evolution of a utility customer from a recipient of energy and into a participant in the grid must also involve a detailed education and marketing of why Smart Grid is beneficial to the individual consumer.

- CPUC Decision 10-06-047 June 24, 2010

reviewed by the CPUC. The purpose of the Smart Grid Deployment Plans is to establish a common vision and outline specific actions to meet California’s Smart Grid policy goals. The 10-year deployment plans are structured to outline the vision for achieving benefits pertaining to: 1) Smart Customer, 2) Smart Market, and 3) Smart Utility. Considering the large scope and complexity of the challenge posed by the grid modernization objective, the

Smart Grid Deployment Plans are key documents that can facilitate the alignment of California’s electricity

<sup>1</sup> Currently, this information will be limited to kWh usage, but in the future may include other information collected by the meter including voltage and current readings.





industry participants to a common vision and a set of well-articulated goals. The development of the Smart Grid Deployment Plans also has significant importance outside of California, as this effort is unprecedented and other state, national and international entities will look at these plans as a benchmark for Smart Grid developments.

While the plans are not intended to incorporate detailed cost and benefit analysis, the utilities

have estimated that grid modernization will require an investment of \$6 billion to \$8 billion dollars over the next 10 years. Although the benefits were not quantified by all of the utilities, they are expected to be just as financially significant and include avoided transmission and distribution investments, avoided energy

procurement costs, measurable reliability improvement, and reduced greenhouse gas emissions. Considering the size of the potential investments needed, it will be increasingly important for the CPUC to be in the forefront of Smart Grid developments and issues.

### Smart Utility

The Smart Grid will enable a utility to operate its transmission and distribution system in ways that anticipate events, enable responsiveness, and permit automatic or “self-healing” responses by the grid. Furthermore, the Smart Grid will help the utility meet environmental policies already adopted by statute or CPUC action.

- CPUC Decision 10-06-047 June 24, 2010

The plans filed by utilities are extensive and demonstrate a varied approach towards Smart Grid. Most importantly, they help highlight the

ubiquity of Smart Grid and the transformational nature of modern technologies. The Smart Grid deployment plans touch upon practically every aspect of the electric industry value chain, from generation to consumer. While the projects proposed by the utilities vary, the roadmaps all have initiatives that focus on customer engagement, demand response, integration of distributed generation, plug-in electric vehicles, advanced outage and distribution management, wide area transmission-level monitoring, as well as work and asset management, just to name a few key areas. All of the plans also recognize the need for enabling infrastructure to support Smart Grid capabilities across the board, such as network communication and data management.

### Smart Market

The Smart Market that emerges from the Smart Grid should be transparent and provide price, tariff and usage information sufficient to facilitate, among other things, demand response and distributed generation.

- CPUC Decision 10-06-047 June 24, 2010





The Deployment Plans also include an overview of utility practices to ensure that the grid and future Smart Grid investments include cyber-security protections. It is imperative that the utilities see cyber-security as a process and builds this process into their plans and culture. The CPUC will review cyber-security information to ensure that the utilities have a coherent and implementable cyber-security strategy that moves beyond compliance and into security. While there are many details still to be determined, the CPUC's direction to the IOUs on cyber-security have resulted in an increased awareness of cyber-security issues, policies, and requirements inside the IOUs, as evidenced by their filings.

Finally, the utilities were also required to include an initial set of metrics as part of Smart Grid deployment plans that can serve as a baseline for future utility reporting on the system and customer benefits from Smart Grid investments. Measuring progress of Smart Grid deployment and quantifying realized benefits is a great challenge and an area that requires significantly more work. To further developments in this area, in addition to the metrics information submitted by the utilities in the Smart Grid deployment plans, there was an effort to develop a set of metrics through a collaborative process between the parties and the CPUC Staff. This initial effort focused on metrics that were based on information already collected by the utility for other purposes, e.g., System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) numbers, or were otherwise easily collected, e.g., number of customers on a time-variant rate and number of escalated customer complaints associated with a customer's Smart Meter. The CPUC will continue this process next year and expects a corresponding decision to be issued in 2012.

## Smart Grid National Developments

The need for the electricity industry to move forward with a massive infrastructure upgrade is not just an idea that a few States are following. Virtually every State along with the Federal government is on board with this needed transformation to upgrade the grid. Utilities and municipalities throughout the U.S. are working to utilize the latest technologies available in order to improve the reliability and efficiency of meeting consumer demand. The Smart Grid market in the U.S. is estimated to grow 70 percent from \$5.6 billion to \$9.6 billion by 2015.<sup>2</sup>

<sup>2</sup> GreenTechMedia Research, US Smart Grid Market Forecast: 2010-2015







Examples of grid modernization projects can be seen all across the country. Smart Grid Information Clearinghouse lists over 200 Smart Grid projects that are currently in progress<sup>3</sup>. Similar to California, Texas continues to be at the forefront of Smart Grid development and has more than 3.5 million Smart Meters and 2,500 HAN devices installed. Utilities in Texas are building upon the Smart Meter implementation, investing heavily into outage management, distribution automation, and upgrades to the grid to accommodate renewable generation, particularly wind.

Other States are investing heavily in Smart Grid as well. For example, in Oklahoma, the Oklahoma Gas and Electric program involves system-wide deployment of a fully integrated Smart Meter system and installation of advanced distribution automation systems. It is a three year project estimated at over \$350 million, with \$130 million of Federal funding. The program is a partnership with customers, aimed at reducing peak loads, overall electricity use and operations and maintenance costs while increasing distribution system efficiency, reliability and power quality. The immediate goal of the program is to defer two 165 MW power plants currently planned for construction in 2015 and 2016.<sup>4</sup>

As another example, in Kentucky, the South Kentucky Rural Electric Cooperative's (SKRECC) project includes the installation of a fully integrated Smart Meter system across the service territory. The installation includes Smart Meters, enhanced communications infrastructure, in-home displays and direct load control devices. The project implements two-way communications and utility applications to: 1) allow customers to view their energy consumption at their convenience through the customer web portal and in-home displays, 2) allow SKRECC to manage, measure and verify targeted demand reduction, 3) provide the utility with automated notifications indicating the scope and location of customer outages and 4) reduce operational costs. Similarly in New Jersey, Ohio and Pennsylvania, FirstEnergy's Smart Grid modernization initiative includes deployment of distribution automation assets, time-based rate programs, load control, and customer systems.

In addition to utility initiatives, significant efforts are also being made at the national level, particularly around standards development. Specifically, the CPUC participates in Smart Grid Interoperability Panel (SGIP) created by the National Institute of Standards and Technology (NIST). Some key examples of SGIP efforts includes standards development for cyber-security, third-party access rules, privacy rules, interconnection rules for

<sup>3</sup> Smart Grid Clearinghouse, [www.sgiclearinghouse.org/ProjectList](http://www.sgiclearinghouse.org/ProjectList)

<sup>4</sup> Department of Energy, Recovery Act Smart Grid Programs, Oklahoma Gas and Electric, <http://smartgrid.gov>





distributed generation and storage resources, and issues relating to electric vehicles. Such efforts are instrumental for progress in grid modernization, as they enable technological advances and ensure that investments made into Smart Grid technologies result in a secure and inter-operable system that's open to market participants and protects the interests of consumers.

## Federal Stimulus Funding for Smart Grid Projects in California

The American Recovery and Reinvestment Act of 2009 (Recovery Act) appropriated \$4.5 billion “to modernize the electric grid.”<sup>5</sup> The United States Department of Energy (DOE) issued Funding Opportunity Announcements (FOAs) establishing a Smart Grid Investment

### Summary of ARRA Projects

- Federal funding of \$153 million received for five projects by SDG&E, Edison and PG&E
- 51 green jobs created

Grant Program<sup>6</sup> and a Smart Grid Demonstrations<sup>7</sup> program to provide funds in support of proposed projects.

The Smart Grid funding provided by the Recovery Act created an opportunity for California to expand and accelerate its activities to modernize the State's electricity infrastructure at a significantly lower cost to ratepayers. Former Governor Arnold Schwarzenegger organized statewide efforts to pursue the maximum amount of Recovery Act funding in order to reduce the state's unemployment rate and stimulate the economy. He also established a task force to “keep track of all of the dollars coming into the state and ensure that Californians see how effectively those dollars are being spent.” The CPUC in 2009 created a process by which the utilities could seek ratepayer funding for projects that were approved for Federal funding.

San Diego Gas and Electric Company (SDG&E), Southern California Edison, and Pacific Gas and Electric Company (PG&E) all received Federal funding for the following projects discussed below. In this section we also describe each project and provide a status report to date as well as the number of jobs created so far as a result of these projects.

<sup>5</sup> American Recovery and Reinvestment Act of 2009 (Recovery Act), Pub. L. 111-5 (H.R. 1), 123 Stat. 115.

<sup>6</sup> United States Department of Energy, *Financial Assistance Funding Opportunity Announcement: Smart Grid Investment Grant Program (SGIG)* (DE-FOA-0000058), June 25, 2009.

<sup>7</sup> U.S. Department of Energy, *Financial Assistance Funding Opportunity Announcement: Smart Grid Demonstration Program (SGDP)* (DE-FOA-0000036), June 25, 2009.





- **SDG&E Grid Communication System (SGCS)**

**Program Description** – SGCS will implement an advanced wireless communication system that allows SDG&E to monitor, communicate with, and control transmission and distribution equipment. This system will accelerate the deployment of Smart Grid applications and devices. It will connect tens of thousands of Smart Grid assets and potentially millions of Smart Meters across 4,100 square miles serving 3.4 million people.

**Jobs Created & Funding** – This project has created seventeen jobs and received over \$31 million from the Federal Stimulus project; the ratepayer cost for this project is just over \$28 million.

- **Edison’s Irvine Smart Grid Demonstration (ISGD)**

**Program Description** – Edison’s ISGD project is a comprehensive demonstration project of situational awareness using phasor measurement units (PMUs) and how this information can be used by the California ISO. The project then extends beyond the substation to evaluate the latest generation of distribution automation, including universal remote circuit interrupters (URCI), looped 12 kV distribution circuit topology, and advanced voltage control sensing and self-healing technologies.

**Jobs Created & Funding** – This project has created ten jobs and received more than \$40 million from the Federal Stimulus project; this project did not require ratepayer matching funds.

- **Edison’s Tehachapi Wind Energy Storage Project**

**Program Description** – The Tehachapi Wind Energy Storage Project (TSP) demonstration project is located at the Antelope-Bailey 66kV system. Antelope-Bailey is part of the Tehachapi Wind Resource Area (TWRA), where up to 4,500 MW of wind resources is expected to come online by 2015. Edison’s service area is home to the State’s most productive sites for wind and solar generation, including the TWRA. The effective cultivation of these resources – enabled in part by energy storage – will help Edison meet state Renewables Portfolio Standard (RPS) goals and establish replicable methods for broader national utilization.

**Jobs Created & Funding** – This project has created nine jobs and received more than \$25 million from the Federal Stimulus project; the ratepayer cost for this project is just over \$26 million.

- **PG&E’s Synchrophasor Project**

**Program Description** – The purpose of the Synchrophasor Project is to deploy an industry leading system-wide PMU-based monitoring system that will significantly enhance PG&E's existing grid monitoring capability and improve PG&E and regional grid reliability.

**Jobs Created & Funding** – This project has created nine jobs and received more than \$22 million from the Federal Stimulus project; the ratepayer cost for this project is just over \$28 million.





- **PG&E's Compressed Air Energy Storage (CAES)**

**Program Description** – The objectives of the 300 MW CAES project are to: 1) verify and demonstrate advanced CAES technology to achieve an optimized energy ratio and heat rate, 2) integrate intermittent renewable resources by using the CAES plant to steady the power fluctuations from load and intermittent renewables, and 3) use the CAES plant to provide ancillary services, including regulation, emergency spinning/non-spinning reserve, and VAR/voltage support. The project is expected to drive measurable benefits such as reduced greenhouse gas emissions, improved grid reliability and flexibility, and lower electric power system costs.

**Jobs Created & Funding** – This project has created six jobs and received more than \$25 million from the Federal Stimulus project; the ratepayer cost for this project is just over \$23 million.<sup>8</sup>

## Looking Ahead to 2012 and Beyond

In many ways, while the progress towards grid modernization has been substantial, the most significant steps towards Smart Grid are yet to be made. There are significant challenges that lie ahead, including achieving widespread adoption of HAN, supporting a growing number of electric vehicles and rooftop solar systems, interconnecting significant amounts of renewable generation, all while ensuring that reliability meets today's requirements and growing cyber-security challenges are addressed. The CPUC will continue its leadership in Smart Grid topics and focus on ensuring that California benefits from grid modernization. The CPUC has several activities planned for 2012.

By the middle of next year, the CPUC expects to adopt Smart Grid deployment plans for SDG&E, Edison, and PG&E. The CPUC staff is reviewing the IOUs' Smart Grid deployment plans in detail and has provided initial comments on the strength and weaknesses of the plans to the parties in the proceeding. As the next step, the CPUC will hold a set of workshops in the first quarter of 2012 focused on Smart Customer, Smart Market, and Smart Utility topic areas and ultimately making a decision on the plans by July 1, 2012.

The CPUC expects to adopt an additional decision that will outline the information that utilities will need to report on the progress of Smart Grid deployment and on the benefits that are being realized from the investments. The CPUC is considering whether to create a set of goals or metrics to measure progress towards grid modernization and to assess how Smart Grid investments are being utilized. Additionally, the CPUC may create additional working groups that will develop goals or metrics on specific topics, such as cyber-security

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<sup>8</sup> This is a multi-phased project, and the CPUC approved \$24.9 million to allow PG&E to start a study to determine the feasibility of a CAES project in their service territory. If the feasibility study shows that a CAES project is feasible, PG&E is to file with the CPUC an application for additional funding for the next phases.





and environment. For example, a cyber-security working group may develop a set of goals or metrics that can be used by the CPUC to monitor the effectiveness of utility cyber-security practices, and potentially form the basis for any future CPUC action on developing cyber-security requirements. An environmental working group may develop goals or metrics that will be able to measure the environmental benefits associated with Smart Grid investments. If adopted, these working groups will provide input into the yearly review process.

Also in 2012, the CPUC will focus on potentially developing cyber-security requirements applicable to the distribution grid and providing greater direction on cyber-security policies to the utilities. The CPUC will also continue working with NIST, DOE, and DHS on their national cyber-security initiatives to ensure that California and Federal efforts are coordinated.

A twenty-first-century economy requires a modern electric power grid. The engagement and cooperation of all stakeholders – regulators, utilities, vendors, customers, and legislation – is a vital step. Everybody has to work together and help solve the challenges as they come up.

- CPUC Staff

Smart Grid is evolving nationally and internationally. Through California legislation (i.e., SB 17, SB 1476, etc.) the CPUC is implementing policies on multiple fronts to ensure that our State remains a leader in moving forward and transforming our grid into one that brings more reliability, more efficiency, more choice, and more cost effectiveness to all Californians.





CALIFORNIA'S SMART GRID

## Smart Grid Timeline

