

# APPENDIX A

PACIFIC GAS AND ELECTRIC COMPANY

SMART GRID ANNUAL REPORT

2012

OCTOBER 1, 2012

SMART GRID TECHNOLOGIES

ORDER INSTITUTING RULEMAKING 08-12-009

CALIFORNIA PUBLIC UTILITIES COMMISSION



## Table of Contents

1.	Smart Grid Annual Report Executive Summary.....	2
2.	PG&E Smart Grid Deployment Plan Update .....	9
2.1.	Introduction .....	9
2.2.	Summary of Updates to PG&E’s Smart Grid Deployment Plan .....	9
2.3.	Smart Grid Project Updates Introduction .....	10
2.4.	Customer Engagement/Empowerment Projects .....	10
2.4.1.	Projects Updates .....	12
2.5.	Distribution Automation/Reliability Projects.....	26
2.5.1.	Definition, Policy Objectives, and Highlights.....	26
2.5.2.	Projects Updates .....	27
2.6.	Transmission Automation/Reliability Projects .....	32
2.6.1.	Definition, Policy Objectives, and Highlights.....	32
2.6.2.	Projects Updates .....	33
2.7.	Asset Management & Operational Efficiency Projects.....	36
2.7.1.	Definition, Policy Objectives, and Highlights.....	36
2.7.2.	Projects Updates .....	37
2.8.	Security (Physical and Cyber) Projects.....	43
2.8.1.	Definition, Policy Objectives, and Highlights.....	43
2.8.2.	Projects Updates .....	43
2.9.	Integrated and Cross-cutting Systems Projects .....	45
2.9.1.	Definition, Policy Objectives, and Highlights.....	45
2.9.2.	Projects Updates .....	46
2.10.	Customer Roadmap Introduction .....	53
2.11.	Overview of Customer Engagement Plan .....	54
2.12.	Smart Grid Engagement by Initiative Area.....	55
2.13.	Key Risks Introduction .....	57
2.14.	Key Risks and Actions Taken to Address Them .....	58
2.14.1.	Managing CyberSecurity Risk Through Control Baseline.....	60
2.14.2.	Key Risks and Major Mitigation Focus Areas .....	63
2.15.	Updates to the PG&E’s Security Risk Assessment and Privacy Threat Assessment.....	64
2.16.	PG&E’s Compliance With NERC Security Rules and Other Security Guidelines and Standards as Identified by NIST and Adopted by FERC .....	65
2.17.	Conclusion .....	68
3.	Smart Grid Metrics and Goals .....	70
3.1.	Introduction .....	70
3.2.	Customer/Advanced Metering Infrastructure Metrics .....	70
3.3.	Plug-in Electric Vehicle Metric .....	75
3.4.	Energy Storage Metric .....	75
3.5.	Grid Operations Metrics .....	76
4.	Conclusion.....	82

# CHAPTER 1

## SMART GRID ANNUAL REPORT EXECUTIVE SUMMARY

## 1. Smart Grid Annual Report Executive Summary

As one of the earliest and largest adopters of Advanced Metering Infrastructure (AMI) in North America—with more than nine million electric and gas SmartMeters™ deployed across its 70,000-square-mile service area—Pacific Gas and Electric Company (PG&E) is now leveraging this technology platform prudently and methodically to build the next-generation Smart Grid to meet the needs of our electric customers in the 21<sup>st</sup> century.

In its June 2011 Smart Grid Deployment Plan, PG&E stated that its vision for the Smart Grid was “to provide customers safe, reliable, secure, cost-effective, sustainable and flexible energy services through the integration of advanced communications and control technologies to transform the operations of our electric network, from generation to the customer’s premise.” PG&E customers will see many benefits from the Smart Grid in the coming years. Some of these benefits include, the ability to lower energy bills by controlling energy use, the availability of pricing signals which will help customers save money by shifting their energy use to times of the day when energy prices are lower, and increased reliability of service, including faster outage detection and restoration, as well as greater convenience from faster response to service requests.

In the 12 months through June 30, 2012, PG&E has made steady progress on its Smart Grid Deployment Plan, always in keeping with its focus on meeting customer needs.

For example, PG&E has continued its progress implementing new Smart Grid technology to enhance the **reliability** of its transmission and distribution grids:

- PG&E, working with the Western Electricity Coordinating Council, is installing a new high-tech monitoring system using “Synchrophasor” technology on its electric transmission system to provide early warning of potential problems so operators can take corrective action before widespread blackouts result. The same technology should also lower transmission costs by allowing operators to increase utilization rates on high-voltage lines.

- PG&E installed advanced automation technology known as Fault Location, Isolation and Service Restoration (FLISR) on 53<sup>1</sup> circuits in the Fresno and Bakersfield area to improve electric system reliability and significantly reduce the frequency and length of service interruptions. PG&E plans to continue installing this equipment in other areas of its system through 2013.
- The widespread deployment of SmartMeters™ enabled PG&E to implement its SmartMeter™ Outage Management Integration Project, which allows PG&E to use SmartMeter™ notifications to better detect areas affected by outages and “ping” individual meters to determine whether service has been restored. The result: faster and more accurate service restoration.

PG&E is also deploying Smart Grid technology to help customers better ***manage their energy use***, helping them in many cases to save money.

- PG&E has installed 9.4 million<sup>2</sup> electric and gas SmartMeters™, which offer customers unprecedented visibility into the timing and magnitude of their energy use.
- More than 2.1 million customers have access to their hourly energy usage information made available by SmartMeters™ via PG&E’s My Energy website. Home energy displays on the same website help customers compare their energy use against other similar households and save money by choosing an optimal rate plan.
- 79,418<sup>3</sup> residential customers were enrolled in the SmartRate™ program, the largest residential critical peak pricing program in the United States. In 2011, PG&E residential customers enrolled in SmartRate™ saved an average of 8 percent on their summer electric bills while reducing peak power demand by an average of 13 percent across 15 Smart Days.

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<sup>1</sup> The total amount of circuits installed as of September 21, 2012. As of June 30, 2012, PG&E had installed 29 circuits.

<sup>2</sup> The total number of SmartMeters PG&E has installed as of June 30, 2012.

<sup>3</sup> The total number of residential customers enrolled onto the SmartRate™ as of September 11, 2012.

- With backing from the White House, PG&E launched its “Green Button” initiative, which provides customers with access to standardized energy usage reports that they can share with energy service providers to help them find ways to reduce their energy consumption and save money.
- PG&E also enrolled 76,920 residential customers into the Energy Alerts program, a program which notifies customers when their energy usage may move them into a higher rate tier. These alerts help reduce the chances of bill surprises and afford customers the opportunity to make adjustments to their energy use, thereby more effectively managing their energy bills.
- PG&E customers continue to install roof-top solar photovoltaic (PV) generation. Over 65,000 customer-owned solar PV systems are connected to PG&E’s electric distribution system.<sup>4</sup>
- In 2012, PG&E launched trial programs to provide customers with energy usage information via in home displays using SmartMeter™ enabled Home Area Networks and new internet and smart phone enabled thermostats to help customers control their energy bills.

PG&E also undertook a number of other Smart Grid initiatives that should enhance the **safety and efficiency** of its electric operations:

- PG&E completed implementation of its SmartMeter™ Transformer Loading Management project giving PG&E the ability to leverage customer usage data from SmartMeters™ for equipment sizing and voltage analysis.
- PG&E completed implementation of the SmartMeter™ Operations Center (SMOC) project to test then implement telecommunication network operations management capabilities that can support PG&E’s SmartMeter™ network to handle growth in the number of deployed meters, effectively monitor the increased amount of data communications from the meters, bring new SmartMeter™-related customer

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<sup>4</sup> Total number of customer-owned Solar PV systems install as of July 2012. A subset of these total installations is reported in the Metrics section of this report as required by the CPUC’s Smart Grid Metrics decision.

services online efficiently, and enable timely customer response as well as proactive reliability and availability management.

- PG&E also completed Phase I of its Plug-In Electric Vehicle (PEV) Demand Response (DR) Pilot. The objective of this pilot was to test baseline functionalities of PEV charging hardware to evaluate potential residential smart charging capabilities utilizing the load management software over the SmartMeter™ communications network. As part of Phase II of this project, PG&E will evaluate specific requirements for PEVs and how their unique attributes can be incorporated into both statewide grid and distribution level operations and planning.
- Recently, PG&E launched a grid-scale battery pilot project at its Vaca Dixon substation to be operated in coordination with a utility-owned solar PV generating facility and California Independent System Operator (CAISO) markets to test the integration of large battery energy storage into grid operations.

Consistent with its focus on Smart Grid technologies that meet customer needs, PG&E is pursuing new, promising Smart Grid initiatives only after testing and piloting technologies to clarify the true costs and benefits that would accrue to customers. In 2011, PG&E filed Application (A.11-11-017) with the California Public Utilities Commission (CPUC or Commission) seeking approval to undertake six Smart Grid pilot projects prior to full deployment. Along with technology pilots included in the application, PG&E proposes to test customer engagement strategies related to Smart Grid.

As a result of the newly approved Electric Program Investment Charge (EPIC) program, PG&E will work with the other California Investor Owned Utilities (IOU) and the California Energy Commission (CEC) to develop technology demonstration and deployment programs that fill gaps in PG&E's Smart Grid Deployment Plan and meet the EPIC program requirements. Smart Grid-enabled capabilities are one subset of the potential focus areas for the EPIC program that will be considered by the CPUC in late 2012 and early 2013.

Finally, PG&E also undertook two Smart Grid initiatives aimed at enhancing the **cybersecurity** of its electric operations:



- PG&E finished implementing its Advanced Detection and Analysis of Persistent Threats (ADAPT) cybersecurity project, which increased PG&E's ability to anticipate, prevent, and respond to a new and emerging class of cyber and physical threats known as Advanced Persistent Threats.
- PG&E began work on the Identity and Access Management (IAM) project. This project seeks to reduce PG&E's exposure to threat of security breaches, and increase system efficiencies, by automating provisioning of applications, automating on-boarding and off-boarding processes, and implementing an integrated system for both physical and application access provisioning.

As PG&E moves towards a smarter grid, cybersecurity will continue to play a critical role in maintaining the safety, efficiency and reliability of the grid. PG&E will continue to enhance its "defense-in-depth" strategy by implementing additional physical and cyber security protection layers across PG&E's infrastructure, as well as developing a holistic Risk Management Framework that proactively assesses, manages and responds to cybersecurity risks. This risk-based approach is consistent with the Commission Staff report issued on September 19, 2012, *Cybersecurity and the Evolving Role of State Regulation: How it Impacts the California Public Utilities Commission*. PG&E has embraced the basic strategy outlined in this paper of "risk-based" security management strategies and continues to take steps to secure its systems.

### **Smart Grid and Supplier Diversity**

PG&E is integrating Smart Grid investments as part of its ongoing commitment to supplier diversity, which is essential to its success as the provider of electricity and gas to its customers in northern and central California. Through its Supplier Diversity Program, PG&E has worked for over 30 years to bring more women-, minority- and service disabled veteran-owned business enterprises (collectively, Diverse Business Enterprises or "DBEs") into its supply chain.

Following a record-breaking year of 36.6 percent total DBE spend in 2011, including a 60 percent supplier diversity spend achieved in utility-scale photovoltaic projects, PG&E plans to continue its demonstrated success in DBE outreach, development and partnership in all phases of its Smart Grid efforts. Initially, these efforts will focus on

hardware, firmware, software and systems integration, communication infrastructure upgrades, voltage management equipment, line sensors, energy forecasting and customer outreach.

As potential Smart Grid prime suppliers are identified, PG&E will emphasize the critical element of supplier diversity inclusion. PG&E will highlight the importance of careful planning for the full participation of DBEs as business solution partners and subcontractors for the primes that hope to become PG&E Smart Grid suppliers. As part of this effort, PG&E will:

- Provide educational opportunities to help prime suppliers and DBEs understand the scope and timing of proposed Smart Grid efforts.
- Provide supplier development opportunities through PG&E's Technical Assistance Program.
- Work with prime suppliers to develop value chain analyses of the scope of work to help identify DBE opportunities.
- Host and encourage prime contractors to participate in matchmaking events with potential DBE subcontractors and business solution partners.

Consistent with past practice, as PG&E continues to evolve its grid, it will continue to take steps to enhance the supplier diversity record by incorporating successful practices and engaging more diverse suppliers in future Smart Grid related purchasing decisions, supporting both the Commissions supplier diversity goals and the goals set forth in General Order (GO) 156.

The remainder of this report is organized as follows

- **Section 2** provides an update of the progress of Smart Grid projects PG&E has implemented over the last 12 months.
- **Section 3** provides an update on the Smart Grid metrics approved by the Commission in Decision (D.) 12-04-025.
- **Section 4** provides PG&E concluding remarks on this report.

## CHAPTER 2

# PG&E SMART GRID DEPLOYMENT PLAN UPDATE

## **2. PG&E Smart Grid Deployment Plan Update**

### **2.1. Introduction**

Pursuant to Ordering Paragraph 15 of the Commission Decision 10-06-047, PG&E provides this annual report with the following information included;

- a) A summary of PG&E's deployment of Smart Grid technologies during the past year (July 2011 through June 2012) and its progress on its Smart Grid Deployment Plan.
- b) The costs and benefits of Smart Grid deployment to PG&E's customers during the past year, including a monetary estimate, to the extent possible, of the health and environmental benefits that may arise from the Smart Grid.
- c) Current PG&E initiatives for Smart Grid deployments and investments.
- d) Updates to PG&E's security risk assessment and privacy threat assessment; and PG&E's compliance with North American Electric Reliability Corporation (NERC) security rules and other security guidelines and standards identified by the National Institute of Standards and Technology (NIST) and adopted by the Federal Energy Regulatory Commission (FERC).

Consistent with PG&E's Smart Grid Deployment Plan, PG&E's Smart Grid Annual Report provides information on the status of all of PG&E's Smart Grid investments, including Smart Grid Baseline Projects, Smart Grid-Related Customer Programs, and proposed Smart Grid Roadmap Projects.<sup>5</sup> For convenience of review, all of PG&E's Smart Grid investments are combined in this annual report for reference.

### **2.2. Summary of Updates to PG&E's Smart Grid Deployment Plan**

The Smart Grid Deployment Plan filed with the CPUC in June 2011 is still accurate and does not need to be updated in any significant way. While some of the specific project schedules have been adjusted to reflect the passage of time as described later in this report, the plan continues to accurately describe PG&E goals and objectives and reflects PG&E's plans with respect to the modernization of its grid, consistent with the

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<sup>5</sup> See PG&E Smart Grid Deployment Plan, Chapters 4, 5 and 6, R.08-12-009, June, 2011.

Commissions goals and Senate Bill (SB) 17. As summarized earlier and described in more detail later in this report, PG&E has made progress implementing approved projects and initiatives and is seeking approval in various proceedings to advance the plan and provide the benefits to customers expected.

### **2.3. Smart Grid Project Updates Introduction**

PG&E continues to invest in Smart Grid related projects and initiatives with the sole aim of enhancing its grid infrastructure to provide safe, reliable and affordable energy services to its customers. Over the past year, PG&E has continued the implementation of key Smart Grid related projects outlined in its Smart Grid Deployment Plan.<sup>6</sup> The projects that PG&E has implemented, or plans to implement, focus on areas such as, customer engagement, transmission and distribution automation and reliability, safety and operational efficiency, cyber security, and integrated and cross cutting systems. As a result of these efforts, PG&E has continued to gain additional information and knowledge enhancing its understanding of the capability of its grid operations, the potential for deployment of new and innovative Smart Grid technologies, and customer expectations as they relate to the Smart Grid.

### **2.4. Customer Engagement/Empowerment Projects**

Over the past year, PG&E has implemented a number of projects to provide customers with the tools necessary to manage their energy usage and their costs. PG&E considers its customers as the primary driver of its Smart Grid program. Therefore, without an engaged and empowered customers population, many benefits offered by a Smart Grid will be difficult to realize. PG&E further believes the continued leverage of SmartMeter™ technology and data access technologies to provide customers with greater benefits, and demonstrate the importance of utilizing customer demand side programs is vital to the support of PG&E efforts to help customers understand their energy use and lower their energy bills.

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<sup>6</sup> PG&E filed its Smart Grid Deployment Plans with the Commission on June 30, 2011.

In the 12 months ended June 30, 2012, PG&E has implemented various project and initiatives that manage, improve, and demonstrate the use of Demand Side Management resources for operational efficiency. For example:

- PG&E implemented a customer data access platform called the Green Button, which allows customers to access standardized historical billing and usage data sets. The ability to access billing and usage data empowers customers and customer-selected third parties to take actions that lead to increased awareness and lower energy bills.
- PG&E expanded its Energy Alerts program which provides notifications to residential customers<sup>7</sup> when their energy consumption crosses or is forecasted to cross into higher usage tiers. 76,920<sup>8</sup> customers enrolled to receive these energy alerts. These customers are continuously being notified and educated on their consumption patterns, an effort which will increase customer awareness and spur behavioral modifications that lead to lower energy usage and customer bills.
- PG&E increased residential customer enrollments in its SmartRate<sup>TM</sup> program. PG&E enrolled 78,830<sup>9</sup> residential customers onto this rate. SmartRate<sup>TM</sup> continues to provide opportunities for customers to manage and reduce their energy usage.

In addition, in 2011, PG&E implemented the Intermittent Renewable Resource Management Pilot,<sup>10</sup> a first of its kind pilot in the nation. Through this pilot, PG&E was able to utilize customer demand response resources for regulation services aimed at addressing the needs of the California Independent System Operator (CAISO) to manage renewable resources, demonstrating that with the right set of enabling

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<sup>7</sup> PG&E offers this program to residential customers with SmartMeters<sup>TM</sup> and who are on electric rate Schedules E1, E6, E7, and E8.

<sup>8</sup> These are the total number of residential customers PG&E had enrolled into the Energy Alert program as of August 2012.

<sup>9</sup> These are the total number of residential customers PG&E had enrolled into the SmartRate<sup>TM</sup> program as of September 11, 2012.

<sup>10</sup> A project update of the Intermittent Renewable Resource Management Pilot project is provided in Section 2.4.1.1.

technologies, educated and enabled customers can play an important role in integrating more renewable resources across PG&E’s service territory.<sup>11</sup>

In the coming years, PG&E will continue to pursue further assessments, demonstrations and implementation of technologies and programs that will empower customers to manage their energy usage. Projects such as PG&E’s Home Area Network (HAN) Enablement pilot project, HAN DR Integration Project, and PG&E Customer Data Access (CDA) project are some of the technologies and programs that PG&E is working on to further provide customers with the tools necessary to manage their energy usage. PG&E will also continue to evaluate the future development of DR technologies and platforms that would support integrating with PG&E operations.

### 2.4.1. Projects Updates

The following sections and tables provide an update on all completed, in-progress or planned projects as of the June 2011 Smart Grid Deployment Plan Filing Date.

#### 2.4.1.1. Demand Response – California Independent System Operator/Renewables/Transmission and Distribution Integration Projects

Intermittent Renewable Resource Management (IRRM) Pilot Phase 1
<b>Project Description</b>
In the IRRM pilot, PG&E leveraged work performed under the Commercial & Industrial (C&I) DR Participating Load Pilot to provide regulation services to the CAISO. The objective of the IRRM pilot was to demonstrate whether customers can provide second by second frequency-regulation service needs to the CAISO.
<b>Project Status/Update</b>
<u>Status:</u> Completed
<u>Update:</u> This pilot demonstrated that DR resources can assist in the balancing supply and demand on the grid, especially with higher levels of renewable resources.
<b>Funding Source</b>
PG&E 2009-2011 Demand Response Activities and Budgets

<sup>11</sup> See, <http://drrc.lbl.gov/sites/drrc.lbl.gov/files/LBNL-5556E.pdf>.

<b>Project Implementation Schedule</b>
This pilot project is complete.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent approximately \$1.14 million. The benefit of having customers provide fast responsive DR can perhaps assist PG&E in future grid planning and operations, especially when more connected intermittent generations appears on the grid.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Customer – PG&E was able to demonstrate and prove that customers enabled with the proper set of technologies can assist with system operations needs. In the future, customers may be relied upon to play a more active role to balance supply and demand on the grid.

<b>Intermittent Renewable Resource Management (IRRM) Pilot Phase 2</b>
<b>Project Description</b>
Leveraging the 2009-2011 IRRM Pilot, PG&E will continue to explore the integration of DR resources into the CAISO market to help with renewable resource integration. In this pilot, PG&E specifically will address unlocking the value streams that new and existing DR resources might be able to provide when utilized for system operations: more importantly, when there is a greater penetration of renewable resources in the grid.
<b>Project Status/Update</b>
<u>Status</u> : This project is currently in progress.
<u>Update</u> : On June 29, 2012, as part of the Commission’s ruling of Decision 12-04-045, PG&E filed Advice Letter (E-4077) seeking approval on PG&E’s DR pilots. Advice Letter E-4077 contains pertinent objectives, course of action, timeline and budget on the proposed pilots.  On July 29, 2012, Energy Division (ED) suspended the Advice Letter E-4077 for (up to) 120 days citing reason that the staff needs more time to review.
<b>Funding Source</b>
Funding for this project is provided under PG&E 2012-2014 Demand Response Proposal approved by the Commission in Decision 12-04-045.
<b>Project Implementation Schedule</b>
The implementation schedule for this project is contingent on approval of Advice Letter E-4077
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has not spent any funds to further develop or implement this project. If proved viable, the possibility of using customers to provide having customers provide fast responsive DR would assist PG&E in future grid planning and operations, especially when more connected intermittent generations appears on the grid, thereby improving overall system reliability.



**Impact to Smart Customer, Smart Market, and/or Smart Utility**

Smart Market – PG&E is beginning to evaluate the value streams of enabling DR resources and provide services to help facilitate the injection of renewable resources. PG&E is committed to discover the necessary program attributes that the system operator will need in the future.

**Proxy Demand Resources (PDR) Program – Phase 1****Project Description**

As part of the Commission's vision of integrating retail-wholesale DR programs, PG&E is in the process of enabling its retail DR programs to directly participate in the CAISO's wholesale market – PDR product.

Phase 1 of this project is focused on assembling the proper tools (i.e., telemetry, forecasting) and integrating interfaces (procurement back end systems to schedule, notify and settle) that PG&E needs to operate when bidding available DR resources in the CAISO market.

**Project Status/Update**

Status: In progress

Update: PG&E has implemented the necessary system integration and constructed the necessary tools to support the operation of this program. PG&E is currently bidding limited amounts of Demand Response (using the PeakChoice™ program) into the CAISO day-ahead energy market.

**Funding Source**

Funding for this project was provided under Market Redesign and Technology Upgrade (MRTU).

**Project Implementation Schedule**

On-going

**Cost and Benefit Estimates**

As of June 30, 2012, PG&E has spent \$15.8 Million. By bidding specific retail DR programs into the CAISO energy market as substitutes for traditional supply side resources, PG&E can improve overall reliability and reduce its procurement costs.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

Smart Utility – PG&E enables the proper system channels and construction of tools to integrate retail DR programs into the wholesale market to compete against supply side resources.

**Demand Response Transmission & Distribution (T&D) System Integration****Project Description**

The project will evaluate areas where existing DR programs can support PG&E's T&D utility planning and operations. In addition, this project will evaluate how future DR programs can be designed and implemented to support the needs and objectives of PG&E's T&D operations.

<b>Project Status/Update</b>
<u>Status</u> : This project is currently pending approval.
<u>Update</u> : On June 29, 2012, as part of the Commission's decision Decision 12-04-045, PG&E filed Advice Letter (E-4077) seeking approval of PG&E's DR pilots. Advice Letter E-4077 contains pertinent objectives, course of actions, timeline and budget on the proposed pilots. On July 29, 2012, ED suspended the Advice Letter E-4077 for (up to) 120 days citing that the staff needed more time to review.
<b>Funding Source</b>
Funding for this project is provided under PG&E 2012-2014 Demand Response Proposal approved by the Commission in Decision 12-04-045.
<b>Project Implementation Schedule</b>
The implementation schedule for this project is contingent on approval of Advice Letter E-4077.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has not spent any funds to further develop or implement this project. In the long run the benefits of this project would include the use of DR resources to improve grid reliability, especially when more intermittent resources are connected on the grid.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Utility – PG&E is beginning to evaluate the value streams of enabling DR resources and provide services to support T&D operations. PG&E is committed to discover the necessary program attributes that transmission and distribution operators will need now and in the future.

#### 2.4.1.2. Electric Vehicle Integration Project

<b>Plug-in Electric Vehicle (PEV) Demand Response Pilot Phase 1</b>
<b>Project Description</b>
The Electric Power Research Institute (EPRI) PEV DR Pilot set out to test baseline functionalities of PEV charging hardware by conducting an end-to-end system connectivity to evaluate potential residential smart charging capabilities utilizing the load management software over the SmartMeter™ network.
<b>Project Status/Update</b>
<u>Status/Update</u> : This project has been completed.
<b>Funding Source</b>
This project was funded under the 2009-2011 Demand Response Program.
<b>Project Implementation Schedule</b>
Work on this project was completed on December 31, 2011.

<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent \$1.2 million.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Market – PG&E investigates the early PEV communication and control technologies with EPRI. PG&E anticipates PEV having a significant role in PG&E’s distribution system operations in the future.

<b>Plug-in Electric Vehicle (PEV) Demand Response Pilot Phase 2</b>
<b>Project Description</b>
In Phase 2 of the PEV DR pilot, PG&E intends to concentrate on evaluating the specifics requirements of PEVs and how their unique attributes can be incorporated into both CAISO and distribution level operations and planning. This evaluation will pave the way to allow any PEV DR provider to offer valuable services to PG&E’s planning and operations functions.
<b>Project Status/Update</b>
<u>Status</u> : This project is pending approval.
<u>Update</u> : On June 29, 2012, as part of the Commission’s ruling of Decision 12-04-045, PG&E filed Advice Letter (E-4077) seeking approval on PG&E’s DR pilots. Advice Letter E-4077 contains pertinent objectives, course of actions, timeline and budget on the proposed pilots.  On July 29, 2012, ED suspended the Advice Letter E-4077 for (up to) 120 days citing reason that the staff needed more time to review.
<b>Funding Source</b>
This project is funded under the 2012-2014 Demand Response Program.
<b>Project Implementation Schedule</b>
The implementation schedule for this project is contingent on approval of Advice Letter E-4077.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has not spent any funds to further develop or implement this project. As part of this project, PG&E will continue to assess best practices to integrate PEV’s in the distribution system. The knowledge gained will help PG&E make improvements to process, service planning and customer service of future endeavors.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Utility – PG&E is assessing the requirements needed to incorporate DR from PEVs into its planning and operations functions and the associated benefits that would accrue to DR PEV providers.

### 2.4.1.3. SmartMeter™ Deployment Projects

<b>SmartMeter™ Program</b>
<b>Project Description</b>
<p>PG&amp;E's SmartMeter™ Program is nearing completion of its installation of AMI technology for virtually all of PG&amp;E's electric and gas customers. As of June 30, PG&amp;E had installed 9.4 million electric and gas SmartMeters™. SmartMeter™ technology enables PG&amp;E's customers to understand how and when they use energy. This technology serves as the foundation for tools that will allow customers to automate their home energy management and enable multiple technologies. The SmartMeter™ system improves infrastructure integrity, helps PG&amp;E manage energy demand and supply, and also enables PG&amp;E to provide more reliable service. Through these functionalities, the SmartMeter™ Program represents a vital first step toward the creation of a Smart Grid, which in turn fosters a clean energy economy and sustainable economic expansion.</p>
<b>Project Status/Update</b>
<p><u>Status:</u> This Project is in progress.</p>
<p><u>Update:</u></p> <p>A successful pilot to install NEMS configured SmartMeters to replace non-smart bi-directional meters were successfully conducted in June-July 2012. Based on the success of the pilot, the Project began residential-NEMS deployment in August.</p>
<b>Funding Source</b>
<p>PG&amp;E's SmartMeter™ Program is funded through Decision 06-07-027 (PG&amp;E's AMI decision) and Decision 09-03-026 (PG&amp;E's SmartMeter™ Upgrade decision).</p>
<b>Project Implementation Schedule</b>
<p>The SmartMeter™ program commenced in 2007 and is scheduled to be concluded in 2013.</p>
<b>Cost and Benefit Estimates</b>
<p>As of June 30, 2012 PG&amp;E spent a total of \$2,252.7 million. The 2011 annual benefits recorded in the SmartMeter™ Balancing Account were \$65.7 million.</p>
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
<p>See Project Description, above. The SmartMeter™ project is a foundational Smart Grid project.</p>

### 2.4.1.4. SmartMeter™ Enabled Tools

<b>The Green Button Initiative</b>
<b>Project Description</b>
<p>PG&amp;E's GreenGreen Button Initiative is a tool launched in late 2011 to provide customers with a means of easily accessing and downloading their energy use online in simple to understand and standardized format.</p>

<b>Project Status/Update</b>
<u>Status:</u> This project was launched in December 2011 but additional enhancements are expected to be ongoing.
<b>Funding Source</b>
The Green Button Initiative was a shareholder funded initiative.
<b>Project Implementation Schedule</b>
This is an on-going project.
<b>Cost and Benefit Estimates</b>
This tool will not only help customer better understand their energy use, but it will also support the evolution of the energy service industry that will result in third party development of tools aimed at helping customers manage their energy usage and reduce their energy bills.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Customer – customers interested in viewing and sharing their energy usage data with third parties are more engaged in managing their energy usage and controlling costs.

<b>Energy and Carbon Management System (C3)</b>
<b>Project Description</b>
<p>PG&amp;E is developing an Energy and Carbon Management System (ECMS) program to provide tools specifically for Commercial and Industrial customers to monitor and manage their energy usage and greenhouse gas (GHG) emissions.</p> <p>Initial deployment was designed to include only five customers, each with over 500 kilowatts (kW) of peak demand, and situated in different industry segments. In later a deployment, PG&amp;E plans to include customers with over 500 kW of peak demand. Functionality has been rolled out in phases beginning with the ability to monitor and report energy, cost, and GHG emissions. Subsequent phases will extend the functionality to include the ability to mitigate and monetize the impacts, including EE and DR project modeling and recommendations, customer segment usage comparison and scenario planning and what-if analysis, Energy Efficiency project tracking and reporting, and business case development.</p>
<b>Project Status/Update</b>
<u>Status:</u> This project is currently in progress.
<u>Update:</u>
To date, PG&E has expanded program participation from the initial trial of 5 customers to now more than 2,000 large commercial and industrial customers consuming production data. PG&E as a result of this program has successfully increased levels of customer interaction with large commercial and industrial customers providing these customers with useful energy tools.

<b>Funding Source</b>
This project is funded as part of PG&E 2009-2011 Demand Response Program and PG&E 2010-2012 Energy Efficiency Programs.
<b>Project Implementation Schedule</b>
This is an ongoing project that commenced in November 2010.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent a total of \$7,174,096. Through the deployment of this project, Large commercial and industrial customers now have additional tool that allow for better management of their energy usage and greenhouse gas (GHG) emissions.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Customer – the program increases customer awareness and engagement in managing their operations in an environmentally sustainable way.

<b>My Energy Web Tools</b>
<b>Project Description</b>
PG&E’s customer website (“My Energy”) allows residential, small and medium business, and small agricultural customers to view usage, price and cost, and take advantage of various rate analysis tools.  The usage information is displayed in a variety of formats including year-to-year comparison, peak/off-peak hourly and 15 minute interval data (depending on the granularity of the SmartMeter™ data), bill-to-date and monthly bill forecast. The “My Energy” website will also include a rate calculator which will calculate the customer bill under a variety of available rate plans.
<b>Project Status/Update</b>
<u>Status</u> : This is an ongoing project.
<u>Update</u> :  My Energy was recently enhanced to include functional tools like Bill-to-Date and Usage/Bill Projections. This was completed late August 2012.
<b>Funding Source</b>
This project is funded as part of PG&E 2009 Rate Design Window that authorized the implementation of a Peak Day Pricing Tariff for different customer classes.
<b>Project Implementation Schedule</b>
Excluding the remaining capabilities outlined above that will be delivered in August 2012, PG&E My Energy project commenced in March 2010 and concluded in November 2012.

**Cost and Benefit Estimates**

As of June 30, 2012, PG&E has spent a total of \$24 million on this project. My Energy provides residential, small and medium business, and small agricultural customers with visually appealing energy data that empowers the customers to recognize their consumption patterns.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

Smart Customer

## Energy Alerts

**Project Description**

PG&E Energy Alerts program is a program that notifies customers when their energy consumption crosses into higher rate Tiers or is forecasted to cross into higher rate Tiers by the end of a billing period. This program is currently being offered to residential customers with electric SmartMeters™ and who are on electric Rate Schedules E1, E6, E7 and E8. PG&E will in the near future provide this service all five million electric customers.

**Project Status/Update**

Status: This project is in progress.

Update:

As of August 11, 2012, 76,920 customers have signed up to receive Energy Alerts with approximately 170 new customers enrolling each week.

**Funding Source**

This project is funded as part of PG&E SmartMeter™ Upgrade program.

**Project Implementation Schedule**

This is an ongoing program that commenced in June 2010.

**Cost and Benefit Estimates**

As of June 30, 2012, PG&E has spent \$60,000 on this program. Energy Alerts provides enrolled customers with usage information and patterns that will help them adjust their consumption patterns to avoid paying higher energy bills.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

Smart Customer

## Home Energy Reports

**Project Description**

Home Energy Reports is a personalized mailers initiative that provides customers with comparative energy information and energy saving tips, known as Home Energy Reports.

<b>Project Status/Update</b>
<u>Status:</u> This project is currently in progress.
<u>Update:</u> Currently, 660,000 residential customers receive these In the next wave of enrollment, PG&E goal is to increase the number of residential customers receiving reports by an additional 400,000 to 600,000.
<b>Funding Source</b>
This project is funded as part of PG&E's 2010-2012 Energy Efficiency Program.
<b>Project Implementation Schedule</b>
The Home Energy Report Program is an ongoing program that commenced in March 2011.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent \$4,410,000 on this program. Based on current enrollments, customers are reporting energy savings of between 1-2 percent annually.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Customer

Customer Data Access Project
<b>Project Description</b>
Under the CDA project, PG&E will develop a platform that will allows third parties access to customer data, once authorized by the customer to do so. Upon authorization, Third-parties will have access to customer meter data, including energy usage data through the use of Opened standards. As part of CDA, PG&E will develop the gateway and set of interface standards that will facilitate third party participation in Demand Response programs in an interoperable and transparent manner.
<b>Project Status/Update</b>
<u>Status/Update:</u> PG&E's CDA Application (12-03-002) is currently pending before the Commission.
<b>Funding Source</b>
This project will be funded by through costs authorized in Application 12-03-002.
<b>Project Implementation Schedule</b>
If approved as requested, PG&E will implement Phase 1 of the CDA project in the 2nd quarter of 2014 and Phase 2 in 2015.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012 PG&E has not spent any funds to implement this project. If approved by the Commission, this project will help provide PG&E customers with a robust means of accessing their energy data in a standardized manners. It will also support the evolution of the energy services industry by providing the data necessary for third



parties to develop applications that will help customer manage their energy use and reduce their monthly bills.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

Smart Customer

**HAN Enablement Program – Phase 1 & Phase 2**

**Project Description**

PG&E's HAN Enablement program will develop the infrastructure to allow customers to register and commission a PG&E validated, standards compliant device with PG&E's AMI network to receive data from their SmartMeter™. In HAN Phase 1 (Initial Deployment), PG&E is installing and supporting up to 500 in-home displays with residential customers. Based on the results of this initial deployment, PG&E will expand the number of participating customers to no more than 5,000 as part of the Phase 2 (Early Adopters) of this project.

Phase 2 of the HAN Enablement Program will provide customers with a list of up to five PG&E validated devices that they can buy through retail channels. Customers will thereafter be able to select a validated device and self-register their HAN device through PG&E's MyEnergy and receive real time usage information directly from their SmartMeter™.

**Project Status/Update**

Status: This project is currently in progress.

Update:

As part of this project, PG&E issued an Request for Information (RFI) out to the retail market to identify devices/technologies (In Home Displays (IHD), gateways, and repeaters) that are interoperable with PG&E's SmartMeter™.

Parallel to the HAN RFI project track, PG&E is currently designing the necessary HAN – Information Technology (IT) system integration that needs to be implemented in order to enable customers to conduct self-registration capabilities for their HAN enabled devices/technologies to synchronize with PG&E's SmartMeter™.

**Funding Source**

Funding for this project will be provided through PG&E SmartMeter™ Upgrade Program.

**Project Implementation Schedule**

PG&E anticipates that this pilot project will be concluded in December 2013.

**Cost and Benefit Estimates**

As of June 30, 2012, PG&E had spent approximately \$2,060,000 to implement this project. Customers who participate in this program will have the ability to better interact with their SmartMeters™, improve the energy use awareness and modify their consumption patterns to conserve energy and reduce their energy bills.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

Smart Customer

## Home Area Network (HAN) Demand Response (DR) Integration Pilot Project

### Project Description

PG&E's HAN DR Integration Project builds upon the HAN IT infrastructure by developing price signals and load control messaging to expand the DR opportunities for residential and Small & Medium Business (SMB) customers. This pilot evaluation project will involve approximately 2,000 residential and SMB customers, allowing PG&E to identify issues, obtain feedback and learn from its customers. It will include HAN devices that provide real-time energy prices and respond to DR notifications of critical pricing events and direct load control signals.

### Project Status/Update

Status: This project is in progress.

Update:

PG&E plans on filing Tier 2 advice letter pursuant to the Commissions directive in Decision 12-04-045, seeking approval to move forward with PG&E's HAN Integration project

### Funding Source

Funding for this project will be through PG&E's 2012-2014 Demand Response Programs and Budgets authorized by Decision 12-04-045.

### Project Implementation Schedule

The implementation schedule for this project is contingent on the approval of HAN advice letter.

### Cost and Benefit Estimates

Through this project, customers will be able to use their validated HAN devices/technologies to receive price and DR signals via their SmartMeter™. This will improve their energy awareness and help them adapt their energy consumption to lower their monthly energy bills.

### Impact to Smart Customer, Smart Market, and/or Smart Utility

Smart Customer – HAN enablement will allow customers with SmartMeter™ interoperable devices/technologies to synchronize with PG&E's SmartMeter™.

## Time Varying Rates (TVR)

### Project Description

Time-varying pricing products, such as Peak Day Pricing (PDP), Time-of-Use (TOU) and Peak Time Rebate (PTR) take advantage of SmartMeter™ capabilities that are now largely available across PG&E's service territory. Charging customers different rates based on varying system conditions is intended to more closely align retail and wholesale electric prices for generation, as well as create economic incentives for customers to actively manage their energy costs by shifting electricity use from when it costs more to when it costs less. There are a number of pricing programs implemented today and others envisioned for the future. The SmartMeter™ has enabled PG&E to cost-effectively offer all customers these types of rate programs which provide significant customer and societal benefits.

<b>Project Status/Update</b>
PG&E continues to administer and offer Time Varying Pricing (TVP) Rates to all PG&E bundled residential and non-residential customer class. Beginning in November 2012, SMB customers with 12 months of SmartMeter™ data will begin a mandatory transition to TOU rates and two years later, in 2014, will be transitioned to opt-out PDP. Small Agricultural customers will transition to mandatory TOU rates annually starting in March, 2013. There is currently no decision that requires the default of Residential customers to TVP. However, they may opt-in to SmartRate™.
<b>Funding Source</b>
This project is funded as part of PG&E Rate Design Window (D.10-02-032, D.11-05-018, and D.11-11-088 – \$97.05 million), 2011 GRC (2011 Phase 1 – \$12.61 million) and AMI Cases (D.06-07-027 and D.10-02-032 – \$2.07 million).
<b>Project Implementation Schedule</b>
On-going.
<b>Cost and Benefit Estimates</b>
\$111.745 million.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Customer

#### 2.4.1.5. Emerging Customer Side Technologies

Automated Demand Response (AUTO-DR) Program
<b>Project Description</b>
Automated Demand Response (AutoDR) offers PG&E's small, medium and large commercial, industrial and agricultural customers an incentive to install equipment that enhances their ability to reduce load during DR program events. Specifically, AutoDR is an automation-based communication infrastructure that links PG&E designated third party hosted solution servers to customer-owned Energy Management Control Systems (EMCS). PG&E helps customers to develop pre-programmed energy management and curtailment strategies to automate their facilities when PG&E calls a DR event day.
<b>Project Status/Update</b>
<u>Status</u> : Project is currently in progress.
<u>Update</u> : Program currently provides incentives to large commercial and industrial customers. PG&E is looking to the viability of providing these same incentives to small/medium customers.
<b>Funding Source</b>
PG&E Auto-DR program since inception has been funded out of PG&E DR activities and budgets.

<b>Project Implementation Schedule</b>
This is an ongoing project.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent \$28,294,810. PG&E Auto-DR program has recruited 94 customers, who provide PG&E with up to 72.4 MW of dispatchable load during the summer session and 36.6 MW during winter seasons.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Customer – PG&E offers this program to enable customers with a way to automate their DR load strategies. This two-way communication and technology provides PG&E with operational status of the customer that is valuable in a smarter grid.

Opower/Honeywell Smart Thermostat Assessment /Pilot
<b>Project Description</b>
PG&E is conducting the 2012 Smart Thermostat Pilot with OPower and Honeywell to evaluate the energy benefits that accrue to customers who utilize internet-enabled thermostats, when exposed to tips and recommendations on how to reduce energy usage. This trial is a component of the Energy Efficiency Portfolio's Emerging Technologies Program, and will include a pilot group of approximately 500 residential customers.
<b>Project Status/Update</b>
<u>Status</u> : This project is currently in progress.
<u>Update</u> : PG&E is currently recruiting customers to take part on this pilot. Installation of Smart Thermostats is currently underway for those customers that have elected to participate in the pilot. PG&E will continue this recruitment through early 4 <sup>th</sup> quarter of 2012.
<b>Funding Source</b>
PG&E will fund this project using funds authorized under the 2010-2012 Energy Efficiency program, as part of Emerging Technology.
<b>Project Implementation Schedule</b>
PG&E commenced recruitment of customers for this pilot on July 19, 2012 and will conclude early 4 <sup>th</sup> quarter of 2012. Once recruitment is finished, through the pilot, PG&E will monitor usage patterns and potential savings of the test and control groups for 12 months. This pilot is scheduled to be completed by the end of 2013.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent \$ 308,252 to implement this project.

<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
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Smart Customer – PG&E is conducting a thermostat behavior assessment project that will assess if customers are more likely to take advantage of having enabling technology and what that translates to as far as energy savings.
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### 2.4.1.6. Customer Education Projects

Smart Grid Customer Outreach and Education Pilot
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<b>Project Description</b>
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PG&E Smart Grid Customer Outreach and Education pilot will test new messaging and customer outreach materials to determine how best to communicate the Smart Grid to customers in a way that meets the overall objectives of the Smart Grid deployment. The results of this pilot will be used to develop strategies to mitigate areas of potential customer concern or confusion prior implementing a larger, territory-wide outreach campaign.
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<b>Project Status/Update</b>
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<u>Status:</u> PG&E Application 11-11-017 is currently pending before the Commission.
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<b>Funding Source</b>
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The level of funding for this pilot project is contingent on the outcome achieved in Application 11-11-017.
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<b>Project Implementation Schedule</b>
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As part of its proposal in Application 11-11-017, if approved, PG&E proposes to implement the Smart Grid customer outreach pilot in 2013 through 2016.
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<b>Cost and Benefit Estimates</b>
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As of June 30, 2012, PG&E has not spent funds to implement this pilot project.
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<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
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Smart Customer
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## 2.5. Distribution Automation/Reliability Projects

### 2.5.1. Definition, Policy Objectives, and Highlights

Projects in the Distribution Automation/Reliability category provide capabilities and associated technology enablement to monitor and control the electric distribution system. Over the past year, PG&E has focused on technology capabilities to increase the visibility and control enabled by Substation Supervisory Control and Data Acquisition (SCADA) in the distribution system, implemented the Cornerstone project (Substation Capacity, Reclosers & Fuses and Feeder Automation) (FLISR) to improve reliability in select urban and suburban areas, implemented technologies to support the

effective consolidation of Distribution Control Centers, and piloted and deployed Smart Grid technologies to improve distribution performance and outage response.

## 2.5.2. Projects Updates

The following section/table provides an update on all completed, in-progress or planned projects as of the June 2011 Smart Grid Deployment Plan Filing.

Distribution Substation Supervisory Control and Data Acquisition (SCADA) Program
<b>Project Description</b>
The Distribution SCADA program focuses on increasing SCADA penetration to support future Distribution Control Center consolidation and improve reliability for PG&E customers. PG&E's goal is to achieve 100 percent visibility and control of all critical distribution substation breakers by 2016, adding or replacing SCADA for approximately 300 substations and approximately 1,000 breakers.
<b>Project Status/Update</b>
<u>Status</u> : This project is currently in progress.
<u>Update</u> : This project is upgraded or replaced SCADA in 60 substations and added SCADA on 220 breakers.
<b>Funding Source</b>
PG&E's 2011 GRC Budget
<b>Project Implementation Schedule</b>
PG&E anticipates the conclusion of this project in December 2016. Implementation of this project began on March 2011.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E spent approximately \$36 million to implement this project. Increasing SCADA penetration enables improvements in reliability, grid planning, and operations.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Utility – PG&E's goal of 100 percent visibility using SCADA is focused on impacting the utility operations and planning personnel. The SCADA expansion is expected to reduce outage time, personnel travel and operations time managing the system and provide data to better operate and plan the distribution system.

Cornerstone Improvement Project – Feeder Automation
<b>Project Description</b>
In June 2010, the CPUC approved PG&E's 3-year Cornerstone Improvement Project, which includes the installation of distribution feeder fault locating and system restoration (FLISR) systems on urban and suburban circuits.

These initiatives are expected to result in reliability improvements for PG&E customers. The Feeder Automation component of Cornerstone Improvement Project involves implementing feeder automation on approximately 400 distribution circuits. The project scope includes automating mainline protection equipment utilizing FLISR schemes to restore unaffected customers within five minutes.

**Project Status/Update**

Status: This project is currently in progress.

Update: This project has installed FLISR on 29 circuits as of June 30, 2012 and 53 circuits as of September 21, 2012. FLISR can reduce the impact of outages by quickly opening and closing automated switches to reduce what may have been a one-to-two hour outage to less than five minutes.

**Funding Source**

Decision 10-06-048.

**Project Implementation Schedule**

PG&E anticipates concluding implementation of activities under this project in December 2013. PG&E commenced FLISR implementation activities in the Summer of 2011.

**Cost and Benefit Estimates**

As of June 30, 2012, PG&E has spent \$20.0 million on this project for just FLISR.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

Smart Utility - The Cornerstone project is a project that seeks to improve the reliability of the distribution system.

**Distribution Management System (DMS) Project**

**Project Description**

PG&E is implementing electronic wall maps to assist in distribution operations control center consolidation. This project is a first step of a strategic system implementation for the electric distribution system to provide increased grid visibility and control capability.

**Project Status/Update**

Status: This project is currently in progress.

Update: This project is just beginning.

**Funding Source**

This project is funded from PG&E's 2011 General Rate Case approved funding.

**Project Implementation Schedule**

PG&E commenced implementation activities in February 2012 and anticipates concluding implementation of activities under this project in June 2015.

<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E spent \$363,000 on this project. This project will enable operational improvements that yield safety, reliability, and operational benefits.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Utility – The project installs electronic wall map capability in centralized distribution operations control centers. The electronic wall map is a new smart technology that assists operations personnel in managing and making operational decisions regarding the distribution system.

<b>Sodium Sulfur (NaS) Battery Energy Storage System (BESS) Demonstration Project</b>
<b>Project Description</b>
In this project, PG&E will utilize sodium sulfur (NaS) battery technology to demonstrate grid-scale energy storage services on the T&D system.  As part of this demonstration, PG&E will implement two projects that seek to aggregate and quantify the battery system benefits by developing and evaluating operating profiles designed to improve service reliability, provide ancillary services, and enhance the value of renewable resource integration. Specifically:  Project 1 – 4 megawatt (MW)/28 megawatt-hour (MWh) NaS BESS: In addition to mitigating reliability and power quality events for customers, this project will offer basic load leveling. The battery will also be able to respond to a regulation signal from the CAISO and may simulate the smoothing of renewable generation.  Project 2 – 2 MW/14 MWh NaS BESS: Located at a major PG&E substation, this unit will provide load leveling, optimize a nearby solar PV installation, and participate in the CAISO ancillary services market.
<b>Project Status/Update</b>
<u>Status</u> : This project is currently in progress.
<u>Update</u> :  Project 1, the unit at the Vaca Dixon substation site, is expected to begin full operation in October 2012. Project 2, the unit at the customer site is scheduled to begin operating by December 2012.
<b>Funding Source</b>
PG&E's 2011 GRC Budget.
<b>Project Implementation Schedule</b>
PG&E commenced implementation of this project in November 2009, and will conclude implementation in May 2013.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E spent approximately \$15 million to implement this project.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Market and Smart Utility – PG&E is testing the operational and integration capabilities of grid-scale storage batteries to better understand the benefits to the utility of integrating renewables and usage in the overall supply



market. PG&E is working with the CAISO on its integration and usage as part of a potential future supply market capability.

**Smart Grid Fault Location, Isolation, and Service Restoration (FLISR)**

**Project Description**

This project continues the installation of FLISR systems work that was funded in the Cornerstone Decision (D.10-06-048). Smart Grid FLISR will expand the implementation of the FLISR system to an additional 400 circuits across the PG&E system to improve customer service reliability.

**Project Status/Update**

Status: This project has is pending approval.

**Funding Source**

Proposed in PG&E 2014 GRC.

**Project Implementation Schedule**

The Smart Grid FLISR project is proposed to start in 2014 and end in 2019.

**Cost and Benefit Estimates**

As of June 30, 2012, PG&E has not spent any funds to implement Phase II of this project. When installed, FLISR can reduce the impact of outages by quickly opening and closing automated switches to reduce what may have been a one-to-two hour outage to less than five minutes.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

Smart Utility – the Smart Grid FLISR project improves customer service reliability.

**Install Smart Grid Line Sensors Pilot Project**

**Project Description**

The goal of this pilot project is to install line sensors to evaluate their impact on: (1) providing more accurate information about the fault location area, allow faster outage restoration by reducing outage response time, and improve customer satisfaction; (2) provide accurate current flow information to operators and engineers to plan and reconfigure the system without overloading equipment based on actual current measurements instead of models; and (3) provide more accurate current flow information to engineers to support better planning of the distribution system rather than relying exclusively on models. Line sensors will be installed on the overhead and underground distribution primary system to test the capabilities of the sensors to communicate when a fault was detected, and to communicate current flow data to operators and operations and planning engineers on an as-needed or pre-determined time schedule.

**Project Status/Update**

Status: This project has been submitted for approval.

<u>Update</u> : Pending before the CPUC; A.11-11-017.
<b>Funding Source</b>
Smart Grid Pilot Deployment Project Decision.
<b>Project Implementation Schedule</b>
Project will begin January 2013 and end December 31, 2016 if approved.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has not spent any funds to further develop or implement this project. This pilot project may demonstrate safety, reliability, and operational benefits through reducing outage time and improving system operations and planning.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Utility – The Smart Grid Line Sensor project improves reliability and increases the capability of the distribution system for operations and planning engineering personnel to operate and effectively run the distribution system.

Voltage and Reactive Power (Volt/Var) Optimization System Pilot
<b>Project Description</b>
The goal of this project is to pilot a voltage and reactive power (Volt/Var) optimization system to evaluate its ability to reduce customer energy usage and reduce utility system losses by managing the distribution voltage from the substation to the customer's service point (distribution primary, secondary and service systems).
<b>Project Status/Update</b>
<u>Status</u> : Project pending approval.
<u>Update</u> : Pending before the CPUC; Application 11-11-017.
<b>Funding Source</b>
Smart Grid Pilot Deployment Project Decision.
<b>Project Implementation Schedule</b>
Project will begin January 2013 and end December 2016 if approved.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has not spent any funds to further develop or implement this project. This pilot project may demonstrate the ability to enable more efficient procurement and supply of electricity, and potentially enable increased penetration of distributed renewable generation - thus reducing greenhouse gas emissions.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Utility – The Volt/Var Optimization project is a smart utility project that seeks to improve the operating efficiency of distribution circuits and customer equipment by managing the voltage and power factor devices improving the overall operating efficiency of the distribution circuit and voltage at the customer metering point.

Additionally managing the distribution voltage and power factor reduces the need for generation which in turn reduces greenhouse gas emissions.

Detect and Locate Faulted Circuit Conditions Pilot
<b>Project Description</b>
The goal of this pilot project is to install and evaluate a fault-finding software system or systems that will assist in more precisely locating failed equipment that caused an outage and determine if there are additional benefits of providing a more accurate location to utility first responders to outages.
<b>Project Status/Update</b>
<u>Status</u> : This project has been submitted for approval.
<u>Update</u> : Pending before the CPUC; Application 11-11-017.
<b>Funding Source</b>
PG&Es Smart Grid Pilot Deployment Project Decision.
<b>Project Implementation Schedule</b>
The project starts January 2013 and ends December 2016 if approved.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has not spent any funds to further develop or implement this project. This pilot project will test if safety, reliability, and operational benefits can be obtained through better understanding of the location of faults.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Utility – The Smart Grid Detect and Locate Faults project improves reliability by improving information to find the likely location of the damaged equipment that caused the distribution outage. The distribution operations personnel will be better equipped to operate and efficiently run the distribution system.

## 2.6. Transmission Automation/Reliability Projects

### 2.6.1. Definition, Policy Objectives, and Highlights

Projects included in the Transmission Automation/Reliability category provide capabilities and associated technology enablement to monitor and control the electric transmission system. Over the past year, PG&E has focused on technology capabilities to improve wide-area monitoring, protection, and control enabled by SCADA in the transmission system, equip operators with the tools necessary to enhance bulk system reliability in coordination with the CAISO and neighboring utilities, and pilot and deploy digital substation technology and other Smart Grid technologies.

## 2.6.2. Projects Updates

The following section/table provides an update on all completed, in-progress or planned projects as of the June 2011 Smart Grid Deployment Plan Filing Date.

Compressed Air Energy Storage (CAES) Demonstration Project
<b>Project Description</b>
The purpose of this project is to perform a feasibility study to determine the technical and economic feasibility of an approximately 300 MW CAES plant using a porous rock structure for air storage at a location within California. CAES technology will compress air into an underground porous rock formation using power produced during non-peak hours, and then will release the stored air to generate electricity during periods of peak demand.
<b>Project Status/Update</b>
<u>Status</u> : This project is currently in progress.
<u>Update</u> : Site selection is underway. Vender/solution selection process is in Request for Proposal state.
<b>Funding Source</b>
The project is funded by the Department of Energy/American Recovery and Reinvestment Act (DOE/ARRA) grant of \$25 million and matching funds approved by the CPUC of \$25 million.
<b>Project Implementation Schedule</b>
The project started January 2012 and is expected to be completed in August 2015.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent approximately \$4.1 million to implement this demonstration project. If demonstrated to be economically and technologically viable, CAES technology may facilitate interconnection of renewable generators and help attain clean energy policy goals.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Market – This project seeks to evaluate the construction of a large energy storage facility that can be used to manage renewables and other generation.

Transmission Substation SCADA Program
<b>Project Description</b>
Under the Transmission Substation SCADA program, PG&E is in the process of installing new SCADA on the transmission system to provide PG&E's Electric Operations and the CAISO with full visibility into the transmission system, significantly improving efficiency and operational flexibility. PG&E's goal is to achieve 100 percent visibility and control of all transmission substations by 2015, adding or replacing SCADA for approximately 300 substations

and approximately 700 breakers.
<b>Project Status/Update</b>
<u>Status</u> : This project is currently in progress.
Update: PG&E has added or replaced SCADA at 75 substations and 205 breakers.
<b>Funding Source</b>
PG&E's Transmission Owner cases.
<b>Project Implementation Schedule:</b>
The project started July 2010 and is expected to be completed in December 2015.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent approximately \$39 million to implement this project. Increasing SCADA penetration enables improvements in reliability, grid planning, and operations.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Smart Utility – PG&E's goal of 100 percent visibility using SCADA is expected to reduce outage time, personnel travel and operations time managing the system and provide data to better operate and plan the transmission system.

Modular Protection Automation and Control (MPAC) Installation Program
<b>Project Description</b>
The multi-year MPAC program aims to deploy pre-engineered, fabricated, and standardized control buildings in transmission substations. These activities are performed in an integrated manner with other PG&E projects such as capacity expansion projects, bus conversions, deficiency and aging asset replacement, control room condition improvements, reliability, and control center consolidation efforts.
<b>Project Status/Update</b>
<u>Status</u> : This project is currently in progress.
Update: PG&E has installed and completed 63 MPAC buildings.
<b>Funding Source</b>
PG&E's Transmission Owner cases.
<b>Project Implementation Schedule</b>
This is an ongoing program, and doesn't have a defined end date, the project began in 2005.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent approximately \$165 million and is projected to spend approximately \$40 million annually into the future. The program will help improve reliability of the transmission system by replacing aging infrastructure and modernizing facilities.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

The program is a Smart Utility project designed to improve reliability of the transmission system by replacing aging infrastructure and modernizing facilities.

**Regional Synchrophasor Demonstration Project**
**Project Description**

This is a regional project that includes nine partner entities, including PG&E. As part of this project, PG&E will install or replace Synchrophasor technology, also known as Phasor Measurement Units (PMU), throughout its service territory, network them together, and provide the data in a secured interface to PG&E's electric transmission operators, neighboring utilities, and the CAISO.

**Project Status/Update**

Status: This project is currently in progress.

Update: As of June 30, 2012, (1) two of 24 substations have had the PMUs installed, (2) the installation of phasor data concentrators at all 13 sites have been completed, (3) the upgrade of network communications is 75 percent complete, (4) the analytic tools proof of concept are being tested at San Ramon, and (5) the operator and engineering training is planned for September 2012.

**Funding Source**

This project was funded by DOE/ARRA at \$54 million to the Western Electricity Coordinating Council (WECC) of which PG&E is a member, and PG&E Transmission Owner rate case.

**Project Implementation Schedule**

This project started April 2010 and is expected to end April 2013.

**Cost and Benefit Estimates**

As of June 30, 2012, PG&E has spent \$12.4 million to implement this project. This project will help provide precise, real-time measurement of electrical operating data from across the Western Interconnection, allowing system operators and planners to measure the state of the electrical system and manage power quality, thereby reducing the potential for outages or constrained supply.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

This project is a Smart Utility project that is focused on gaining data and information that can be used to understand and improve upon the interconnection and reliability of the transmission system throughout the WECC area.

**Substation Automation Interoperability Upgrade**
**Project Description**

This project proposes to transform substation protection, automation and control functions from analog to digital by using digital devices and fiber optic cable instead of the traditional copper cables that is currently used for outdoor and

indoor applications. This project will use Intercontinental Exchange (IEC) standard 61850 to guide the installation design and installation and take advantage of the digital equipment (e.g., relay and Remote Terminal Unit, etc.) already available in the market. Once implemented, all of the outdoor and indoor wiring can be replaced by fiber optic cable which will significantly reduce design, installation, material and testing costs while improving system reliability by virtual of less equipment with potential wiring and testing errors.

Many vendors have already adopted IEC 61850 standard except they are not interoperable with other vendor products. Since many utilities like PG&E use multiple vendor products for protection and control, this project is to engage vendors to develop digital interfacing devices that can be interchangeable and functional with different vendor products, develop prototype for testing and evaluation prior to field installation.

**Project Status/Update Project is in its initial stages**

Status: Completed RFI including analysis/evaluation. PG&E is seeking other utilities involvement and is waiting for their response.

**Funding Source**

PG&E's FERC (TO case) and or General Rate case. The project cost is potentially being cost shared between PG&E and other utilities with Quanta Technology providing technical consultation and interface with the vendors.

**Project Implementation Schedule**

The implementation schedule for this project is dependent on the other utilities interests and business case funding.

**Cost and Benefit Estimates**

Business case is under development and preliminary analysis suggests that a 15-20 percent reduction on a typical breaker and a half project.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

Smart Utility – This project anticipate slowing future capital and expense costs while improving asset reliability.

**2.7. Asset Management & Operational Efficiency Projects**

**2.7.1. Definition, Policy Objectives, and Highlights**

Projects included in the Asset Management & Operational Efficiency category provide capabilities and associated technology enablement to track and manage asset information (e.g., location, maintenance history, specifications/characteristics), as well as assess and plan asset maintenance, replacement, and capacity enhancements. Over the past year, PG&E has focused on technology capabilities to leverage industry-standard technologies (e.g., integrated GIS/SAP system) to capture and provide access to accurate, traceable, and verifiable asset information for all stakeholders to support the Electric Operations business.

## 2.7.2. Projects Updates

The following section/table provides an update on all completed, in-progress or planned projects as of the June 2011 Smart Grid Deployment Plan Filing Date.

Transformer Load Management Project
<b>Project Description</b>
The SmartMeter™ Transformer Loading Management project enables T&D electric planning engineers and estimators to access actual customer usage data from SmartMeter™ for analysis in equipment sizing and voltage analysis. The solution will enable PG&E to report transformer (or multiple transformers) load based on interval usage data and the ability to drill down to month, week, day, and Service Point level to see the peak usage. The solution will also identify transformer (or multiple transformers) by load category (over loaded, under loaded) over the entire SmartMeter™ population.
<b>Project Status/Update</b>
<u>Status</u> : This project was completed in June 2012.
<u>Update</u> : Not applicable
<b>Funding Source</b>
This project was funded through the SmartMeter™ upgrade project, Decision 06-07-027.
<b>Project Implementation Schedule</b>
This project is complete.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E had spent a total of \$1.1 million to implement this project. This project will improve the quality of data used to manage assets, yielding reliability benefits.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
This project is a Smart Customer, Smart Market and Smart Utility project. The information provided by smart meters is cross cutting since it provides customers data to make decisions on their usage against costs from a smart market and provides information to the utility not seen before to manage its assets and market forecast regarding energy needed in the short and long term markets.

Condition-Based Maintenance (CBM) – Distribution Network Project Release
<b>Project Description</b>
The distribution network CBM project will deploy an application to accurately monitor underground equipment in the downtown San Francisco and Oakland secondary network systems. This application will also guide maintenance activities based on real-time operating conditions. Currently PG&E's performance analysis and condition assessments rely on manually intensive procedures. The CBM technology solution for electric distribution network will provide automated capabilities for field personnel to capture maintenance process and data electronically via rugged



computers and to upload data to SAP. Coupled with the SCADA system, it will be used to trigger maintenance work on the networks.

**Project Status/Update**

Status: This project is in progress.

Update: The work completed through June 30, 2012 consisted of automating the record keeping for network maintenance and improving work tracking systems. Release 2 is scheduled for completion by December 2012 and will include tracking systems for oil sampling and analysis on the distribution networks. Work on the transfer of the SCADA historian from DNA Plus to PI starts in July 2012 and will be completed by the end of 2013 which includes work to tie the new SCADA systems into the Condition Based Maintenance system.

**Funding Source**

Funded through PG&E's capital budget.

**Project Implementation Schedule**

Work on this project commenced August, 2010 and is planned to conclude December, 2013.

**Cost and Benefit Estimates**

As of June 30, 2012, PG&E has spent approximately \$2.63 million to implement this project. This project is expected to deliver safety, reliability, and operational benefits through improving the understanding of the condition of key assets in the SF and Oakland networks.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

This project is a Smart Utility project that provides PG&E personnel with information regarding existing assets to make informed maintenance and upgrade decisions.

SmartMeter™: Outage Management Integration Project
<b>Project Description</b>
The SmartMeter™ Outage Management Integration project integrates the SmartMeter™ "Last Gasp" and Restoration messages into PG&E's Outage Management System for outage notification to operators and dispatchers and improved outage restoration. The project will deliver: (1) the capability to create trouble reports from AMI alarms when an associated customer call has been received; (2) the capability to ping a transformer to determine if an outage is larger than it was inferred to be; (3) the capability to identify and display probable secondary fault locations based on unique alarm events and prior inference locations; and (4) the capability to ping individual meters to determine whether they have been restored.
<b>Project Status/Update</b>
<u>Status</u> : This project is complete.
<u>Update</u> : Not applicable.
<b>Funding Source</b>
Project funded within PG&E's SmartMeter™ Project, Decision 06-07-027.

<b>Project Implementation Schedule</b>
PG&E was started in May 2008 and completed September 2011.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent a total of \$9.85 million to implement this project. This project is expected to deliver reliability and operational benefits through leveraging SmartMeter™ data to better understand and resolve customer outages.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
This project is a Smart Utility project that integrates SmartMeter™ outage last gasps into PG&E's outage management system and allows for pinging customers to make sure they are back in power after the outage restoration work was completed.

<b>Electric Distribution Geographic Information System and Asset Management (ED GIS/AM) Project</b>
<b>Project Description</b>
<p>The ED GIS/AM project is a continuation of and enhanced approach to the Automated Mapping and Facilities Management (AM/FM) Project, where PG&amp;E upgraded hardware and software components from 2008 to 2010 and completed alignment of electric and gas maps to a common coordinate scheme or “land base”, to prepare the maps for migration and conversion into a new enterprise Geographic Information System (GIS) solution.</p> <p>While the purpose and scope of the ED GIS/AM project is consistent with and leverages work completed as part of the predecessor AM/FM project, key enhancements are being made to drive increased business value with the integrated GIS and enterprise asset management system (SAP) data. A significantly more rigorous approach to assure data quality and implement data governance processes is included as part of the new ED GIS/AM project. In addition, the scope of the ED GIS/AM project has been expanded to include mobile mapping and web-based analytics for multiple ED functions. These and other capabilities are more fully detailed and scoped in the GIS/AM project as compared to the 2011 GRC AM/FM forecast, resulting in a more comprehensive and longer duration project.</p>
<b>Project Status/Update</b>
<u>Status</u> : This project is currently in progress.
<u>Update</u> : The development of the enterprise-wide data repository commenced in October 2011 and will be completed by December, 2014.
<b>Funding Source</b>
Project funded from PG&E's GRC allocated capital and expense budget.
<b>Project Implementation Schedule</b>
PG&E anticipates the conclusion of this project by December 2014.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent a total of \$15 million to implement this project. PG&E has quantified expected cost savings including \$0.6 million in 2014, \$3.4 million in 2015 and \$4.1 million in 2016 based on efficiencies gained

from implementing the ED GIS/AM solution. These savings will result from back-office efficiencies as well as improved productivity by applying ED GIS/AM technology in conjunction with other initiatives to streamline processes that are currently manual or less efficient.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

Smart Utility - this project is expected to deliver safety, reliability, and operational benefits through enhanced visualization of PG&E's electric distribution system.

**Condition-Based Maintenance (CBM) – Substation Project**

**Project Description**

CBM is a PG&E program to implement advanced maintenance strategies and solutions that will aid in the identification and corrective action on the Transmission assets before equipment failures occur. The CBM technology solution for electric transmission substation provides the platform for equipment readings, temperature, and other data points to provide equipment lifecycle predictive analysis. The solution will automate many of the manual processes that are used today including: (1) review of station inspection and test data to identify abnormal conditions; (2) update maintenance trigger plans from oil condition assessment results, counter readings, etc.; and (3) equipment ranking for replacement decisions. The tool is also designed to provide easy access to inspection and test data to asset strategy and engineering personnel that do not have it readily available today. The data will be used to adjust maintenance triggers and for capital investment strategy.

**Project Status/Update**

Status: This project is in progress.

Update: Project will be completed in 2012.

**Funding Source**

PG&E's FERC approved Transmission Owner rate case.

**Project Implementation Schedule**

Work on this project commenced on July 2009 and is planned to conclude September 2012.

**Cost and Benefit Estimates**

As of June 30, 2012, PG&E has spent approximately \$21.8 million to implement this project. The CBM will allow decisions to be made, based on equipment condition or events, providing decision makers with the ability to do the right maintenance at the right time, reducing unplanned work.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

This project is a Smart Utility project that enables a computerized system to assist in analyzing asset operating data against the equipment capabilities and specifications to make informed decisions on maintenance, replacement and upgrade decisions.

Network Supervisory Control and Data Acquisition (SCADA) Monitoring Project
<b>Project Description</b>
<p>The project will install new monitoring and control systems on the downtown San Francisco and Oakland secondary network systems including full remote control on network protectors (including remote setting of relays), and primary switches. The monitoring itself includes voltages, currents, temperature, oil level and chamber pressures. It may also include moisture, hydrogen level and other dissolved gas monitoring depending on feasibility and availability of sensor technologies. For vaults, the monitoring system will include SCADA battery, water detection and may include others such as distributed generation monitoring and motion detection, depending on future strategy, needs, feasibility and available technologies. Real-time data collected from the equipment may be used for triggering of alarms for operation or maintenance activities, and trending for asset management decisions on maintenance and replacement strategies. The new SCADA system will also have remote operating capabilities that include vacuum switch control, network protector open/close, station transfer trip of the network protectors and group open/close.</p>
<b>Project Status/Update</b>
<u>Status</u> : This project is currently in progress.
<u>Update</u> : This project has one of 12 network groups completed. The Z-34-1 network group was released to operations in August.
<b>Funding Source</b>
Funded by PG&E's GRC allocated capital and expense budget.
<b>Project Implementation Schedule</b>
PG&E started this project in December 2010 and anticipates its completion in December 2017.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent approximately \$17.6 million to implement this project. The new control features included as part of this project will improve personnel safety and overall system operability.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
This project is a smart utility project that provides information for PG&E to better manage its assets and make informed maintenance, repair and upgrade decisions.

Load Forecasting Automation Program
<b>Project Description</b>
<p>The Load Forecasting Automation program will automate existing manual electric distribution system load forecasting to increase accuracy of the process and improve forecast documentation. Current and future SCADA data will be gathered and stored within the existing data historian system and will become an input to the new forecasting tool. Circuits with SCADA will provide hourly load data into the historian system and non-SCADA circuits will provide a single monthly peak load from monthly substation inspections. Additionally, this project will replace analog bank demand meters with electronic recording meters.</p>

<b>Project Status/Update</b>
<u>Status</u> : This project is currently in progress.
<u>Update</u> : The load forecasting application was installed on the PG&E servers, site acceptance testing was completed and all historical loading and transfers through 2011 has been uploaded into the program. User training documents were developed and currently in review. Training scheduled for July 2012. Following training in July of all users and following the summer peak, the 2012 load history and customer data will be loaded in to the application so users can begin using the new program for forecasting of 2013 loads.
<b>Funding Source</b>
PG&E's 2011 GRC Budget.
<b>Project Implementation Schedule</b>
PG&E commenced automation of its manual systems in April 2010, and anticipates completion in September 2012.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent a total of \$2.83 million to implement this project. Automatic load forecasting will drive benefits associated with improved planning.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
This project is a Smart Customer and Smart Utility project that provides enhances PG&E's forecasting and load flow capabilities for integrating renewables/distributed generation and allows planning engineers to better manage when distribution circuits upgrades are needed.

Short Term Demand Reporting Smart Grid Pilot Project
<b>Project Description</b>
The objective of the proposed Project is to evaluate if more granular sources of data can be acquired and used to improve the accuracy of PG&E's short-term electricity demand forecasts. The Project will follow a three phase approach to analyze, build, and pilot the data acquisition, modeling, and forecasting activities.
<b>Project Status/Update</b>
<u>Status</u> : PG&E proposal is currently pending before the Commission.
<u>Update</u> : PG&E filed its proposal with the Commission in November 21, 2011.
<b>Funding Source</b>
This project is to be funded by PG&E's Smart Grid Pilot Deployment Project if approved.
<b>Project Implementation Schedule</b>
This project will be started in January, 2012 with completion in December 31, 2016.

<b>Cost and Benefit Estimates</b>
As of June 30, 2012, no funds have been expended. This pilot project may demonstrate the ability to improve short-term forecasting, allowing more efficient energy procurement.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
This project is a Smart Market and Smart Utility project that uses SmartMeter™ usage data to better forecast generation purchase in the short and long term as well provide another source of forecasted load for PG&E's planning and operations personnel to use in operational and planning decisions.

## 2.8. Security (Physical and Cyber) Projects

Since the publication of the Smart Grid Deployment Plan, PG&E has completed the Advanced Detection and Analysis of Persistent Threats (ADAPT) cybersecurity project that was primarily focused on increasing the Utility's capability to effectively anticipate, prevent, and respond to a new and emerging class of cyber and physical threats known as Advanced Persistent Threats, or APT. Following the conclusion of the ADAPT project, PG&E has undertaken the implementation of a second project, the IAM project. This is a multi-year investment focused on improving PG&E's core access control capabilities. Additional detail on these two projects has been provided in the following section, and discussion of PG&E's overall Cybersecurity Risk Management Program is provided in Section 2.14.2.1 of this report.

### 2.8.1. Definition, Policy Objectives, and Highlights

The cybersecurity projects have multiple goals and provide regulatory compliance benefits (SOX, NERC CIP, and other standards and regulations) significant risk reduction benefits, and alignment to PG&E Risk Management Framework as described later in this document.

### 2.8.2. Projects Updates

The following section/table provides an update on all completed, in-progress or planned projects as of the June 2011 Smart Grid Deployment Plan Filing Date.

Advanced Detection and Analysis of Persistent Threats (ADAPT) Cyber Security Project
<b>Project Description</b>
The ADAPT project is focused on increasing PG&E's ability to effectively anticipate, prevent, and respond to current and shifting cyber and physical threats by enhancing the following three control areas:

- a) Intelligence and threat management controls: Build specific “early-warning” controls that electronically collect, analyze, and correlate information on Utility-targeting threats before they “approach” the Utility’s logical perimeter.
- b) Advanced detective and preventative controls: Develop controls that “harden” the Utility’s cyber security infrastructure with multiple layers of technology to filter, quarantine, and send alarms on questionable data.
- c) Adaptive response controls: Enhance incident monitoring, response, and investigation capabilities to quickly respond to potential security incidents

**Project Status/Update**

Status: This project is complete.

Update: PG&E completed this project in May 2012.

**Funding Source**

Funded by PG&E’s capital and expense budget.

**Project Implementation Schedule**

PG&E completed this project in May 2012.

**Cost and Benefit Estimates**

As of June 30, 2012, PG&E has spent approximately \$18.4 million to implement this project. ADAPT implemented enhanced capabilities that are being used across the PG&E enterprise including Threat Analysis Capability, Advanced Malware Detection, Network Monitoring and Visibility, Network Mapping, Network Recording, Governance, Risk, and Compliance (GRC) Platform, Case Management, Vendor Management, Enhanced Remote Access, and Physical Access Management.

**Impact to Smart Customer, Smart Market, and/or Smart Utility**

The ADAPT project, enhances controls across the entire PG&E infrastructure and is not limited to the Smart Grid. Each of the Smart Customer, Smart Market, and Smart Utility areas benefit from these improved controls that protect key processes and systems across the enterprise. For example, as part of ADAPT, PG&E has implemented a standard cybersecurity process for all third party vendors to minimize third party security risks.

**Identity and Access Management Project**

**Project Description**

The IAM project is a multi-year, enterprise level investment that will strengthen authorized PG&E system access controls and reduce the risk of unauthorized access. The project will improve centralized control over access to PG&E’s key systems, provide role-based access control to those systems, provide a central authoritative source for identity attributes of authorized individuals, and provide enhanced auditing capabilities to achieve enterprise-wide visibility and control of employee access to systems.

Through the IAM Project, PG&E will implement key technologies and services in the areas of identity management, credential administration, provisioning, entitlements, access management, and audit and compliance.

<b>Project Status/Update</b>
<u>Status</u> : This project started March 2012.
<u>Update</u> : This project is ongoing and in-progress.
<b>Funding Source</b>
Funded by PG&E's capital and expense budget.
<b>Project Implementation Schedule</b>
This is a multi-year project expect to complete in 2016.
<b>Cost and Benefit Estimates</b>
As of July 30, 2012, PG&E has spent approximately \$1 million to implement this project.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
The IAM project, enhances controls across the entire PG&E infrastructure and is not limited to the Smart Grid. Each of the Smart Customer, Smart Market, and Smart Utility areas benefit from these improved controls that protect key processes and systems across the enterprise. For example, the infrastructure that allows customers to login to PG&E My Energy will be enhanced with increased security and control mechanisms to validate that only customers and their approved designees can access customer energy information online.

## **2.9. Integrated and Cross-cutting Systems Projects**

### **2.9.1. Definition, Policy Objectives, and Highlights**

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

Integrated communications systems will provide solutions to connect and enable sensors, metering, maintenance, and grid asset control networks. In the mid-to-long term, integrated and cross cutting systems would enable information exchange with the IOU, service partners and customers using secure networks. Data management and analytics projects will improve the IOU's ability to utilize vast new streams of data from T&D automation and SmartMeters™ for improved operations, planning, asset management, and enhanced services for customers.



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

Workforce development & advanced technology training enables the successful deployment of new technologies, ensuring that the IOUs' workforces are prepared to make use of new technologies.

The integrated and cross-cutting systems group is driven by several state and federal laws and regulatory orders including SB17, EISA, CPUC Decision 10-06-047, AB 32 and Executive Order S-305 , SB 078 and SB X1-2.

### 2.9.2. Projects Updates

The following section/table provides an update on all completed, in-progress or planned projects as of the June 2011 Smart Grid Deployment Plan Filing Date.

Applied Technology Services (ATS) Distribution Test Yard (DTY)
<b>Project Description</b>
The DTY will serve as a laboratory, substation, and simulated distribution circuit facility for monitoring and evaluating various new distribution tools, equipment, and applications. It will include the necessary substation and line equipment with isolated communications networks to allow safe and thorough testing without risking network security issues. This DTY will be part of the overall ATS end-to-end test capability for distribution systems of the future.
<b>Project Status/Update</b>
<u>Status</u> : This project is currently in progress.
<u>Update</u> : Construction is completed and site is operational. Facility was commissioned in September 2012.
<b>Funding Source</b>
This project is being funded under PG&E 2011 GRC.
<b>Project Implementation Schedule</b>
Completion of this project that commenced in January 2010 is anticipated to be in August 2012.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent \$6.53 million to implement this project.

<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Cross-Cutting initiatives apply across Smart Customer, Smart Markets and Smart Utility.

<b>SmartMeter™ Operations Center (SMOC) Project</b>
<b>Project Description</b>
<p>The SMOC project implements telecommunication network operations management capabilities to support PG&amp;E's SmartMeter™ network to handle growth in the number of deployed meters, effectively monitor the increased amount of data communications from the meters, bring new SmartMeter™-related customer services on-line efficiently, and enable timely customer response as well as proactive reliability and availability management. This scope includes designing and implementing a new SMOC for the day-to-day operations of the existing installed systems and ensure vendor production and operational commitments.</p> <p>The Operations Center will be expanded in the future to extend capabilities to support SmartMeter™ and Smart Grid strategies. The SMOC will become a central hub to manage the operations of the SmartMeter™ network, grid network systems, and telecommunications network.</p>
<b>Project Status/Update</b>
<u>Status</u> : This project has been completed.
<u>Update</u> : Implementation of this project was completed in July 2012.
<b>Funding Source</b>
This project is being funded under PG&E's 2011 GRC budget.
<b>Project Implementation Schedule</b>
PG&E completed the implementation of this project in July 2012.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E spent \$2.1 million to implement this project. This demonstration project will help evaluate and attain policy objectives in clean energy goals in an efficient manner.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Cross-Cutting initiatives apply across Smart Customer, Smart Markets and Smart Utility.

<b>Data Historian Foundation Project</b>
<b>Project Description</b>
This project will implement enhanced data historian software for managing and analyzing operational data with select user groups in electric transmission (including the Synchrophasor Project), gas operations, power generation, and energy procurement. When deployed and integrated with other electric systems such as EMS and SCADA, the new

<p>data historian will serve as the central data archiving and analysis system for all time-series operational data. This solution enables PG&amp;E operators, engineers, managers and executives to analyze, visualize, and share operational and business data in a manner that not only makes the most sense to them, but also informs intelligent decision-making throughout the utility value chain. The benefits of this capability include productivity improvements, situational awareness, reliability improvements, and regulatory compliance. A separate project is required to enable these capabilities for electric distribution.</p>
<p><b>Project Status/Update</b></p>
<p><u>Status</u>: This project is currently in progress.</p>
<p><u>Update</u>: Project is progressing according to plans. Deployment to Transmission Operation is planned for 2013.</p>
<p><b>Funding Source</b></p>
<p>This project is being funded under PG&amp;E TO Rate Case and PG&amp;E proposed 2014 GRC.</p>
<p><b>Project Implementation Schedule</b></p>
<p>Completion of this project that commenced January 2011 is anticipated in June 2013.</p>
<p><b>Cost and Benefit Estimates</b></p>
<p>As of June 30, 2012, PG&amp;E has spent \$7.7 million. This project will enable the company to make intelligent decision for the planning process and deliver operational enhancements.</p>
<p><b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b></p>
<p>Cross-Cutting initiatives apply across Smart Customer, Smart Markets and Smart Utility</p>

<p>Telecommunications Architecture</p>
<p><b>Project Description</b></p>
<p>PG&amp;E will meet near-term and long-term future telecommunications needs by developing and implementing a multi-tier, multi service telecommunications infrastructure architecture, consisting of a core and an edge network. Smart Grid projects require an exponential increase in the ability for customers, markets and utilities to securely and reliably communicate on a near real time basis. New communication models include customer to utility, customer to market, and smart “equipment to equipment.” PG&amp;E’s telecommunication infrastructure must be enhanced to facilitate this increased communications and also developed in a systematic, economic manner that allows for re use of communications infrastructure.</p> <p>A blend of technologies will be needed to address the diverse performance needs and geography of the PG&amp;E service territory. Increased SCADA density, Phasor Measurement Units, cyber security, and network management requirements will drive capacity, latency, and quality of service requirements that must be built into future networks.</p>
<p><b>Project Status/Update</b></p>
<p><u>Status</u>: This project is currently in progress.</p>
<p><u>Update</u>: PG&amp;E has started the implementation of an MPLS IP network starting in 2012 with the core sites; Data</p>

Centers and major Operating facilities. Capacity enhancements are underway as well to equip the core with the capabilities to handle the larger capacity, reliability and security requirements.
<b>Funding Source</b>
This project is being funded under PG&E GRC budget.
<b>Project Implementation Schedule</b>
2012-2016
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent \$5 million. Project costs are \$25 million over five years. Benefits are estimated at \$10 million in lifecycle asset replacement avoidance. Mitigation of security risks is also a benefit.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Cross-Cutting initiatives apply across Smart Customer, Smart Markets and Smart Utility.

Information Management Architecture
<b>Project Description</b>
<p>PG&amp;E intends to invest in a core set of Information Management and processing capabilities to allow participants in the Smart Grid to have timely access to the best available data to drive their energy related decisions. The Information Architecture foundation includes enhanced decision support tools to more accurately analyze, predict, and respond to energy impacting events based on data processed from a multitude of systems and stakeholders. The high level areas of foundational information architecture investments include the following:</p> <p>Master Data Management across business processes and systems.</p> <p>Enhancement of PG&amp;E's current operational data store capabilities.</p> <p>Common services including Service Oriented Architecture and framework to support Smart Grid systems and data interoperability.</p> <p>Enhanced business intelligence and analytic capabilities to support storing and processing of disparate sources of data.</p> <p>Data governance program and standards to support the enhanced information architecture and management foundation.</p>
<b>Project Status/Update</b>
<u>Status</u> : Project has not started.
<u>Update</u> : Project to be started when overall Smart Grid effort receives budget.
<b>Funding Source</b>
This project is being funded under PG&E's GRC budget and other related applications
<b>Project Implementation Schedule</b>

Pending.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent no funds to implement this project.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Cross-Cutting initiatives apply across Smart Customer, Smart Markets and Smart Utility.

Technology Evaluation, Standards and Testing (TEST)
<b>Project Description</b>
<p>PG&amp;E proposes to create a foundational Smart Grid TEST capability to support the successful deployment of Smart Grid initiatives as described in the Smart Grid Deployment Plan, as well as new initiatives that will emerge in the future. This TEST initiative has five components:</p> <ol style="list-style-type: none"> <li>1. Creating and coordinating Smart Grid technology identification and development across PG&amp;E.</li> <li>2. Leveraging data from newly deployed technology and infrastructure throughout PG&amp;E's operations and services.</li> <li>3. Applying external research and demonstrations from industry and publicly funded projects to improve PG&amp;E's operations.</li> <li>4. Expanding PG&amp;E's engagement in standards development efforts and supporting compliance certification activities not currently covered.</li> <li>5. Reducing the risk of new and emerging technologies through an "end-to-end" technology evaluation and testing capability.</li> </ol>
<b>Project Status/Update</b>
<u>Status</u> : PG&E proposal for this initiative is currently pending before the Commission.
<u>Update</u> : PG&E filed its application with the Commission in November 21, 2012 and this application is currently pending before the Commission.
<b>Funding Source</b>
If authorized, this project will be funded under PG&E's Smart Grid Pilot Deployment Project (A.11-11-017).
<b>Project Implementation Schedule</b>
If authorized, PG&E will implement this project from 2013 through 2016.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has not spent any costs to implement this project.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Cross-Cutting initiatives apply across Smart Customer, Smart Markets and Smart Utility.

LLNL CES-21 Joint Utility Partnership
<b>Project Description</b>
<p>PG&amp;E, Southern California Energy (SCE), and San Diego Gas and Electric (SDG&amp;E) filed a joint application to recover costs for a public-private collaborative agreement with Lawrence Livermore National Laboratory, known as the "California Energy Systems for the 21st Century Project" (CES 21 Project). The CES-21 Project's objective is to apply high performance, computationally based problem solving resources to analyze and address the complex challenges presented by California's Clean Energy Plan and the advanced 21st century energy systems (electric and natural gas).</p> <p>The application requests authorization to recover up to \$150M over five years for the CES 21 Project. Joint funding will be shared among the IOUs: PG&amp;E – 55 percent, SCE – 35 percent, SDG&amp;E – 10 percent. There is no minimum spend for the CES 21 Project. The IOUs have proposed that a Board of Directors will review and approve individual projects.</p>
<b>Project Status/Update</b>
<u>Status</u> : The Joint Utilities' proposal (A.11-07-008) is currently pending before the Commission.
<u>Update</u> : PG&E anticipates a final decision by year-end 2012.
<b>Funding Source</b>
If approved, this project will be funded under Application 11-07-008.
<b>Project Implementation Schedule</b>
If approved, PG&E will implement this project from 2013 through 2017.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has not spent any funds in this project.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Cross-Cutting initiatives apply across Smart Customer, Smart Markets and Smart Utility.

Electric Program Investment Charge (EPIC) Decision RD&D
<b>Project Description</b>
<p>As a result of the CPUC's EPIC Decision 12-05-037, PG&amp;E, in addition to the other California IOUs, and the CEC will be proposing A 2012-2014 Triennial Investment Plan and program framework to provide ongoing support for the development and deployment of next generation clean energy technologies. Promising new Smart Grid technologies that support the integration of renewable resources onto the grid is one potential focus area for the EPIC program that will be filed with the CPUC by November 1, 2012, with work commencing in 2013.</p>
<b>Project Status/Update</b>
<u>Status</u> : Decision Approved, Pending PG&E filing of Triennial Investment Plan on November 1, 2012 with the CPUC.
<u>Update</u> : Pending filing.

<b>Funding Source</b>
EPIC Decision 12-05-037, Public Goods Charge funding.
<b>Project Implementation Schedule</b>
PG&E will propose initiatives within a three year investment cycle as part of the Triennial Investment Plan.
<b>Cost and Benefit Estimates</b>
PG&E has been authorized so spend approximately \$15 M a year as part of the EPIC Decision.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Cross-Cutting initiatives apply across Smart Customer, Smart Markets and Smart Utility.

Workforce Development
<b>Project Description</b>
Develop the Smart Grid workforce along two parallel tracks: (1) scale training programs required for mass deployment based on knowledge and skill elements captured during each demonstration pilot; and (2) create a pipeline of new workers and facilitate ongoing skills development for employees and the public by building career pathway programs in partnership with the California post-secondary education system. Significant new workforce skills and knowledge are required for successful Smart Grid design, deployment, operation, maintenance, and customer care. PG&E will develop internal training programs through experience with demonstration pilot projects and scale them for mass deployment. Smart Grid career pathways will be built through partnerships with California's post-secondary education system to enable the public as well as PG&E employees to develop the requisite skills and knowledge for the future.
<b>Project Status/Update</b>
<u>Status:</u> A framework was developed for up-skilling the workforce to support mass deployment of the Smart Grid Deployment Plan. Progress continues with the California Public Postsecondary System in the following areas: (1) basic computer literacy training is being developed and implemented with initial teams to prepare for computerization of paper-based processes, and (2) broad-based engineering training requirements were reviewed as documented by the IOUs in the California Smart Grid Center's survey of knowledge and skills. PG&E contributed to the development of Sacramento State University's four-course Smart Grid certificate program for Power Engineers. Meetings conducted with 26 Bay Area community colleges created awareness of Smart Grid technologies and projections of workforce needs.
<u>Update:</u> In order to accomplish mass deployment and new worker pipeline for Smart Grid, strategic educational partnerships must be created. This will be a key area of focus for 2013 to engage and partner with educational institutions in our Smart Grid workforce development plan. As an initial step, a Scholars-in-Residence program was funded to enable work with PG&E on Smart Grid standards development and testing by Sacramento State University graduate students.
<b>Funding Source</b>
This project is being funded under PG&E's PowerPathway™ program.

<b>Project Implementation Schedule</b>
Ongoing planning for implementation pending rate case approvals.
<b>Cost and Benefit Estimates</b>
As of June 30, 2012, PG&E has spent \$15,000.
<b>Impact to Smart Customer, Smart Market, and/or Smart Utility</b>
Cross-Cutting initiatives apply across Smart Customer, Smart Markets and Smart Utility.

## 2.10. Customer Roadmap Introduction

In its Smart Grid Workshop Report, CPUC Staff requested the following information to be included in the October 1, 2012 Smart Grid Annual Report:

1. Timeline that connects specific projects with specific marketing and outreach efforts, and
2. Specific steps to overcome roadblocks, as identified in the workshops and included in this report.<sup>12</sup>

In addition, CPUC Staff requested that PG&E provide marketing and outreach information using the sample template in Appendix 1 to the Smart Grid Workshop Report. PG&E has organized information within this template as follows:

- Timeline. PG&E has adapted the CPUC Staff's template (Appendix 1) to reflect the existing and planned work that is related to the Smart Grid, including approved initiatives in place that meet the customer objectives outlined in SB 17 and Decision 10-06-047.<sup>13</sup> PG&E has also outlined proposed Smart Grid pilot deployment initiatives and related customer outreach and education, pending approval of Application 11-11-017.
- Initiative Detail. For each of the project areas identified in the Customer Engagement timeline, PG&E has provided more detail on existing or proposed

<sup>12</sup> See Smart Grid Workshop Report: Staff Comments and Recommendations, March 1, 2012, page 10.

<sup>13</sup> These are also summarized in PG&E's pending Smart Grid Pilot Deployment Project application, Application 11-11-017, page 5-1.



outreach in accordance with the proposed template from the Commission’s Smart Grid Workshop Report.

Table 2 below provides an annual illustration of PG&E’s customer engagement timeline.

TABLE 2  
PACIFIC GAS AND ELECTRIC COMPANY  
2012 SMART GRID ANNUAL REPORT  
CUSTOMER ENGAGEMENT TIMELINE

	2012	2013	2014	2015
Enablement Tools				
My Energy Web presentment tools	X	X	X	X
Energy Alerts	X	X	X	
Home Energy Reports	X	X		
Home Area Network (HAN); Smart Thermostat, etc.	X	X	X	
Third-party tools (e.g. Green Button)	X	X	X	
Customer Premise Devices				
SmartMeter™	X	X		
SmartAC™	X	X	X	
DG programs (California Solar Initiative; Solar Water Heating, etc.)	X	X	X	X
Rates Options				
SmartRate™ and related residential time varying rates	X	X	TBD	TBD
Time of Use	X	X	X	
Peak Day Pricing		X	X	X
Pilot Deployment Projects <sup>A</sup>				
Smart Grid customer outreach research & message testing**	X	X	X	
Smart Grid foundational outreach			X	X
Line sensor/related technology B			X	X
Voltage and Reactive Power Optimization			X	X
<i>Note:</i>				
<sup>A</sup> All activities in this section subject to approval of PG&E’s Smart Grid Pilot Deployment Project, Application 11-11-017.				
<sup>B</sup> Marketing, Education and Outreach (ME&O) on the pilot Smart Grid deployment initiatives subject to approval of Application 11-11-017, in addition to insight and findings from the proposed research and message testing.				

## 2.11. Overview of Customer Engagement Plan

PG&E believes that the customer must be placed at the center of its Smart Grid development plans to ensure that customer benefits, options and the role that customers will play are clearly communicated. Additionally, customers must have the

tools and knowledge to personally benefit from the Smart Grid in the ways most impactful to them as businesses, individuals and families. PG&E efforts over the last 12 months have been focused on goals.

This effort has included customer education about the tools currently available to them, which are designed to help PG&E’s customers understand their energy use, engage with their usage in ways they prefer—whether online, in-home or through the mail—and offer more choice and options as it relates to rate plans and new technology.

Additionally, PG&E’s has sought to more broadly educate customers on longer-term benefits of Smart Grid technology beyond these immediate offerings, to provide context for future technologies and customer-facing benefits that will be available in the coming years. Central to this effort is PG&E’s proposed Customer Outreach and Education Pilot, which includes research and message testing to better understand customers’ interest in the Smart Grid benefits and services they most value.

**2.12. Smart Grid Engagement by Initiative Area**

In the following section PG&E describes the customer engagement elements for each initiative identified in Table 2 above, as requested by CPUC Staff in its March 1, 2012 Smart Grid Workshop Report.

Enablement Tool: Power Management Tools	
Project Description	ME&O to educate customers about the various tools available to see their power usage, and manage their energy use in new ways, leveraging available interval data. There are increasing options for customers to interact with their energy usage in ways that are convenient and suit their preferences.
Target Audience	Heavier focus on Residential and SMB
Sample Message	“PG&E offers a number of ways to help you see your energy use and understand ways to save.”
Source of Message	Utility
Current Customer Engagement Road Block(s)	<ul style="list-style-type: none"> <li>• Not all customers are Web savvy or inclined to adopt new technology.</li> <li>• Low awareness of some of the tools.</li> <li>• Low engagement within tools like My Energy once customers sign-up to see their power.</li> </ul>

Strategy to Overcome Roadblocks	<ul style="list-style-type: none"> <li>• Offer customers alternatives to logging into My Energy or signing up for a HAN pilot, such as Home Energy Reports which are mailed to their residence.</li> <li>• Continue to market tools, but package as a holistic solution available to customers (as opposed to only relying on efforts around singular program/tool sign-up). This will also help set the stage as Smart Grid pilot technologies become available and set the context for these upgrades.</li> <li>• Show customers, in familiar and even entertaining ways, how customers like them benefit from engaging with their energy usage information.</li> </ul>
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Enablement Tools: In-Home Devices	
Project Description	ME&O to educate customers about the devices available for their home or business that either: (1) provide interval energy usage data like SmartMeter, (2) allow customers to participate directly in grid operations like SmartAC or (3) facilitate customer generation in the case of Solar.
Target Audience	Residential and SMB customers (large C&I often have dedicated account representatives or specific tools for their business needs).
Sample Message	“Devices are available to help manage energy use and costs.”
Source of Message	Utility
Current Customer Engagement Road Block(s)	<ul style="list-style-type: none"> <li>• Continued benefits education on benefits of SmartMeter technology.</li> <li>• Privacy and RF concerns with wireless devices.</li> <li>• In the case of solar, upfront investment required.</li> </ul>
Strategy to Overcome Roadblocks	<ul style="list-style-type: none"> <li>• Provide customers with factual information about devices like SmartMeter™, focusing on the benefits and energy management tools it enables.</li> <li>• Continue to market solar (DG) rebates that are available, and offer assistance through dedicated Web and call center resources.</li> </ul>

Rate Options	
Project Description	ME&O to educate customers about new rate structures—both default (SMB) and opt-in (residential).
Target Audience	Large focus on Residential regarding opt-in rates like SmartRate. Heavy focus on SMB regarding TOU default.
Sample Message	“Rate options offer new ways to conserve energy and save money.”
Source of Message	Utility

<p>Current Customer Engagement Road Block(s)</p>	<ul style="list-style-type: none"> <li>• Need to clearly communicate nuances of rates and ensure customers understand how they can benefit.</li> <li>• TOU and critical peak pricing requires action from the customer on event days.</li> <li>• Overcoming sentiment that new rates will result in higher bills for customers.</li> </ul>
<p>Strategy to Overcome Roadblocks</p>	<ul style="list-style-type: none"> <li>• Sustained, ongoing outreach about the new rates (if default) and how to participate in the program (if opt-in like SmartRate), both before sign-up or default and through the event season.</li> <li>• Provide customers examples of how to benefit on the rate on peak days, and provide a high-level summary of why event days get called.</li> <li>• Bundling the enablement tools available to customers (mentioned above), so that customers can conduct rate comparisons and understand their energy costs in more detail.</li> </ul>

**2.13. Key Security Risk Introduction**

PG&E initially laid out its strategy for measuring, managing and mitigating both cybersecurity technology risks and physical security risks in its June 2011 Smart Grid Deployment Plan filing. The strategy described in June 2011 highlighted PG&E’s fundamental cybersecurity approach at that time. The Utility business continues to evolve. New operational models depend more and more on converged ITs and Operational Technologies to perform advanced business functions such as those proposed for the Smart Grid. Many of these functions are automated and will be implemented through information-rich applications or grid automation with “smart” devices. New technologies change the risk and threat landscape. New threats continue to put pressure and change the risk posture of the Utility requiring more protective measures and safeguards to prevent, detect, respond, and recover in a resilient manner that does not jeopardize the safe, reliable, and cost-effective delivery of energy to customers. Since June 2011, PG&E’s cybersecurity strategy has evolved, with the implementation of a more quantitative approach to risk management through the newly developed and deployed Risk Management Framework (RMF) that blends current efforts for managing compliance with this new method for proactively managing risk. This approach is emphasized in the CPUC September 19, 2012 Policy Paper: *Cybersecurity and the Evolving Role of State Regulation: How it Impacts the California Public Utilities Commission*. As recognized by the CPUC, “Compliance is an important component of addressing cybersecurity, but it is not enough to ensure that the rapidly evolving risks are

adequately considered and acted upon effectively. ... A broader risk management-based approach is needed to move beyond minimal compliance and mitigate cybersecurity risks as they arise.” PG&E recognizes that focusing solely on compliance management without a holistic risk management framework will not achieve the desired optimal outcome to adequately protect the Utility and the Smart Grid. This philosophy also extends to PG&E’s physical security strategy, which is driven by the Corporate Security department and plays an important role in protecting PG&E’s Smart Grid assets. Physical security continues to remain focused on four layers of physical security that work to complement each other to provide the necessary level of security for the Smart Grid. From a cybersecurity perspective, physical security is leveraged as part of the overall defense-in-depth strategy; a critical protection layer for the widely distributed systems and devices planned for the evolving Smart Grid.

#### **2.14. Key Risks and Actions Taken to Address Them**

PG&E established the RMF as part of its ongoing focus on continuous improvement—from cybersecurity risk assessment to technology risk management. PG&E’s June 2011 Smart Grid Deployment Plan described its holistic approach to cybersecurity which was based on the concept of risk assessment. It described how security would be achieved for the Smart Grid through principle-based concepts such as “defense-in-depth” and “least privilege” that are enabled through multiple security “service layers”. PG&E Smart Grid Pilot Deployment Project (A.11-1-017) extends this concept by tying together how each detailed security “service” would be specifically woven into each of the proposed pilot projects to assess and mitigate the cybersecurity risks.

PG&E has taken additional steps to further enhance its cybersecurity risk management procedures and has implemented processes to consistently measure, manage, and mitigate technology risks. PG&E’s Risk Management Framework quantifies system-specific risk via a “cybersecurity risk index” to give a relative cybersecurity measure on a system by system basis. Processes are also applied to evaluate and rank the likelihood of, and impact from, potential information security risks for each of PG&E’s lines of business. Risk evaluation activities may include augmenting security controls through mitigation, transferring some of the risk to a third party (such as in the case of cyber insurance), or accepting an appropriate level of “residual” risk. As the

CPUC staff notes, “Regulators must also be able to adapt their assessments of cost-effectiveness to a dynamic assessment of risk. Using risk assessment can greatly enhance the ability of regulators to determine appropriate level of funding for cybersecurity measures, recognizing that a 100 percent secure system cannot be achieved.<sup>14</sup>” Through these efforts PG&E is able to establish that appropriate level of investment while reducing residual risk just below the target threshold with the right amount of controls in place to ensure safe and reliable operations. PG&E has adopted a continuous approach to managing and controlling IT risk by regularly and repeatedly measuring and mitigating risk to acceptable threshold levels. This methodology enables PG&E to prioritize security specific investments by identifying opportunities for improvement in the cybersecurity control framework. PG&E has most recently prioritized three security related investment areas—Disaster Recovery, Telecommunications Network Enhancements and Identity and Access Management—to bring about operational risk reduction benefits and further improve the controls across PG&E.

While the next sections primarily focus on managing cybersecurity, physical security remains critical for controlling risk within the Smart Grid. PG&E’s Corporate Security department remains abreast of changes in the regulatory landscape and continues to closely follow all Critical Cyber Assets outlined in the NERC Cyber Security Standards, CIP 006 as well as industry standards from NIST, such as those outlined in the industry guideline NISTIR 7628, Guidelines for Smart Grid Cyber Security. From a design perspective, physical security focuses on four key complementary layers. These layers consist of environmental design, mechanical and electronic access control, intrusion detection, and video monitoring. PG&E is pursuing automation technology in each of these areas to reduce the physical risk profile, enhance alarming and alerting, and improve PG&E’s speed of detection and response capabilities when alarms and alerts are activated.

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<sup>14</sup> CPUC September 19, 2012 Policy Paper: *Cybersecurity and the Evolving Role of State Regulation: How it Impacts the California Public Utilities Commission.*

### **2.14.1. Managing CyberSecurity Risk Through Control Baseline**

PG&E's risk assessment and evaluation processes are designed to run systems through multiple scenarios (such as unauthorized access to a system, and inability of the system to process security events) and test the strength of PG&E's baseline security controls. Controls are the system safeguards that mitigate various types of risk, and PG&E has developed a set of standardized, baseline controls that align to multiple best practice governing bodies and regulations.

PG&E has established the following thirteen control families as part of its baseline controls:

- **Security Leadership**

This control includes strategy development and industry leadership in security. This includes continual analysis of the target state to the current state to identify potential security gaps through both internal and external benchmarking initiatives.

- **Audit and Risk Management**

This control layer drives the risk management function. The risk management and governance functions provide the overarching risk management structure that guides the cyber security risk process.

- **Privacy Protection**

PG&E's privacy controls protect customer privacy and have multiple standards, policies, and procedures which ensure compliance with federal and state laws as well as California Public Utilities Commission (CPUC or Commission) orders aimed at protecting private customer information.

- **Records Management**

This control governs how PG&E handles the lifecycle of records from document creation to disposition.

- **Configuration Management**

Configuration and change management controls are a cornerstone for ensuring cybersecurity effectiveness across PG&E. The ability to provide assurance that Smart Grid hardware and software are configured as expected and changes to that configuration are managed is critical for managing cybersecurity risk.

- Operational Management

This layer provides the real-time security and risk operations control through “situational awareness” by providing an overview and measure of the current threats and vulnerabilities facing the Enterprise. This is also where PG&E engages heavily in public-private information sharing across private sector and public sector entities for securely acquiring and submitting threat information to assess risk.

- Human Resource Management

The objective of this control layer is to ensure that the security controls are well understood, evenly applied, well trained, and enforced throughout the Enterprise. This layer emphasizes the fact securing the Utility is a shared responsibility across PG&E. This layer also incorporates areas such as personnel screening and background checks.

- Monitoring and Measurement

The control layer provides critical security testing for new and existing systems across the Enterprise. The measurement focuses on assuring that the controls are effective and are meeting the system design requirements, the acceptable risk thresholds, and the compliance requirements. Developing metrics in alignment with industry is a way in which PG&E is benchmarking itself to measure relative effectiveness of the control framework. PG&E is actively leading the development of cybersecurity metrics with NERC.

- System Design, Build, & Implementation

The control ensures that security and risk management is built into the early stages of technology projects and technology infrastructure so that potential security risks can be managed and mitigated. The control design process starts with a principle-



based approach that integrates the security controls into conceptual, logical, and physical system architectural designs.

- Physical Security

The physical control layer is vital for controlling cybersecurity risk within a Smart Grid. PG&E's Corporate Security department remains abreast of changes in the regulatory landscape and continues to closely follow industry standards.

- System Continuity

This layer assumes that critical systems will and do fail and provides the necessary controls to ensure that the recovery of the business process meets the recovery time objectives for that process. Systems are tested, gaps identified, and corrective action is implemented to mitigate the risk of a critical business process being inoperable for an undesirable amount of time.

- Acquisition of Facilities, Technologies and Services

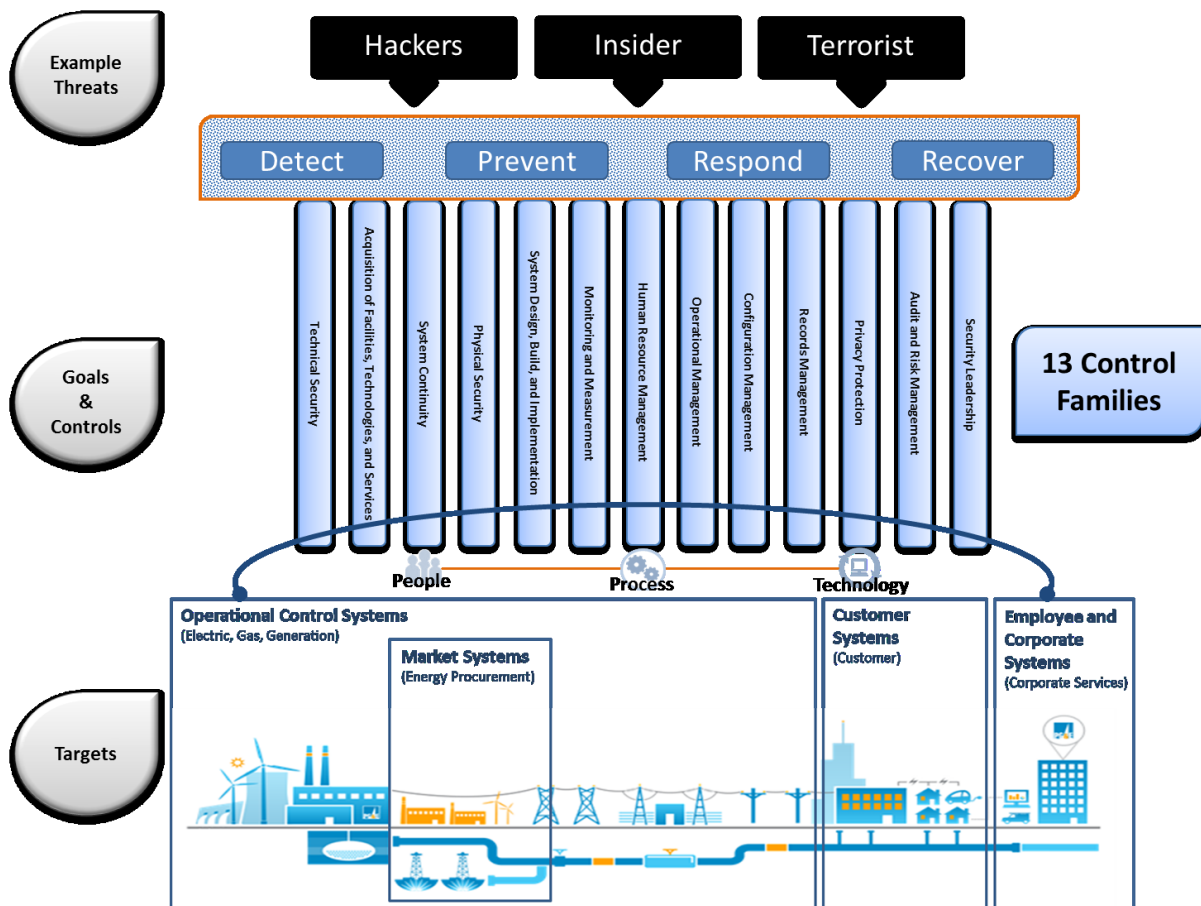
This control layer provides assurance around protecting the supply chain for investments in areas such as cloud services or new and emerging Smart Grid end point devices. PG&E has developed common procurement language based off of industry best practices that is being used for new contracts and contract renewals. The language ensures that third party vendors and suppliers are following a best practices approach in alignment with the PG&E baseline controls. In addition PG&E has established a third party vendor assessment program to sure that vendor security reviews are conducted to verify that PG&E controls are being adhered to and any gaps mitigated accordingly.

- Technical Security

This control layer represents the entire technology foundation for security and risk management. It includes investments in existing security technologies that are aging and in need of lifecycle replacement as well as proposed investments in new security-based initiatives. Extending the Identity and Access Management framework to include control of Smart Grid devices is an example of the how PG&E is evolving technology control strategies.

These control families provide a baseline for risk measurement and inform controls implementation across people, process, and technology. The figure below provides an overview of the control families that drive risk mitigation within PG&E across the 4 utility defined “risk areas”: Operational Control Systems, Market Systems, Customer Systems, and Employee and Corporate Systems.

PACIFIC GAS AND ELECTRIC COMPANY  
 2012 SMART GRID ANNUAL REPORT  
 FIGURE 1: PG&E CYBERSECURITY CONTROLS – OVERVIEW



### 2.14.2. Key Risks and Major Mitigation Focus Areas

The Smart Grid Deployment Plan outlined investments in various service areas and highlighted the need for investment in a cross-cutting cybersecurity architecture to support the Smart Grid. PG&E has executed and continues to plan targeted improvements across the cybersecurity infrastructure to improve PG&E’s risk posture. In Section 2.8, *Security (Physical and Cyber) Projects*, of this report, PG&E provided an

update on the ADAPT project and PG&Es IAM Initiatives, two important cybersecurity cross-cutting initiatives that enhance PG&Es control foundation.

PG&E is also pursuing ongoing security related improvements to both its IT network and its disaster recovery program. Through these investments, PG&E is increasing security in its IT network through improved network segmentation and visibility. Segmentation is an architectural approach that ensures different types of systems are logically or physically isolated from each other by applying technology control techniques in the network. The isolation reduces risk by minimizing the impact of an event to other systems should an adverse event occur. PG&E has also initiated several enhancements to its IT Disaster Recovery program to identify mission critical processes, infrastructure, business applications and Data Center services and to strengthen the operational resiliency and disaster response in these areas.

#### **2.15. Updates to the PG&E's Security Risk Assessment and Privacy Threat Assessment**

PG&E is committed to protecting customer privacy by implementing policies, standards, and procedures which ensure compliance with federal and state laws. A key privacy decision adopted by the CPUC in July, 2011, Decision 11-07-056, requires each California electric utility to conduct an independent audit of its data privacy and security practices in connection with its GRC proceedings. The ruling focuses on privacy and security protections for energy usage data and the Smart Grid in alignment to the Fair Information Practices Principles developed by the Federal Trade Commission, adopted by the Department of Homeland Security and outlined in the Decision 11-07-056. The decision also aligns to the more general privacy provisions required by California SB 1476. PG&E is currently in the process of conducting an assessment covering customer energy usage data that is collected, stored and processed in accordance with the decision. The assessment will review and report on PG&E's privacy and cybersecurity practices, procedures and controls in place to protect customer energy usage data from unauthorized access, destruction, use, modification, or disclosure. The audit began on June 15 and will conclude by September 30. PG&E will continue to participate with the CPUC and other federal initiatives to ensure alignment with industry needs and opportunities. In addition, PG&E is evaluating the "Privacy by Design"

framework adopted by SDG&E (<http://privacybydesign.ca/>) to further the privacy initiative and controls already deployed across PG&E.

## **2.16. PG&E's Compliance With NERC Security Rules and Other Security Guidelines and Standards as Identified by NIST and Adopted by FERC**

PG&E has developed and established formal standards that form the foundation for controls implementation and adherence. Examples of those standards include password management, user access management, information classification, information security, training, and privacy. PG&E standards leverage industry best practice standards such as NIST. PG&E also participates in industry peer groups to understand changes in technology and regularly updates applicable standards. PG&E has implemented a user-friendly Guidance Document Management initiative in order to make standards more intuitive and easy to understand. This helps improve compliance with both the spirit and intent of the guidance.

PG&E's RMF described previously enables compliance with multiple state and federal regulations and is aligned to leading industry practices and standards including the following:

- NERC Critical Infrastructure Protection (NERC CIP)
  - PG&E has developed nine standards that align with the CIP standards for protection of our critical infrastructure. In addition, PG&E participates on committees with industry peers to monitor changes to the CIP standards and implements the changes required.
- Industry Guidelines/(NIST, etc.)
  - The NISTIR 7628 is a set of documents detailing guidelines and controls for Smart Grid cybersecurity. PG&E has taken a leadership role in developing the "NISTIR 7628 User's Guide", and the Guide was used to help inform PG&E's Smart Grid Pilot Deployment Application filing last year.
- Privacy
  - CPUC Privacy Decision 11-07-056
  - California SB 1476

- California SB 1386
- SCADA System Security
  - International Electro Technical Commission 62351
- Others
  - International Organization for Standardization/IEC 27000 Series
  - Federal Communication Commission Regulations
  - Sarbanes Oxley
  - Health Insurance Portability and Accountability Act

PG&E participates in multiple forums to ensure that its control design is current, comprehensive and remains in alignment with the standards and industry groups mentioned above. A listing of the industry-related security forums that PG&E participates in is included below.

PACIFIC GAS AND ELECTRIC COMPANY  
 2012 SMART GRID ANNUAL REPORT  
 FIGURE 2: INDUSTRY LEADERSHIP AND ENGAGEMENT

Acronym	Organization	Function	Capacity / Role
AGA	American Gas Association	Cybersecurity Working Group	Member
BPC	Bipartisan Policy Center	Cybersecurity Task Force	Member
DOE / NIST	Department of Energy	Electric Sector Risk Management Process	Advisor
DOE / White House	Department of Energy	Cybersecurity Capability Maturity Model	Advisor
EI	Edison Electric Institute	Cybersecurity Working Group	Member
EI	Edison Electric Institute	Threat Scenario Project	Member
NASPI	North American SynchroPhasor Initiative	Initiative Working Group	Member
NBISE	National Board of Information Security Examiners	Smart Grid Cybersecurity Panel	Advisor
NEI	Nuclear Energy Institute	Cybersecurity Task Force	Member
NERC	North American Reliability Corporation	Critical Infrastructure Protection Committee (CIPC)	Voting Member
NERC	North American Reliability Corporation	Bulk Electric System Security Metric Working Group	Chair
NESCO	National Electric Sector Cybersecurity Organization	Board	Member
NIST	National Institute of Standards and Technology	Smart Grid Interoperability Panel Cybersecurity Working Group	Lead and Voting Member
OpenSG	Open Smart Grid	Security Working Group	Member
Trans Forum	North American Transmission Forum	Security Practices Working Group	Member
UNITE	Investor Owned Utility Cosortuium	Security Directors Council	Member
WECC	Western Electricity Coordinating Council	Critical Infrastructure and Information Management Subcommittee	Member

## **2.17. Conclusion**

PG&E continues to improve upon its ability to measure, manage, communicate, and mitigate potential cybersecurity and technology risks that could impact the systems that PG&E depends on to deliver safe and reliable electric and gas services to its customers. PG&E's new RMF enhances PG&E technology-focused capabilities and creates more holistic risk management and compliance practices. New risk measurement procedures and risk controls enable PG&E to establish an objective risk baseline, develop target risk thresholds, and chart a clearly prioritized and efficient investment plan for mitigating risks.

PG&E's risk management approach is focused on ensuring that risks are well understood at all levels of the Company and that there is executive support for mitigating and managing operational risks, physical security risks as well as cyber security risk. PG&E's IT risk management efforts are focused on continuous improvement to effectively predict and proactively manage risk by integrating risk management strategies, plans and practices into everyday business activities.

# CHAPTER 3

## SMART GRID METRICS



### 3. Smart Grid Metrics and Goals

#### 3.1. Introduction

In this section, PG&E provides an update on the nineteen consensus Smart Grid metrics approved by the Commission in Decision 12-04-025. PG&E continues to support the Commission position that these consensus metrics will provide parties and the Commission with information that will allow for better understanding of PG&E Smart Grid investments and provide the foundation for moving forward with Smart Grid investments.

#### 3.2 Customer/Advanced Metering Infrastructure Metrics

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

Number of PG&E Advanced Meter Malfunctions Where Customer Electric Service is Disrupted; Percentage of Total Installed Advanced Meters	
Metric	Value
Number of Meter Malfunctions	486 meters
Percentage of Total Meters	0.01 %
<u>Note:</u> Reporting date: July 2011 through AMI deployment completion date.	

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

Load impact in MW of peak load reduction from the summer peak and from winter peak due to smart grid-enabled, utility administered demand response (DR) programs	
Metric	Value
From the Summer Peak May – October 2011:	
Residential	0 MW
Non-Residential < 200 kW	5.4 MW
Non-Residential ≥ 200 kW	47.5 MW
Other (Agricultural)	19.2 MW
Total	72.4 MW
From the Winter Peak November 2011 – April 2012 :	
Residential	0 MW

Non-Residential < 200 kW	1.3 MW
Non-Residential ≥ 200 kW	34.4 MW
Other (Agricultural)	0.9 MW
Total	36.6 MW
<i>Note:</i> Includes: Peak Time Rebate (PTR) (CARE and non-CARE), Demand Response (DR) impacts, to the extent available, Critical Peak Pricing (CPP), programmable communicating thermostat PCT, Time of Use (TOU), A/C Cycling, Excludes: Energy information tools such as In-Home Displays, web presentment, budget assistant, and third -party data access.	

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

Percentage of PG&E DR enabled by AutoDR in each individual DR impact program	
Metric	Value
Percentage of DR enabled by AutoDR – Demand Bidding Program (DBP)	40 %
Percentage of DR enabled by AutoDR – Peak Day Pricing (PDP) program	6%
Percentage of DR enabled by AutoDR – Capacity Bidding Program (CBP)	33%
Percentage of DR enabled by AutoDR – PeakChoice program	1%
<i>Note:</i> Verified kW load reductions (engineering analysis) available for Demand Response, divided by total Demand Response portfolio kW, with the resulting number multiplied by 100.	

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

Number and Percentage of PG&E Owned Advanced Meters with Consumer Devices with HAN or Comparable Consumer Energy Monitoring or Measurement Devices Registered with PG&E		
Metric	Number	Percentage
Residential	77	100%
Non-Residential < 200 kW	0	-
Non-Residential ≥ 200 kW	0	-
Other	0	-
Total	77	100%
CARE	0	-
Non-CARE	77	100%
Total (CARE and Non-CARE)	77	100%

Climate Zone [x]	74	96%
Climate Zone [y]	3	4%
Climate Zone [z]	0	-
Total by Climate Zone	77	100%
<i>Note: Percentage is defined as the number of advanced meters with consumer devices with HAN or comparable consumer energy devices registered with the utility divided by the number of advanced meters installed for the group of concern, with the resulting number multiplied by 100.</i>		

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

Number and Percentage of Customers on a Time-Variant or Dynamic Pricing Tariff		
Metric	Number	Percentage
Residential	165,370	4%
Non-Residential < 200 kW	99,973	15%
Non-Residential ≥ 200 kW	10,829	2%
Other	0	-
Total	276,172	5%
CARE	0	-
Non-CARE	276,172	100%
Total (CARE and Non-CARE)	276,172	100%
Climate Zone [P]	12,079	4%
Climate Zone [Q]	554	0.2%
Climate Zone [R]	42,095	15%
Climate Zone [S]	57,782	21%
Climate Zone [T]	36,008	13%
Climate Zone [V]	2,740	1%
Climate Zone [W]	23,257	9%
Climate Zone [X]	98,094	36%
Climate Zone [Y]	3,332	1%
Climate Zone [Z]	231	0.1%
Total by Climate Zone	276,172	100%
<i>Note: Percentage is defined as the number of customers that are on a time-variant or dynamic pricing tariff divided by the number of customers in the group of concern, with the resulting number multiplied by 100.</i>		

Metric 6: Number and percentage of escalated customer complaints related to (1) the accuracy, functioning, or installation of advanced meters; or (2) the functioning of a utility-administered Home Area Network with registered consumer devices.

Number and Percentage of Escalated PG&E Customer Complaints Related to (a) Accuracy, Functioning or Installation of Advanced Meters, or (b) Functioning of a PG&E-administered Home Area Network with Registered Consumer Devices		
Metric	Number	Percentage
Escalated customer complaints related to the accuracy, functioning or installation of advanced meters	8	6.6%
Escalated customer complaints related to the functioning of a PG&E-administered HAN with registered consumer devices	0	0
<p>Note: Percentage is defined as the number of escalated complaints related to (1) the accuracy, functioning, or installation of advanced meters or (2) the functioning of a utility-administered Home Area Network with registered consumer devices) divided by (the number of escalated complaints in total)], with the resulting number multiplied by 100.</p>		

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

Number and Percentage of Advanced Meters Replaced Before the End of their Expected Useful Life During the Course of One Year, Reported Annually, with an Explanation for the Replacement		
Metric	Number	Percentage
Advanced meters replaced	17,548	0%
<p>Explanation for the replacements: These advanced electric meters were replaced due to a malfunction before the end of their expected useful life (e.g., damaged meter, etc.). Note that during this same period (i.e., July 1, 2011, though June 30, 2012), an additional 55,109 advanced electric meters were removed from the field. Of these, approximately 20,000 had an indication that replacement was due to a malfunction causing the meter to become inoperable. All are currently being handled under PG&amp;E's meter vendor warranty process.</p>		

Note: Percentage is defined as the number of advanced meters replaced before the end of their expected useful life during the course of one year, reported annually divided by the number of advanced meters installed, with that resulting number multiplied by 100.

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

Number and Percentage of Advanced Meters Field Tested at the Request of Customers Pursuant to Utility Tariffs Providing for Such Field Tests, and the Number of Advance Meters Tested Measuring Usage Outside the Commission-mandated Accuracy Bands		
Metric	Number	Percentage
Advanced meters field tested	6,069	0.13%
Advance meters tested measuring usage outside the Commission-mandated accuracy bands	4	NA
Note: Percentage is defined as the number of advanced meters field tested divided by the number of advanced meters installed, with that resulting number multiplied by 100.		

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

Number and Percentage of Customers Using a PG&E Web-based Portal to Access Energy Usage Information or to Enroll in PG&E Energy Information Programs or Who Have Authorized PG&E to Provide a Third-Party with Energy Usage Data		
Metric	Number	Percentage
Customers using a PG&E web-based portal to access energy usage information <sup>A</sup>	1,472,776	86%
Customers using a PG&E web-based portal to enroll in PG&E energy information programs	75,882	2%

Customers who have authorized PG&E to provide a third-part with energy usage data <sup>B</sup>	184,982	–
<p>This number does not represent “unique customer’s using PG&amp;E MyEnergy Portal, but rather total number of customers that accessed energy usage information of the 1,695,153 My Energy active accounts, or 86%.</p> <p>This number represent the total number of Green Button downloads and not the total number of customer who downloaded Green Button data. PG&amp;E cannot ascertain how many of these downloads were shared with 3<sup>rd</sup> parties.</p>		

### 3.3. Plug-in Electric Vehicle Metric

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

Number of PG&E Customers Enrolled in a Time-Variant Electric Vehicle Tariffs	
Metric	Value
Number of E-9A Customers	1,461 customers
Number of E-9B Customers	121 customers
<p><u>Note:</u> Utilities currently have limited ability to determine which customers have electric vehicles. As methods for acquiring this information are determined in that proceeding, this metric should be updated. Metrics related to metering arrangements should be deferred until after PEV metering policy is set in Alternative Fueled Vehicles OIR (R.09-08-009).</p>	

### 3.4. Energy Storage Metric

Metric 1: MW and MWh per year of utility-owned or operated energy storage interconnected at the transmission or distribution system level. As measured at the storage device electricity output terminals. The measure is for January 1, 2011 through December 31, 2012, Data is unavailable for any other time frame.

MW and MWh of PG&E-owned or Operated Energy Storage Interconnected at the Transmission or Distribution System Level	
Metric	Value
Energy Storage interconnected at the transmission system level	1,212 MW
	584,000 MWh

Energy Storage interconnected at the distribution system level	0 MW
	0 MWh
Note: As highlighted in this Smart Grid Project Update, a 2 MW battery storage project was installed at PG&E Vaca Dixon Substation after December 31, 2011	

### 3.5. Grid Operations Metrics

Metric 1: The systemwide total number of minutes per year of sustained outage per customer served as reflected by the System Average Interruption Duration Index (SAIDI) Major Events Included and Excluded for each year starting on July 1, 2011 through June 30, 2012. There were no major events in this time period.

PG&E's System Average Interruption Duration Index (SAIDI), Major Events Included and Excluded	
Metric	Value
SAIDI – Major Events Included	141.1
SAIDI – Major Events Excluded	141.1

Metric 2: How often the systemwide average customer was interrupted in the reporting year as reflected by the System Average Interruption Frequency Index (SAIFI), Major Events Included and Excluded for each year starting on July 1, 2011 through June 30, 2012. There were no major events in this time period.

PG&E's System Average Interruption Frequency Index (SAIFI) Major Events Included and Excluded	
Metric	Value
SAIFI – Major Events Included	1.067
SAIFI – Major Events Excluded	1.067

Metric 3: The number of momentary outages per customer system-wide per year as reflected by the Momentary Average Interruption Frequency Index (MAIFI), Major Events Included and Excluded for each year starting on July 1, 2011 through June 30, 2012. There were no major events in this time period.

PG&E's Momentary Average Interruption Frequency Index (MAIFI)	
Major Events Included/Major Events Excluded	
Metric	Value
MAIFI – Major Events Included	1.643
MAIFI – Major Events Excluded	1.643

Metric 4: Number and percentage of customers per year and circuits per year experiencing greater than 12 sustained outages for each year starting on July 1, 2011 through June 30, 2012.

Metric 4: Number and Percentage of PG&E's Customers per Year and Circuits per Year Experiencing Greater Than 12 Sustained Outages per Year		
Metric	Number	Percentage
Customers experiencing greater than 12 sustained outages per year	965	0.02%
Circuits experiencing greater than 12 sustained outages per year	19	0.6%
<p><i>Note: (Percentage of customers experiencing greater than 12 sustained outages per year equals [(the number of customers experiencing greater than 12 sustained outages in a year) divided by (the total number of customers)] with the resulting number multiplied by 100.</i></p> <p><i>Percentage of circuits experiencing greater than 12 sustained outages per year equals [(the number of circuits experiencing greater than 12 sustained outages in a year)</i></p>		

Metric 5: System load factor and load factor by customer class for each year starting on January 1, 2011 through December 31, 2011. Data is unavailable for any other time frame. July 1, 2011 through the latest year that this information is available.

PG&E Load Factors	
Metric	Value
System Load Factor	59.2%
Residential Load Factor	43.3%



Non-Residential < 200 kW Load Factor	Small L&P: 51.2% Medium L&P: 49.3%
Non-Residential ≥ 200 kW Load Factor	Large L&P: 69.0%
Other (agriculture) Load Factor	48.8%
<i>Note: (Until Advanced Meters are fully deployed for residential, small commercial and industrial, and small agriculture customers, load factors will be calculated using estimates, rather than measured directly.)</i>	

Metric 6: Number of and total nameplate capacity of customer-owned or operated, grid-connected distributed generation facilities. The measure is for January 1, 2011 through December 31, 2012. Data is unavailable for any other time frame.

Number and Total Nameplate Capacity of PG&E Customer-owned or operated Grid connected Distributed Generation Facilities		
Metric	Number	Nameplate Capacity
Distributed generation facilities (solar)	43,266 facilities	632.3 MW
Distributed generation facilities (non-solar)	520 facilities	179.4 MW
Distributed generation facilities (solar and non-solar)	43,786 facilities	811.7 MW
<p><i>Note: (Information and estimates about production of distributed generation facilities that serve on-site customer load is produced annually by the CEC in their California Energy Demand Forecast)</i></p> <ul style="list-style-type: none"> <li>The values show include projects installed under the following programs: Self-Generation Incentive Program (SGIP), California Solar Initiative (CSI) Mass Market program, CSI Single-family Affordable Solar Housing (SASH) program, CSI Multi-family Affordable Solar Housing (MASH) program, and New Solar Homes Partnership (NSHP).</li> </ul>		

Metric 7: Total electricity deliveries from customer-owned or operated, grid-connected distributed generation facilities, reported by month and by ISO sub-Load Aggregation Point. This information is for July 1, 2011 through June 30, 2012.

Total Electricity Deliveries from PG&E Customer-owned or Operated Grid-connected Distributed Generation Facilities	
Metric	GWh
July 2011	3.39
August 2011	3.32
September 2011	3.67
October 2011	2.61
November 2011	2.26
December 2011	4.68
January 2012	2.81
February 2012	2.63
March 2012	3.43
April 2012	6.10
May 2012	6.44
June 2012	4.81
CAISO Sub-LAP_PGCC-APND	0.64
CAISO Sub-LAP_PGEB-APND	1.68
CAISO Sub-LAP_PGF1-APND	1.96
CAISO Sub-LAP_PGFG-APND	1.01
CAISO Sub-LAP_PGHB-APND	0.03
CAISO Sub-LAP_PGLP-APND	1.21
CAISO Sub-LAP_PGNB-APND	0.75
CAISO Sub-LAP_PGNC-APND	1.52
CAISO Sub-LAP_PGNV-APND	2.28
CAISO Sub-LAP_PGP2-APND	0.86
CAISO Sub-LAP_PGSA-APND	1.48
CAISO Sub-LAP_PGSB-APND	1.36
CAISO Sub-LAP_PGSF-APND	0.37
CAISO Sub-LAP_PGSI-APND	3.91
CAISO Sub-LAP_PGSN-APND	0.05

CAISO Sub-LAP_PGST-APND	1.18
<p><u>Note:</u> (Information and estimates about production of distributed generation facilities that serve on-site customer load is produced annually by the CEC in their California Energy Demand Forecast.</p>	

Metric 8: Number and percentage of distribution circuits equipped with automation or remote control equipment, including SCADA systems. The measure is for July 1, 2011 through June 30, 2012.

Number and Percentage of PG&E Distribution Circuits Equipped with Automation or Remote Control Equipment, Including SCADA		
Metric	Number	Percentage
PG&E distribution circuits equipped with automation or remote control equipment, including SCADA	1,627	51.5%
<p><u>Note:</u> Percentage of distribution circuits equipped with automation or remote control equipment equals the number of distribution circuits equipped with automation or remote control equipment) divided by the total number of distribution circuits with the resulting number multiplied by 100.</p>		

# CHAPTER 4

## CONCLUSION

#### 4. Conclusion

In its 2011 Smart Grid Deployment Plan, PG&E outlined its Smart Grid vision:

*“Providing customer safe, reliable, secure, cost-effective, sustainable, and flexible energy services through the intergration of advanced communications and control technologies to transform the operations of PG&E electric network, from generations to the customers premise”*

Over the past 12 months, PG&E has remained true to this vision and made significant Smart Grid investments aimed at, (a) enhancing the reliability of PG&E transmission and distribution grid, (b) helping customers better understand and manage their energy use, and (c) improving the safety and efficiency of PG&E’s electric operations.

Hand in hand with these investments, PG&E has also continued to evolve its processes, systems and technologies to adapt to the ever changing cybersecurity risk and threat landscape. Universally, cybersecurity has been noted as a key Smart Grid priority and utilities working together with state and federal government agencies as well as industry-leading security organizations must ensure that critical grid infrastructure remains well protected and resilient in the face of new threats.

PG&E has also taken important steps to further its supplier diversity record as part of Smart Grid efforts. PG&E maintains a strong commitment to supplier diversity and continues to focus on achieving the Commissions supplier diversity goals set forth in General Order 156. PG&E intends to continue this successful track record by implementing specific strategies related to its Smart Grid Pilot Projects filed under Applicaton 11-11-017 with the Commission.

PG&E’s Smart Grid journey will continue to focus on demonstrating customer benefits by testing and piloting promising new technologies prior to deployment on a larger scale to ensure that utility operations remain safe, reliable and provide the expected benefits. PG&E understands that the nation’s utilities have an obligation to build a better grid for their customers that provides not only these ‘baseline’ benefits of safe and reliable electricity, but also results in a modern, flexible grid that can advance energy policy goals, integrate new and renewable clean energy resources onto the grid and allow

customers to better understand their energy use and be empowered to make energy related choices.