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BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Consider Smart Grid Technologies Pursuant to Federal Legislation and on the Commission's own Motion to Actively Guide Policy in California's Development of a Smart Grid System. (U39E)	Rulemaking 08-12-009 (Filed December 18, 2008)

ANNUAL REPORT OF PACIFIC GAS AND ELECTRIC COMPANY (U 39 E) ON STATUS OF SMART GRID INVESTMENTS PURSUANT TO ORDERING PARAGRAPH 15 OF D. 10-06-047

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Dated: October 1, 2014

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Pursuant to Ordering Paragraph 15 of Decision (D.) 10-06-047 of the California Public Utilities Commission, Pacific Gas and Electric Company (PG&E) hereby files its annual report for the year ending July 1, 2014 on the status of Smart Grid investments. PG&E's Smart Grid Annual Report is attached as Appendix A.

Respectfully Submitted,

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SMART GRID ANNUAL REPORT - 2014

OCTOBER 1, 2014

SMART GRID TECHNOLOGIES

ORDER INSTITUTING RULEMAKING 08-12-009

CALIFORNIA PUBLIC UTILITIES COMMISSION

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CHAPTER 1

SMART GRID ANNUAL REPORT

EXECUTIVE SUMMARY

1. Smart Grid Annual Report Executive Summary

In 2013, the over 15 million people served by Pacific Gas and Electric Company (PG&E) collectively experienced the fewest minutes without electricity in company history. The results for 2013 demonstrate that PG&E continues to make significant progress in safely delivering reliable service that benefits homes and businesses throughout Northern and Central California.

In 2013, not only did the average duration of a service interruption for a PG&E customer fall to an all-time low, but customers also experienced the fewest service interruptions in company history. Customers have seen a 40 percent improvement in the average duration of a service disruption and a 27 percent improvement in the number of customer interruptions since 2006. PG&E's Smart Grid investments played a key role in its ability to deliver these results.

In addition to safety and reliability benefits, PG&E's Smart Grid efforts support the integration of distributed generation (DG) and energy storage on the grid. PG&E continues to be a leader in installed solar energy systems with more than 125,000 customers installed roof-top solar photovoltaic (PV) systems connected to PG&E's electric distribution system as of July 2014. The Solar Energy Power Association has recognized PG&E as the #1 ranked utility in new solar installations for six years in a row.

To enhance its continued support for solar energy installations, PG&E has begun piloting new voltage control technology in its Smart Grid Pilot Project and DG integration projects through its Electric Program Investment Charge (EPIC) program. Further, PG&E's Energy Storage for Distribution Operations demonstration project seeks to assess the costs and benefits of using energy storage to reduce grid costs and facilitate the installation of even more renewable generation. PG&E also plans to use its Solar Photovoltaic (PV) Submetering demonstration project to demonstrate potentially low-cost method to provide homeowners with easier access to insights about their energy generation and usage.

In its Smart Grid Deployment Plan approved by the California Public Utilities Commission (CPUC or Commission) in July 2013, PG&E described its vision for the Smart Grid: "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." This vision continues to guide PG&E's Smart Grid program. Through 2014 and in the coming years, PG&E's customers will continue to see many benefits from the Smart Grid. Some of these benefits include: the ability to lower energy bills by managing 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, quicker restoration, and greater customer convenience resulting from faster response to service issues. PG&E will leverage its Smart Grid plan and investments to evolve the grid to support new and expanding customer needs such as increased deployment of distributed energy resources, electrification of transportation and greater control by customers of their energy usage. The launch of the Electric Program Investment Charge (EPIC) program and the technology demonstration and deployment pilots also enhances PG&E's Smart Grid Deployment Plan.

PG&E has made steady progress on its Smart Grid Deployment Plan to date, keeping its focus on meeting customer needs, as summarized in this Annual Report, which covers the July 2013 through June 2014 time period.

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

> PG&E has installed advanced automation technology on nearly 600 distribution circuits throughout its service area to improve electric system reliability by significantly reducing the length of service interruptions. These systems have avoided more than 40 million customer outage minutes since inception of the program in 2012. To benefit even more of its customers, PG&E will be continuing the program on additional distribution circuits, as authorized in its 2014 General Rate Case (GRC) Decision.
>
> PG&E completed a project to install a new high-tech monitoring system on its electric transmission system. This technology will provide an early warning of potential problems using "Synchrophasor" technology. Conducted with the Western Electricity

Coordinating Council (WECC), this project allows operators to take corrective action before widespread blackouts occur. The same technology may also lower transmission costs by allowing operators to increase utilization rates on high-voltage lines.

The widespread deployment of SmartMeters™ has also 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 poll individual meters to determine whether service has been restored. The result has been faster and more accurate service restorations. PG&E estimates it avoided 6,500 "truck rolls" during outage events in the current reporting year, helping its crews to improve restoration efforts while also reducing greenhouse gas (GHG) emissions by over 61,000 pounds of CO_2.

PG&E is also deploying Smart Grid technology to help customers better ***manage their energy use***, helping them in many cases to save money and reduce GHG emissions from electric generation:

PG&E has substantially completed deployment of SmartMeters™ across its entire service territory. PG&E has installed roughly 10 million electric and gas SmartMeters™ as of September 1, 2014, which offer nearly all of its customers unprecedented visibility into the timing, volume, and cost of their energy use.

More than 2.5 million customers have signed up for access that provides hourly energy usage information made available by SmartMeters™ via PG&E's My Energy website. Home energy displays on My Energy help customers compare their energy use against other similar households and save money by choosing an optimal rate plan.

As of September 1, 2014, over 131,000 residential customers are enrolled in PG&E's SmartRate™ program. This is the largest residential critical peak pricing program in the United States. SmartRate™ generated over 1,500 megawatt-hours (MWh) in energy savings in 2013, nearly three times the 536 MWh in energy savings in 2012. The program grew by over 11,700 customers over the past year. This program not only

helped customers save energy but it also eliminated over 595,000 pounds of CO_2 emissions.

PG&E continued to enhance the Home and Business Energy Checkup tools, also known as the Universal Audit Tools, through My Energy. The goal of these tools is to make it easy for our customers to find targeted energy savings ideas for their home or business. The tools include information to help customers understand how they use energy, including comparisons to similar homes and businesses, and a breakdown of their energy end uses. The audit tools are progressive in nature, continually leveraging information the customer provides, and include recommendations across energy efficiency, demand response, distributed generation, and behavioral changes. Enhancements during the reporting period included adding an end-use disaggregation graphic to the Home Energy Checkup to help customers understand how their energy use breaks down into key areas. In the Business Energy Checkup, an Agricultural Teacher's portal was created to help bring the Business Energy Checkup into agriculture classroom discussions on Energy Efficiency. PG&E also released a new multifamily property owner tool into the Business Energy Checkup to help property owners use the tool to assess common areas.

As of July 2014, more than 106,000 residential customers are enrolled in PG&E's Energy Alerts program, a program that notifies customers when their energy usage may move them into a higher rate tier. Customers can choose to be notified either by phone call, text message, or email alert. These alerts help reduce bill surprises and allow customers the opportunity to more effectively manage their energy bills.

Building on the 2012 SmartMeter™-enabled Home and Business Area Networks (HAN) trial programs, in 2013, PG&E launched HAN as a platform, allowing all eligible residential and small business customers across the service territory to purchase and connect an in-home display device to their SmartMeter™ to receive their near real-time energy usage information. Phase 2 was completed in February 2014, allowing

customers to check their eligibility and self-register for their HAN-enabled devices online using My Energy and synchronize with their PG&E SmartMeter™.

In May 2014, the CPUC approved rules to provide access to customer energy usage and usage-related data to local government entities, researchers, and state and federal agencies while protecting the privacy of personal data. PG&E will be implementing the various requirements approved in this decision in late 2014. Previously, in September 2013, the CPUC approved PG&E's Customer Data Access (CDA) application. The CDA project is one of the technologies and programs that PG&E is working on to further provide customers with the tools necessary to manage their energy use. It is planned to be operational in early 2015.

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

PG&E has continued work on the Demand Response Plug-In Electric Vehicle (PEV) Pilot, which was approved by the CPUC in April 2013. Since obtaining approval for this pilot, PG&E has released and received responses to a Request For Information (RFI) and a Request For Proposal (RFP). PG&E will be notifying successful bidders later this year. The objective of this pilot is to evaluate the feasibility of utilizing PEV batteries, when they are in the vehicle and after they are removed from the vehicle, to provide grid services. The pilot helps evaluate the capabilities and willingness of PEV owners and automakers to participate and provide services to support grid operations.

PG&E released to grid operations in 2012 and 2013 two grid-scale battery pilot projects: a 2 megawatt (MW) project at its substation near Vacaville and a 4 MW project on a distribution circuit in San Jose. Both projects are operated in coordination with California Independent System Operator (CAISO) markets and distribution system operations to test and evaluate the benefits of integrating utility-scale battery energy storage into day-to-day grid operations. Additionally, through its EPIC program, approved in November 2013, PG&E is demonstrating new technology to automate the interaction of these battery systems with the CAISO markets.

Consistent with its focus on Smart Grid technologies that meet customer needs, PG&E is pursuing new and promising Smart Grid initiatives after testing and piloting technologies to verify the true costs and benefits provided to customers. In July 2013, the Commission approved the formal launch of four of PG&E's Smart Grid pilot projects: the Line Sensors Pilot, the Voltage and Reactive Power (Volt/Var) Optimization System Pilot, the Detect and Locate Faulted Circuit Conditions Pilot, and the Smart Grid Short Term Demand Forecasting Pilot. Over the past year, PG&E has made significant progress on these pilot projects. The Short Term Demand Forecasting Pilot completed Phase 1 and received regulatory approval in July to continue to the next Phase. PG&E currently expects the Line Sensors, Volt/Var, Detect and Locate Faulted Circuit Condition Pilots to complete Phase 1 in the months ahead. Upon successful completion, PG&E will seek Commission approval to proceed to the Phase 2 field trials.

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

PG&E collaborated with National Institute of Standards and Technology (NIST) in its development of the Cybersecurity Framework for critical infrastructure protection, published in February 2014. Over the past year, PG&E has worked with the Department of Homeland Security (DHS) and the Department of Energy (DOE) to establish and participate in the Enhanced Security Services program. In 2014, PG&E initiated a project to implement the infrastructure and communications channels necessary to participate in the Cybersecurity Risk Information Sharing Program (CRISP), which was established by DOE for coordinating the protection, prevention, mitigation, and recovery from cyber incidents.

PG&E's Smart Grid Benefits Summary

PG&E's Smart Grid benefits are estimated as incremental savings from July 2013 through June 2014 in reduced operational costs, improved reliability, increased customer energy savings, and other forms of customer and societal benefits such as reduced environmental costs.

Table 1-1: PG&E's Smart Grid Estimated Project Benefits – July 2013 to June 2014

	Annual Savings
Direct Customer Savings	$21.2 Million
Avoided Costs	$11.0 Million
Avoided Environmental Costs	$0.21 Million
Customer Energy Usage	$4.5 Million
Customer Reliability Costs	$42.1 Million
Total Cost Savings	$79.1 Million
Reliability	Avoided 33.3 million customer outage minutes
Greenhouse Gas Emissions	Avoided 36.5 million pounds of CO_2 emissions

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

- PG&E's SmartMeter™ project[1]
- PG&E's SmartMeter™ outage information improvement
- PG&E's SmartRate™ program
- PG&E's Home Energy Reports project Energy Alerts, and My Energy Site
- PG&E's automated demand response program
- PG&E's Fault Location and Service Restoration (FLISR) project
- PG&E's Modular Protection and Automation Control (MPAC) project

[1] In PG&E's 2014 GRC Decision 14-08-032, the CPUC approved a one-time permanent reduction to PG&E's GRC revenue requirement of $182.2 million, beginning on January 1, 2014, to reflect the closure of the SmartMeter™ Program and its annual mechanism for returning benefits to customers. The overall reporting period benefits of $79.1 million do not include this one-time permanent reduction.

Smart Grid and Supplier Diversity

Through its nationally-recognized 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 another record-breaking year in 2013, where PG&E spent over $2.3 billion with diverse businesses for a 42.1 percent total DBE spend, PG&E will continue its demonstrated success in DBE outreach, development and partnership in all categories of procurement, including the Smart Grid.

The first four approved Smart Grid pilot projects (from CPUC Decision 13-03-032) are well underway, following a detailed RFI process for three of the projects: Line Sensor, Volt/VAR Optimization, and Fault Location projects. PG&E is evaluating a range of hardware, software and systems integration, communication infrastructure, and voltage management software from the selected suppliers. Where feasible, as it does more generally, PG&E seeks to leverage diverse suppliers effectively.

The remainder of this report is organized as follows:

Chapter 2 provides an update of the progress on PG&E's Smart Grid projects from July 1, 2013 through June 30, 2014.

Chapter 3 provides an update on the Smart Grid metrics approved by the Commission in Decision 12-04-025.

Chapter 4 provides PG&E's concluding remarks on this Annual Report.

CHAPTER 2

PG&E'S SMART GRID DEPLOYMENT PLAN AND PROJECT UPDATES

2. PG&E's Smart Grid Deployment Plan and Project Updates

Pursuant to Decision 10-06-047, Ordering Paragraph 15 and the Smart Grid Deployment Plan Decision 13-07-024, Ordering Paragraph 4, PG&E provides this Smart Grid Annual Report with the following information included:

a) A summary of PG&E's deployment of Smart Grid technologies during the past year (July 2013 through June 2014) and its progress on its Smart Grid Deployment Plan.[2]

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 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 its PG&E's Smart Grid investments, including Smart Grid Baseline Projects, Smart Grid-Related Customer Programs, and proposed Smart Grid Roadmap Projects.[3] For convenience of review, PG&E's Smart Grid investments are combined in this Annual Report.

2.1. Summary of Updates to PG&E's Smart Grid Deployment Plan

The Smart Grid Deployment Plan filed with the Commission in June 2011 and approved in July 2013 forms the foundation for PG&E's approach to modernizing the grid to support new

---

[2] Unless otherwise specified, PG&E has provided cost and benefits for all projects for the period beginning July 1, 2013 through June 30, 2014. For the SmartMeter™ Program, PG&E has provided the costs and benefits since inception.

[3] PG&E's Smart Grid Deployment Plan, Application 11-06-029, Chapters 4, 5, and 6.

customer demands on the grid. Since its initial preparation and review by the Commission, PG&E is increasing its Smart Grid program focus on integrating increasing levels of distributed energy resources, energy storage, and electric vehicles into the grid. PG&E is leveraging the foundational investments in SmartMeters™, distribution automation, and other technologies identified in PG&E's original Smart Grid Deployment Plan. While the focus of the plan is shifting to some extent to account for new and emerging grid needs, the plan continues to describe PG&E's goals and objectives and reflects PG&E's plans to modernize its grid, consistent with the Commission's 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 Smart Grid projects and initiatives and is seeking approval in various proceedings to further advance the plan and provide benefits to its customers.

2.2. Smart Grid Project Updates

PG&E continues to invest in Smart Grid related projects and initiatives with the objective 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. The projects that PG&E has implemented, or plans to implement, focus on areas such as customer engagement and empowerment, transmission and distribution automation and reliability, safety and operational efficiency, cybersecurity, and integrated and cross-cutting systems. As a result of these efforts, PG&E has continued to gain additional information and knowledge, which enhances 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.

2.3. Customer Engagement and Empowerment Projects

Over the past year, PG&E has made steady progress on a number of projects to provide customers with tools necessary to manage their energy usage and costs. PG&E considers its customers to be the primary driver of its Smart Grid program. Therefore, without an engaged and empowered customer population, many benefits offered by a Smart Grid will be difficult to realize. PG&E believes that continuing to leverage 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 support PG&E's efforts to help customers understand their energy use and manage their energy bills.

In the 12 months ending on June 30, 2014, PG&E has implemented various projects and initiatives that manage, improve, and demonstrate the use of Demand-Side Management resources for operational efficiency. For example:

> PG&E continued to enhance the Home and Business Energy Checkup tools, also known as Universal Audit Tools, through My Energy. The objective of these tools is to make it easy for our customers to find targeted energy savings ideas for their home or business. The tools include information to help customers understand how they use energy, including comparisons to similar homes and businesses and a breakdown of their energy end uses. The audit tools are progressive in nature, continually leveraging the additional information that customers provide and includes recommendations for energy efficiency, demand response, distributed generation, and behavioral changes. Enhancements over the reporting period included a new end-use disaggregation graphic added to the Home Energy Checkup to help customers understand how their energy use breaks down into key areas. In the Business Energy Checkup, an Agricultural Teacher's portal was created to help bring the Business Energy Checkup into agriculture classroom discussions on Energy Efficiency. PG&E also released a new multifamily property owner tool into the Business Energy Checkup to help property owners use the tool to assess common areas.
>
> PG&E increased residential customer enrollments in its SmartRate™ program. Through August 29, 2014, PG&E has enrolled 131,203 residential customers onto this rate. SmartRate™ continues to provide opportunities for customers to manage and reduce their energy usage.
>
> 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. The HAN-DR Integration project and 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 use. In addition, PG&E will also continue to evaluate the future development of DR technologies and platforms that would support integrating with PG&E operations.

PG&E expanded its Energy Alerts program, which provides notifications to residential customers when their energy consumption crosses or is forecasted to cross into higher usage tiers. Over 106,000 PG&E customers have enrolled to receive these energy alerts. These customers are continuously being notified and educated about their energy consumption patterns, which will increase customer awareness and spur behavioral modifications and may lead to lower energy usage and customer bills.

The following sections provide an update on completed, in-progress or planned projects during the July 1, 2013 through June 30, 2014 time period. Throughout Section 2, the dollar amounts associated with the specific projects refer to the total amount spent from July 1, 2013 through June 30, 2014, unless otherwise noted.

2.3.1. Demand Response Projects

Intermittent Renewable Resource Management (IRRM) Pilot Phase 1	**Completed - $0 Million**
Description: In the IRRM Pilot Phase 1, PG&E leveraged work performed under the Commercial and Industrial (C&I) DR Participating Load Pilot to provide regulation services to the CAISO. The objective of the IRRM Pilot Phase 1 was to demonstrate whether customers can provide second by second frequency-regulation service needs to the CAISO. Funding Source: Funding for this project was provided under PG&E's 2009-2011 Demand Response Activities and Budgets. Status: Phase 1 of this pilot project was completed in 2011. This pilot demonstrated that DR resources can assist in the balancing supply and demand on the grid, especially with higher levels of renewable resources. Benefits Description: 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 generation appears on the grid. Benefit Category: Engaged Consumer – PG&E was able to demonstrate and prove that customers enabled with the proper set of technologies can assist with system operational needs. In the future, customers may be relied upon to play a more active role to balance supply and demand on the grid.	

Intermittent Renewable Resource Management (IRRM) Pilot Phase 2	$1.04 Million

Description: In the IRRM Pilot Phase 2, PG&E will leverage the 2009 2011 IRRM Pilot Phase 1 and 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, and, more importantly, when there is a greater penetration of renewable resources in the grid. IRRM Pilot Phase 2 is structured to allow for the inclusion of third party DR providers which is a step closer to integrating DR retail programs into the CAISO wholesale market.

Funding Source: Funding for this project is provided under PG&E's 2012-2014 Demand Response Proposal and approved by the Commission in Decision 12-04-045.

Status: On February 1, 2014, the pilot launched and it is currently operational. As of July 2014, the pilot has enabled over 4 MW of incremental DR that is being bid-in as energy services in the CAISO wholesale market. The pilot has three participants that are made up of technology vendors and large commercial and industrial customers. The IRRM Pilot Phase 2 was granted an extension as part of the 2015 – 2016 DR Bridge Funding (Decision 14-05-025) and will be renamed the Supply Side DR Pilot.

Benefits Description: If proved viable, the IRRM Pilot Phase 2 will be the gateway for more DR resources to be integrated into the CAISO wholesale market. PG&E is structuring the IRRM Pilot Phase 2 as a bridge between the retail and wholesale market, and also to allow for third party DR providers' participation in the CAISO wholesale market. This step is vital in order to have a self-sustaining and fruitful third party DR market in California.

The IRRM Pilot Phase 2 would also assist PG&E in future grid planning and operations, especially as more connected intermittent generations appears on the grid, potentially improving overall system reliability.

Benefit Category: Smart Market – PG&E is continuing to evaluate the value streams of enabling DR resources in a changing operations environment and to provide services to help facilitate the reliable and cost effective integration of renewable resources. PG&E is committed to discover the necessary program attributes that system operators will need in the future.

Proxy Demand Resources (PDR) Program Phase 1	Completed - $0 Million

Description: As part of the Commission's vision of integrating retail-wholesale DR programs, in the PDR Program Phase 1, 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 was 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.

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

Status: The PDR Program Phase 1 has been completed.

Benefits Description: 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.

Benefit Category: 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	**$0.17 Million**

Description: In T&D System Integration, PG&E will evaluate areas where existing DR programs can support PG&E's T&D 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.

Funding Source: Funding for this project is provided under PG&E's 2012 – 2014 Demand Response Proposal approved by the Commission in Decision 12-04-045.

Status: This project is currently in progress. The first phase of the pilot is expected conclude in Q3 2014. The first phase includes study of the required DR resource characteristics to meet distribution needs. The pilot expects to conduct the field demonstration as part of 2015 – 2016 DR Bridge Funding Activities (Decision 14-05-025).

Benefits Description: In the long run, the benefits of this project would include the use of DR resources to improve grid reliability, especially as more intermittent resources are connected on the grid.

Benefit Category: Smart Utility – PG&E is continuing to evaluate the value streams of enabling DR resources and to provide new services to support T&D operations. PG&E is committed to determining the necessary program attributes that transmission and distribution operators will need now and in the future.

AC Cycling Next Generation Technology Assessment	**$0.67 Million**

Description: Under its direct installation program, PG&E has deployed over 200,000 one-way paging air conditioner direct load control receivers (LCR) since 2007. With technological advances in communication platforms and standards such as ZigBee and OpenADR and declining cellular transmission costs, PG&E will identify a two-way LCR that will be deployed in 2017 to expand the AC cycling demand response program for the residential segment. In 2013, PG&E conducted a targeted technology assessment of a ZigBee based LCR that connected through a SmartMeter™. The process for identifying the new technology is through a Request for Quote (RFQ), laboratory test, and a field test in 2014-15. PG&E will include the new technology in its application for 2017-19.

Funding Source: Funding for this project is provided under PG&E's 2015-16 Bridge Funding Budget for Demand Response as approved by the Commission in Decision 14-05-025.

Status: On July 1, 2014 PG&E issued an RFQ for two-way direct LCRs for central air conditioners. Devices chosen from the RFQ will be included in a laboratory test, which will conclude in December 2014.

Benefits Description: By installing two-way direct load control devices, PG&E will have near real-time visibility to an individual premise and the air conditioner's actual response to a load control event signal. This will facilitate early detection of device

malfunction in either under- or over-performance. Additionally, costs can be avoided related to unnecessary truck rolls to retrieve internal programming and operational history. Currently, PG&E uses SmartMeter™ data to determine an estimate of the number of non-performing devices in its maintenance program. With a disconnect alarm on a two-way LCR, unnecessary truck rolls can be avoided to sites.

Benefit Category: Smart Utility – The two-way technology will provide greater visibility into device behavior, which will be used in more accurate forecasting of load reduction during events and provide efficiencies in program management operations.

2.3.2. Electric Vehicle Integration Projects

Plug-in Hybrid Electric Vehicle/Electric Vehicle (PHEV/EV) Smart Charging Pilot	**Completed - $0 Million**

Description: In the PHEV/EV Smart Charging Pilot, PG&E and the Electric Power Research Institute (EPRI) tested 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.

Funding Source: Funding for the project was provided under PG&E's 2009 – 2011 Demand Response Program.

Status: This project was completed on December 31, 2011.

Benefits Description: The findings of this project support the adoption and penetration of electric vehicles and improve PG&E ability to bill customers with electric vehicles in the long run.

Benefit Category: Smart Market – PG&E investigated the early PEV communication and control technologies with EPRI in preparation for potential smart charging applications.

Demand Response Plug-In Electric Vehicle (DR PEV) Pilot	**$0.12 Million**

Description: In the DR PEV Pilot, PG&E intends to evaluate the feasibility of utilizing PEV batteries, when they are in the vehicle and after they are removed from the vehicle, to provide grid services to the utility.

Funding Source: Funding for the project is provided under the 2012 – 2014 Demand Response Program.

Status: On April 2, 2013, this project was approved, per Advice Letter 4077-E-B. Upon approval of the pilot, PG&E initiated work on the pilot, as detailed in Advice Letter 4077-E-B. On August 16, 2013, PG&E released a Request For Information (RFI) to automakers and received responses from various parties. Building off of the RFI, PG&E released a Request For Proposal (RFP) on April 30, 2014 to automakers for the purposes of entering into a contract to provide grid services through the use of managed charging and stationary storage applications. The RFP closed on August 8, 2014. PG&E notified successful bidders on September 8, 2014.

Benefits Description: As part of this project, PG&E will be able to evaluate the capabilities and willingness of EV owners and automakers to participate and provide grid services to the utility.

Benefit Category: Smart Market – PG&E will be able to assess the development of the DR - PEV market to provide grid services to the utility.

2.3.3. SmartMeter™ Deployment Project

SmartMeter™ Program	Completed - $2.34 Billion[4]
Description: PG&E's SmartMeter™ Program launched the deployment of foundational technology to help PG&E's customers understand how and when they use energy, including through automated home energy management. The SmartMeter™ system improved infrastructure integrity, helped PG&E manage energy demand, and also enabled PG&E to provide more reliable service. Through these broad system-wide enhancements, the SmartMeter™ Program has served the vital foundational step to enable creation of the Smart Grid, which in turn fosters a clean energy economy and sustainable economic expansion. Funding Source: Funding for PG&E's SmartMeter™ Program was provided under Decision 06-07-027 (PG&E's AMI decision) and Decision 09-03-026 (PG&E's SmartMeter™ Upgrade decision). Status: PG&E's SmartMeter™ Program commenced in 2007 and concluded on December 31, 2013. Under the Program, PG&E successfully installed nearly 10 million gas and electric SmartMeters™ and a supporting telecommunications network and IT infrastructure. In PG&E's 2014 GRC Decision 14-08-032, the CPUC approved the closure of the SmartMeter™ Program's balancing accounts, including the Program's Benefits Realization Mechanism. Benefits Description: From July 1, 2013 through the December 31, 2013 closure of the SmartMeter™ Program, PG&E had recorded $20.5 million in benefits in the SmartMeter™ Balancing Accounts (benefits for all of 2013 totaled $39.2 million). In PG&E's 2014 GRC Decision 14-08-032, the CPUC approved a one-time permanent reduction to PG&E's GRC revenue requirement, beginning on January 1, 2014, to reflect the closure of the SmartMeter™ Program and its annual mechanism for returning benefits to customers. Thus, PG&E's CPUC-adopted 2014 GRC revenue requirement was reduced by SmartMeter™ expense savings of $182.2 million, net of savings already returned to customers, as well as a $5.8 million of capital expenditures benefit. Benefit Category: Smart Utility and Engaged Consumer - The SmartMeter™ Program provided the foundation for much of the Smart Grid project, including implementation of the SmartMeter™ Tools Project.	

[4] Total amount spent since inception through December 31, 2013, the completion date for the SmartMeter™ Program.

2.3.4. SmartMeter™ Enabled Tool Projects

The Green Button Initiative	Completed - $0 Million

Description: In PG&E's Green Button Initiative, the Green Button tool provides customers with a means of easily accessing and downloading their energy use online in a standardized format that can be shared with energy service providers.

Funding Source: Funding for this project was through shareholder funding.

Status: This project was launched in December 2011; additional operational enhancements are expected to be ongoing. With the success of Green Button, PG&E released Green Button Connect (GBC) on October 1, 2012.

Benefits Description: This tool not only helps customers better understand their energy use, but it also supports 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.

Benefit Category: Engaged Consumer – customers interested in viewing and sharing their energy usage data with third parties are more engaged in managing their energy usage and controlling costs.

Green Button Connect (GBC) Beta	$0.54 Million

Description: With Green Button Connect (GBC) Beta, PG&E gives customers greater control over SmartMeter™ enabled energy usage data. Green Button Connect is a software interface that allows PG&E customers to easily share their energy usage data with other energy service providers. These developers can then "mash up" the data in unique ways to provide valuable insights to customers.

Funding Source: Funding for the initial launch of the project was through shareholder funding. Ongoing O&M funding was provided by funds that are used to support web applications.

Status: This project was launched in October 2012 with three developers. The success of the initial three developers led PG&E to publish an application in January 2013 to expand the third party requestor pool. PG&E selected eight vendors for the first round of expanded third parties, which was implemented by August 2013. To date, PG&E has received 100 plus applications with vendors ranging from a student implementing a social gaming app to more experienced companies performing analysis for business customers. Based on feedback provided from customers and vendors through GBC Beta, PG&E will be making enhancements to the Customer Data Access project (see below) which is being fully implemented in early 2015.

Benefits Description: This platform provides developers the opportunity to continuously develop innovative tools aimed at helping customers manage their energy usage and reduce their energy bills.

Benefit Category: Engaged Consumer – customers interested in viewing and sharing their energy usage data with third parties are more engaged in managing their energy usage and controlling costs.

Energy and Carbon Management System (ECMS)	$0 Million

Description: In the ECMS, PG&E has developed tools specifically for PG&E's large Commercial and Industrial (C&I) customer account representatives to identify opportunity customers and enable a consultative energy discussion with those customers using advanced usage analytics and financial metrics for proposed energy efficiency projects.

Funding Source: This project was funded under PG&E's 2010 – 2012 and 2013 – 2014 Energy Efficiency Programs.

Status: The tool set was rolled out to all PG&E large C&I account representatives for customers with usage greater than 500kW. The project concluded at the end of 2013.

Benefits Description: Through the deployment of this project, large C&I account representatives now have an additional tool that allows them to help their customers towards better management of their energy usage and associated greenhouse gas (GHG) emissions.

Benefit Category: Engaged Consumer – the program increases customer awareness and engagement in managing their operations in an environmentally sustainable way.

My Energy Web Tools	Completed – $0 Million

Description: 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.

Funding Source: This project was funded under PG&E's 2009 Rate Design Window that authorized the implementation of a Peak Day Pricing Tariff for different customer classes.

Status: This project has concluded. PG&E's My Energy project commenced in March 2010 and concluded in November 2012. My Energy was enhanced to include functional tools like Bill to Date and Usage/Bill Projections in late August 2012.

Benefits Description: 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.

Benefit Category: Engaged Consumer – the program increases customer awareness and engagement in managing their energy usage in an environmentally sustainable and economically efficient manner.

Universal Audit Tools (UAT)	$0.8 Million

Description: PG&E provides the Home Energy Checkup and Business Energy Checkup (also known as Universal Audit Tools) for residential and small and medium business customers through My Energy. These tools utilize SmartMeter™ data along with

other customer insights to make it easy for our customers to find energy savings ideas that are particular to how they use energy. The tools are progressive in nature, continually learning based on the information the customer provides, and include recommendations across energy efficiency, demand response, distributed generation, and behavioral changes.

Funding Source: This project was funded under PG&E's 2010-2012 and 2013-2014 Energy Efficiency Programs.

Status: The residential tool launched Q1 2012 and the business tool launched Q3 2012. Updates and improvements to the tools occur on an ongoing basis. In the Home Energy Checkup, an end-use disaggregation graphic was added to help customers understand how their energy use breaks down into key areas. In the Business Energy Checkup, an Agricultural Teacher's portal was created to help bring the Business Energy Checkup into agriculture classroom discussions on Energy Efficiency. PG&E also released a new multifamily property owner tool into the Business Energy Checkup to help property owners use the tool to assess common areas.

Benefits Description: These tools help raise customer awareness on home and business energy use and educate them on saving opportunities through energy efficiency, demand response, distributed generation, and behavioral changes.

Benefit Category: Engaged Consumer – the program increases customer awareness and engagement in managing their energy usage in an environmentally sustainable and economically efficient manner.

Energy Alerts	**$0.1 Million**

Description: The PG&E Energy Alerts program 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™ who are on electric Rate Schedules E1, E6, E7, and E8.

Funding Source: This project was funded under PG&E's SmartMeter™ Upgrade program.

Status: This is an ongoing program that commenced in June 2010. As of July 19, 2014, over 106,000 customers have signed up to receive Energy Alerts.

Benefits Description: Energy Alerts provides enrolled customers with usage information and patterns that will help them adjust their consumption patterns to avoid paying higher energy bills. During calendar year 2013, the Energy Alerts resulted in a total cost savings of $912,000 for customers by helping them reduce their energy consumption by 17.8 GWh. This energy reduction has also led to the elimination of 7.0 million pounds of greenhouse gas emissions.

Benefit Category: Engaged Consumer – the program increases customer awareness and engagement in managing their energy usage in an environmentally sustainable and economically efficient manner.

Home Energy Reports	**$8 Million**

Description: Home Energy Reports is a behavior-based energy efficiency initiative, under the Residential Energy Advisor (EA) program, that provides customers with normative neighborhood comparisons to similar households and personalized energy

saving recommendations. The key features of the report include raising awareness of customer energy usage, using social norms to influence customer behaviors, and motivating customers to further engage with PG&E programs and resources such as the My Energy Web Tools and the Universal Audit Tools.

Funding Source: This project was funded under PG&E's 2010-2012 and 2013-2014 Energy Efficiency Programs.

Status: The Home Energy Report Program is an ongoing program that commenced in March 2011. In 2014, PG&E expanded the Home Energy Report program to over one million residential customers. In addition, PG&E has added email reports to a subset of the customer base as an additional service to the mail reports.

Benefits Description: PG&E has reported initial estimated energy savings for 2013 of 12.3 MW, 71.4 GWh and 2.5 million Therms saved that was calculated using 'ex-post' randomized control trial (RCT) experimental design measurement evaluation. The initial estimate will be refined by CPUC's independent impact evaluator DNV Kema at the end of the 2013-2014 program cycle.

Benefit Category: Engaged Consumer – the program increases customer awareness and engagement in managing their energy usage in an environmentally sustainable and economically efficient manner.

Customer Data Access Project	**$0.45 Million**

Description: Under the Customer Data Access (CDA) project, PG&E will develop a platform that will provide authorized and secure data to customer-authorized third parties. Upon authorization, third parties will have access to customer meter data, including electric internal energy usage data, in a standardized format. Phase 2 of the CDA project will focus on increasing the types of customer data that will be supported. Possible additional data include DR events, pricing information, and public/directed messages for third parties.

Funding Source: This project will be funded by through in the CDA Decision 13-09-025.

Status: On September 19, 2013, the CPUC approved PG&E's CDA Application (D. 13-09-025). PG&E plans to implement Phase 1 of the CDA project in Q1 2015 and Phase 2 in Q4 2015.

Benefits Description: This platform will help provide PG&E's customers and their selected third party service providers with a robust means of accessing their energy data in a standardized manner. 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 customers manage their energy usage and reduce their monthly energy bills.

Benefit Category: Engaged Consumer – the program increases customer awareness and engagement in managing their energy usage in an environmentally sustainable and economically efficient manner.

Energy Data Access	**$0.02 Million**

Description: In Decision 14-05-016, the Commission adopted rules to provide access to energy usage and usage-related data to

local governments, researchers, and state and federal agencies while protecting the privacy of customers' personal data.

Funding Source: PG&E will track the incremental costs associated with implementing this decision and is authorized to seek recovery of such costs via a separate application or in a general rate case proceeding.

Status: PG&E is in the process of implementing this decision, which includes the development of an energy data request portal, a data request and release process, a data catalog, and an Energy Data Access Committee. In subsequent Smart Grid Annual Reports, PG&E will report on the data catalog, which will include the details of all data requests received from third parties.

Benefits Description: This program will provide energy data to qualified educational institutions for research purposes, local governments for their climate action plans, to state and federal agencies to fulfill statutory obligations, including low income participation in energy efficiency programs.

Benefit Category: Engaged Consumer – this program facilitates access to energy data for local governments, academic researchers, and state and federal government entities needing data to fulfill statutory requirements.

HAN Enablement Program – Phase 1 & Phase 2	**Completed - $1.39 Million**

Description: PG&E's HAN Enablement program is an infrastructure that allows customers to register and commission a standards compliant device with PG&E's AMI network to receive near real-time data from their SmartMeter™. In HAN Phase 1 (Initial Deployment), which ran from March 1, 2012 through April 30, 2013, PG&E installed and supported 430 in home displays (IHDs) with residential customers. Starting in January 2013, PG&E launched HAN as a platform, making the capability to register a device and received near real time usage information from a customer's electric SmartMeter™ available to all eligible customers across its service territory.

Phase 2 of the HAN Enablement Program provides customers with a list of five PG&E validated devices that can be purchased through retail channels. As part of this project, PG&E issued a Request for Information (RFI) to the retail market to identify devices and technologies (IHDs, gateways, and repeaters) that are interoperable with PG&E's SmartMeter™. After purchasing a validated HAN device, customers will be able to self-register their device through PG&E's My Energy (with self-registration launching at the beginning of 2014) and receive near real-time usage information directly from their SmartMeter™.

Funding Source: Funding for this project was provided under PG&E's SmartMeter™ Upgrade Program.

Status: Phase 1 was completed in April 2013. Phase 2 was completed in February 2014 when PG&E launched the ability for customers to check their eligibility and self-register for their HAN enabled devices/technologies on My Energy. As part of the on-going program management, operational issues (e.g. compatibility with selected meters) are being identified and resolved.

Benefits Description: Customers who participate in this program are able to leverage their SmartMeter™ to improve awareness of their energy use and modify their consumption patterns to conserve energy and reduce their energy bills. HAN Phase 1 participants resulted in an estimated 4.6% daily load reduction due to the IHD.

Benefit Category: Engaged Consumer – the program increases customer awareness and engagement in managing their energy usage in an environmentally sustainable and economically efficient manner.

Home and Business Area Network (HAN) Demand Response (DR) Integration Pilot Project	$6.57 Million

Description: PG&E's HAN DR Integration Project builds upon the HAN IT infrastructure by delivering 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 SmartRate™ and SMB Peak Day Pricing (PDP) 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.

Funding Source: Funding for this project is under PG&E's 2012 – 2014 Demand Response Programs and Budgets authorized by Decision 12-04-045 and Advice Letter 4119-E.

Status: This project is in progress. PG&E has completed the design and build phases of the necessary DR and rate engine IT systems in order to deliver price and DR signals to HAN devices. The pilot will test the delivery of data and messages to devices including current price, current energy rate, bill-to-date, bill forecast and DR event messages. PG&E anticipates that this pilot will be concluded by December 2014.

Benefits Description: 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 or load shifting behaviors to lower their monthly energy bills, and makes it easier for customers to participate in DR programs.

Benefit Category: Engaged Consumer – HAN enablement will allow customers with SmartMeter™ interoperable devices/technologies to synchronize with PG&E's SmartMeter™.

Time Varying Pricing Rates (TVP)	$12 Million

Description: Time varying pricing products, such as Peak Day Pricing (PDP) and Time-of-Use (TOU), 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. PDP provides between 30-45MW of load reduction on the hottest days of summer, equaling the load of almost 2 peaker power plants. 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.

Funding Source: This project is funded as part of PG&E's 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– $2.07 million).

Status: PG&E continues to administer and offer Time Varying Pricing (TVP) Rates to all PG&E bundled residential and

nonresidential customer class. Beginning in November 2012, SMB customers with 12 months of SmartMeter™ data began 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 enroll in to the SmartRate™ program. Approximately 110,000 SMB customers defaulted to TOU in November 2013 and 200,000 SMB customers are forecasted to default to PDP in November 2014. In 2014, PG&E will also run a pilot to increase load from existing PDP participants by providing them in season support emails and customized analytics based on their facilities' performance.

Benefit Description: Time Varying Pricing enables customers to save money while still using the same amount of energy, and will reduce demand during peak summer time periods lowering system-wide costs.

Benefit Category: Engaged Consumer and Smart Utility – the program increases customer awareness and engagement in managing their energy usage in an environmentally sustainable and economically efficient manner while at the same time allowing PG&E great control and flexibility over its transmission and distribution.

2.3.5. Emerging Customer Side Technology Projects

Automated Demand Response (AutoDR) Program	**$3.3 Million**

Description: PG&E's Automated Demand Response (AutoDR) program offers small, medium and large commercial, industrial and agricultural customers an incentive to install automated equipment that enhances their ability to reduce load during DR program events. Specifically, AutoDR is an automation-based communication infrastructure that links PG&E's designated third party hosted solution servers to customer-owned Energy Management Control Systems (EMCS). PG&E helps its customers to develop pre-programmed energy management and curtailment strategies to automate their facilities when PG&E calls a DR event day.

Funding Source: Since its inception, PG&E's Auto DR program has been funded under PG&E's DR activities and budgets, which have been authorized by the Commission.

Status: PG&E's AutoDR program is currently in progress. PG&E's AutoDR program currently provides incentives to large commercial and industrial customers. PG&E rolled out an AutoDR Advanced Thermostat Pilot to small and medium commercial customers in the third quarter of 2014. This pilot will test the AutoDR technology in the SMB segment and evaluate how well the technology will improve customer operational efficiency with the new remote control capability. The new Advanced Thermostat Pilot also makes it easier for customers to participate in DR Programs. After completion of the assessment at the end of 2014, PG&E will apply the best practices and lessons learned from the assessment to develop an SMB ADR program with a targeted rollout in 2015.

Benefits Description: PG&E's AutoDR program has recruited 336 customers who will provide PG&E with up to 84 MW of dispatchable load during the Demand Response seasons. During the past year, 618 MWh were shed reducing greenhouse gas emissions by 774,035 pounds.

Benefit Category: Engaged Consumer – 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	**$0.13 Million**

Description: PG&E is conducting a Smart Thermostat Assessment Pilot with Opower and Honeywell to evaluate the energy benefits that accrue to customers who utilize internet-enabled thermostats, when exposed to behavioral energy saving messaging. 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.

Funding Source: PG&E funded this project using funds authorized under the 2010 – 2012 Energy Efficiency program as part of Emerging Technology.

Status: This project is currently in progress and with a final report expected in Q3 2014. PG&E successfully installed Smart Thermostats in 505 residential homes in the San Francisco Bay Area and the Central Valley in February 2013. Opower and PG&E monitored usage differences between the test and control groups for a 12 month period.

Benefits Description: PG&E is leveraging key learnings from this project to guide development of a full Smart Thermostat Assessment Pilot expected to launch Q4 2014.

Benefit Category: Engaged Consumer – 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.

Business Energy Reports	**$0 Million**

Description: Business Energy Reports is a behavior-based energy efficiency emerging technologies pilot, similar in concept and experimental design to the residential Home Energy Reports program, which provides small to medium (SMB) commercial customers with printed energy assessment reports with normative comparisons to similar businesses and offers personalized energy saving recommendations. The key features of the Business Energy Report include raising awareness of the energy usage and cost at the business premise, using social norms to influence customer behaviors, informing customers of new and existing PG&E energy efficiency programs, and motivating customers to go online and engage with PG&E such as registering for MyEnergy Web Tools and the Universal Audit Tool.

Funding Source: PG&E funded this project using funds authorized under the 2010 – 2012 Energy Efficiency program as part of Emerging Technology.

Status: This project is currently in progress and scheduled to be completed in Q4 2014. In June 2013, PG&E launched a small field experiment to 160 small to medium commercial customers to collect customer feedback on ways to improve the reports and personalization before the full scale field placement. PG&E launched a full-scale field placement experiment to 15,000 SMB commercial customers in October 2013.

Benefit Description: PG&E has hired an independent consultant to design, conduct, and evaluate the randomized controlled trial (RCT) experimental design for the full-scale roll-out to 15,000 commercial customers. Benefit Category: Engaged Consumer – giving customers the tools needed to make informed energy decisions.

2.4. Distribution Automation and Reliability Projects

Projects in the Distribution Automation and Reliability category provide capabilities and associated technology enablement to monitor and control the electric distribution system. PG&E continues to focus on technology capabilities to increase the visibility and control enabled by Substation Supervisory Control and Data Acquisition (SCADA) in the distribution system, continues to deploy Fault Location, Isolation, and Service Restoration (FLISR) technology projects first introduced by the Cornerstone project, 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.

The following section provides an update on all completed, in-progress or planned projects through June 2014 unless otherwise noted.

Distribution Substation Supervisory Control and Data Acquisition (SCADA) Program	**$99.2 Million (since program inception)**
Description: 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 2018, adding or replacing SCADA for approximately 393 substations and approximately 1,107 breakers. Funding Source: This project is funded under PG&E's 2011 and 2014 GRC Budget. Status: This project is currently in progress. PG&E anticipates the conclusion of this project in December 2018. Implementation of this project began on March 2011. This project has upgraded or replaced SCADA in 78 substations and added SCADA on 359 breakers between 2011 through June 2014. Benefits Description: Increasing SCADA penetration enables improvements in reliability, grid planning, and operations. Benefit Category: 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 and design the distribution system.	

Cornerstone Improvement Project – Feeder Automation	**Completed - $145.2 Million (since project inception)**

Description: The Cornerstone Improvement Project includes the installation of distribution feeder fault locating, isolation and service restoration (FLISR) systems on select urban and suburban circuits. The project is 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.

Funding Source: Decision 10-06-048.

Status: This project has been completed. In June 2010, the CPUC approved PG&E's 3-year Cornerstone Improvement Project. PG&E concluded implementation of activities under this project in December 2013. PG&E commenced FLISR implementation activities in the Summer of 2011. This project installed FLISR technology on 514 distribution circuits as of December 31, 2013. 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. In addition, the deployment of new switches and retrofit of others provides operators with the ability to remotely open and close equipment enhancing reliability and public safety.

Benefits Estimate: These initiatives will result in an overall reliability improvement of PG&E's grid system, allowing PG&E to provide reliable and safe energy. This project has provided the following savings to customers:

	Customer Minutes of Interruption Avoided	Value of Service
July 1, 2011 – June 30, 2012	206,777	$186,000
July 1, 2012 to June 30, 2013	1,661,505	$2,100,000
July 1, 2013 to June 30, 2014	33,330,000	$43,000,000

Benefit Category: Smart Utility - The Cornerstone project was a project that seeks to improve the reliability of the distribution system.

Distribution Management System (DMS) Project	**$5.3 Million**

Description: The DMS Project implements electronic wall maps to assist in distribution operations control center consolidation. This project is a key strategic system implementation for the electric distribution system to provide increased grid visibility and control capability.

Funding Source: This project is funded under both PG&E's 2011 and 2014 General Rate Cases.

Status: This project is currently in progress. PG&E commenced implementation activities in February 2012 and anticipates concluding implementation of activities under this project in June 2015. This project has two phases. The project has completed its first phase and went live in October 2013. Phase 2 is currently in the testing phase and is expected to be deployed in October 2014 prior to the start of the roll-out of transferring the first control center into the new facilities.

Benefit Description: This project will enable operational improvements that yield safety, reliability, and operational benefits.

Benefit Category: 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. The DMS will also be a foundational system for future Smart Grid projects.

Sodium Sulfur (NaS) Battery Energy Storage System (BESS) Demonstration Projects	**$33.0 Million**

Description: In these projects, PG&E will utilize sodium sulfur (NaS) battery technology to demonstrate grid-scale energy storage services on the T&D system. PG&E implemented 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.

Project 1 – 2 megawatt (MW)/14 megawatt hour (MWh) NaS BESS: Located at a major PG&E substation, this unit will provide load leveling and participate in CAISO energy and ancillary services markets.

Project 2 – 4 MW/28 MWh NaS BESS: Located at the end of a distribution feeder in San Jose, this system will be used to enhance reliability and power quality for customers, as well as for feeder peak shaving. The system will also participate in CAISO markets for energy and ancillary services, and in tests of its ability to improve the integration of intermittent renewable generation.

Funding Source: The project was originally forecasted for cost recovery in the 2011 GRC and was subsequently rolled into the 2014 GRC Budget.

Status: This project is currently in progress. PG&E commenced implementation of these projects in November 2009 and released the projects to operations in 2012 and 2013. Additional evaluation work will be conducted by PG&E's Applied Technology Services and EPRI via a grant from the California Energy Commission. Project 1, the unit at the substation site, began operational testing in January 2013 and testing with CAISO at the end of 2013. In 2014, the system will be used primarily for performance evaluation of active participation in CAISO markets. Project 2, on Yerba Buena Road in San Jose began operational testing in 2013, and will be used to island downstream loads in the event of a utility disturbance and for performance evaluation for a variety of battery functionalities (load shaping, reliability enhancement, renewable integration, and ancillary services) under a grant from the California Energy Commission.

Benefit Description: If proved viable and implemented system-wide, this project will improve PG&E energy storage capabilities resulting in improved system reliability and reduced procurement costs, as well as inform the discussion around the costs and

benefits of battery energy storage systems.

Benefit Category: 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)	**$0.7 Million**

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 150 circuits per year across the PG&E system to improve customer service reliability.

Funding Source: This project is proposed to be funded in PG&E's 2014 GRC.

Status: This project has been approved. The Smart Grid FLISR project has begun in 2014 and is expected to end in 2019.

Benefit Description: 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.

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

Install Smart Grid Line Sensors Pilot	**$0.94 Million**

Description: This project will 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.

Funding Source: This project is funded under Smart Grid Pilot Deployment Project Decision 13-03-032.

Status: Phase I of the project is in progress. This project began in August 2013 and is anticipated to end by December 2016. The CPUC approved this project in March 2013 (D.13-03-032; A.11-11-017). The project is broken into two gated phases:

Phase I - perform benchmarking, analysis, plan a measurement and evaluation plan to capture benefits, send out a request for information (RFI) and then design and pick potential pilot vendor solutions to be tested at the ATS facilities located in San Ramon

Phase II - pilot acceptable vendor solutions on approximately 30 PG&E distribution feeders and then complete a report on

the project with a specific focus on costs and benefits to be used in requesting a system roll out.

Benefit Description: This pilot project may demonstrate safety, reliability, and operational benefits through reducing outage time and improving system operations and planning. This project is expected to deliver the following benefits:

- Customer Cost Savings: reduced O&M from more efficient outage response and restoration
- Reliability Benefits: improved CAIDI and SAIDI

A forecast of these potential benefits was submitted as part of A. 11-11-017. The project will update the pilot benefits forecast in late 2014 and perform measurement & verification of actual benefits should the CPUC approve Phase 2.

Benefit Category: 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	**$3.32 Million**

Description: This project will 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).

Funding Source: This project is funded under Smart Grid Pilot Deployment Project Decision 13-03-032.

Status: Phase I of the project is in progress. This project began in August 2013 and is anticipated to end by December 2016. The CPUC approved this project in March 2013 (D.13-03-032; A.11-11-017). The project is broken into two gated phases:

Phase I - perform benchmarking, analysis, plan a measurement and evaluation plan to capture benefits, send out a request for information (RFI) and then design and pick potential pilot vendor solutions to be tested at the ATS facilities located in San Ramon.

Phase II - pilot acceptable vendor solutions on approximately 12 PG&E distribution feeders and then complete a report on the project with a specific focus on costs and benefits to be used in requesting a system roll out.

Benefit Description: 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 and reducing greenhouse gas emissions. This project is expected to deliver the following benefits:

- Customer Energy Savings: avoided cost savings from reduced energy consumption (MWh) and peak demand (MW)
- Environmental Savings: avoided greenhouse gas emissions

A forecast of these potential benefits was submitted as part of A. 11-11-017. The project will update the pilot benefits forecast in late 2014 and perform measurement & verification of actual benefits should the CPUC approve Phase 2.

Benefit Category: 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	**$0.71 Million**

Description: This project will 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.

Status: Phase I of the project is in progress. This project began in August 2013 and is anticipated to end by December 2016. The CPUC approved this project in March 2013 (D.13-03-032; A.11-11-017). The project is broken into two gated phases:

Phase I - perform benchmarking, analysis, plan a measurement and evaluation plan to capture benefits, send out a request for information (RFI) and then design and pick potential pilot vendor solutions to be tested at the ATS facilities located in San Ramon.

Phase II - pilot acceptable vendor solutions on approximately 15 PG&E distribution feeders and then complete a report on the project with a specific focus on costs and benefits to be used in requesting a system roll out.

Benefit Description: This pilot project may demonstrate safety, reliability, and operational benefits through reducing outage time and improving system operations and planning. This project is expected to deliver the following benefits:

- Customer Cost Savings: reduced O&M from more efficient outage response and restoration
- Reliability Benefits: improved CAIDI and SAIDI

A forecast of these potential benefits was submitted as part of A. 11-11-017. The project will update the pilot benefits forecast in late 2014 and perform measurement & verification of actual benefits should the CPUC approve Phase 2.

Benefit Category: 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. Additionally, this project will explore enhancing the utilities ability to locate and mitigate high impedance faults.

2.5. Transmission Automation and Reliability Projects

Projects included in the Transmission Automation and 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.

The following section provides an update on all completed, in-progress or planned projects through June 2014 unless otherwise noted

Compressed Air Energy Storage (CAES) Demonstration Project	**$10.3 Million**
Description: The purpose of this demonstration project is to determine the technical and economic feasibility of an approximately 300 MW CAES plant using a porous rock structure for up to 10 hours of air storage at a location within California. CAES technology will compress air into an underground porous rock formation during periods of excess generation and then will release the stored air to generate electricity during periods of peak demand. Funding Source: The project is funded under the Department of Energy/American Recovery and Reinvestment Act (DOE/ARRA) grant of $25 million and matching funds approved by the CPUC and CEC of $24 million and $1 million, respectively. Status: This project is currently in progress. The project started January 2012 and is expected to be completed in December 2016. PG&E selected two reservoirs for core extraction and analysis. Preliminary core analysis shows both sites have the permeability and porosity suitable for a CAES project. The DOE drafted an Environmental Assessment for the preferred site as part of its National Environmental Policy Act (NEPA) review and issued it for public comment in December of 2013; the DOE issued a Finding of No Significant Impact (FONSI) in May of 2014 which allows the project to move forward with ground disturbance activities associated with the air injection test. PG&E also prepared and submitted an Underground Injection Control permit application to the EPA; this permit, which is required prior to construction of the injection/withdrawal well as part of the air injection test, was issued for public comment on July 14, 2014; public comments were due on August 12, 2014. No comments were received and the permit was issued to PG&E on August 20, 2014. Currently, PG&E is working on procurement, construction and risk mitigation for the air injection testing phase of the feasibility study; the air injection test is scheduled to commence in the 4th Quarter of 2014. A Request for Offers (RFO) for third party bids to build, own, and operate a CAES facility is currently scheduled for release in the 2nd Quarter of 2015. Benefit Description: If demonstrated to be economically and technologically viable, CAES technology may facilitate the integration of renewable generators and help attain clean energy policy goals. Benefit Category: Smart Market – This project seeks to evaluate the feasibility of a large energy storage facility that can be used to manage renewables and other generation.	

Transmission Substation SCADA Program	**$80.9 Million (Since Program Inception)**
Description: 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 current goal is to achieve 100 percent visibility and control of all transmission substations by 2017, adding or replacing SCADA for approximately 230 substations and approximately 673 breakers.

Funding Source: This project is funded under PG&E's Transmission Owner cases.

Status: This project is currently in progress. The project started in July 2010 and is expected to be completed in December 2017. PG&E has added or replaced SCADA at 110 substations and 422 breakers from 2010 through June 2014.

Benefit Description: Increasing SCADA penetration enables improvements in reliability, grid planning, and operations.

Benefit Category: 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	**$284 Million (Since Program Inception)**

Description: 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.

Funding Source: This project is funded under PG&E's Transmission Owner cases.

Status: This project is currently in progress. This is an ongoing program, and doesn't have a defined end date, the project began in 2005. PG&E has installed and completed 90 MPAC buildings.

Benefits Description: The program will help improve reliability of the transmission system by replacing aging infrastructure and modernizing facilities. Over the past year, the MPAC Installation Program has avoided $10.4 million in capital costs over traditional upgrade methods and has avoided a cumulative total of $50.3 million.

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

Regional Synchrophasor Investment Project	**Completed - $41.7 Million**

Description: As part of this project, PG&E installed or upgraded Synchrophasor technology, also known as Phasor Measurement Units (PMU), throughout its service territory, has networked them together, and provided the data in a secured interface to PG&E's electric transmission operators, WECC, neighboring utilities, and the CAISO. The data exchange portion of the project includes positioning PG&E to share data with WECC. Nine other partner entities can coordinate and exchange data

amongst partner entities, including PG&E.

Funding Source: This project was funded by DOE/ARRA at $54 million to the WECC of which PG&E is a member, and PG&E's Transmission Owner rate case. From July 1, 2012 to May 30, 2014 the project costs were $41.7 million; PG&E funded $23.9 million of those costs and DOE funded $17.8 million.

Status: This project started in April 2010 and completed in May 2014 with a closeout report to WECC. The Synchrophasor investment project key accomplishments delivered: (1) the original 24 substations have had the Phasor Measurement Units (PMU) installed/upgrade with 2 new locations added in 2013 for a total of 202 PMU's, (2) the installation of Phasor Data Concentrators (PDC)at all 13 sites have been completed for a total of 34 devices, (3) the upgrade of network communications was completed to increase network bandwidth and meet redundancy requirements, (4) the proof of concept facility continues to be used for testing and ongoing product validation at San Ramon.

Benefit Description: 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.

Benefit Category: Smart Utility – This project 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	**$0 Million**

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.

Funding Source: This project is funded under 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.

Status: The project is in its initial stages. PG&E has completed RFI including analysis/evaluation. PG&E is seeking other utilities involvement and is waiting for their response. The implementation schedule for this project is dependent on the other utilities interests and business case funding. Currently, the project is on hold to seek additional utility partners.

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

Benefit Category: Smart Utility – This project anticipate slower future capital and expense costs while improving asset reliability.

2.6. Asset Management and Operational Efficiency Projects

Projects included in the Asset Management and 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.

The following section provides an update on all completed, in-progress or planned projects through June 2014 unless otherwise noted.

Transformer Load Management Project	**Completed - $0 Million**

Description: 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.

Funding Source: This project was funded through the SmartMeter™ upgrade project, Decision 06-07-027.

Status: This project was completed in June 2012.

Benefits Description: This project will improve the quality of data used to manage assets, yielding reliability benefits.

Benefit Category: Engaged Consumer, Smart Market and Smart Utility – 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	$0.7 Million

Description: 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 guides replacement and maintenance activities based on real time operating conditions. The CBM technology solution for electric distribution network provides automated capabilities for field personnel to capture maintenance process and data electronically via rugged computers and to upload data to SAP. When ultimately coupled with the SCADA system, it will be used to trigger real time maintenance and replacement work on the networks.

Funding Source: This project is funded through PG&E's 2014 GRC.

Status: This project is in progress. Work on this project commenced in August 2010 and was completed in December 2013. The CBM system is operational and PG&E completed the conversion of the available SCADA information to the PI Historian system. The next phase of the project is the integration of the PI Historian and the CBM system into a single system which will provide a comprehensive assessment of the condition of all of PG&E's network transformers and network protectors. PG&E has eliminated the time based replacement of equipment on the networks in favor of a condition based replacement system. The new CBM and PI Historian systems are what make this possible.

Benefit Description: 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 network system.

Benefit Category: Smart Utility — this project provides PG&E personnel with information regarding existing assets to make informed maintenance and upgrade decisions.

SmartMeter™ Outage Management Integration Project	$0 Million

Description: 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. Phase I 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 ping individual meters to determine whether they have been restored. Phase 2 of the project will identify and isolate downstream outages that have occurred prior to a larger upstream outage.

Funding Source: This project is funded within PG&E's SmartMeter™ Project, Decision 06-07-027. Future work planned to be funded by PG&E's Proposed 2014 GRC.

Status: Phase 1 of this project was started in May 2008 and completed in September 2011. Phase 2 has not been started.

Benefits Description: This project is expected to deliver reliability and operational benefits through leveraging SmartMeter™ data to better understand and resolve customer outages. The program this past year saved more than 6,500 "truck rolls" eliminated approximately 61,000 pounds of greenhouse gas emissions and saving the utility more than $733,000.

Benefit Category: Smart Utility – this project 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.

Electric Distribution Geographic Information System and Asset Management (ED GIS/AM) Project	**$35.1 Million**

Description: The ED GIS/AM project is a continuation of and enhanced approach to the Automated Mapping and Facilities Management (AM/FM) Project, where PG&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.

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.

Funding Source: This project is funded from PG&E's 2011 and 2014 GRCs.

Status: This project is currently in progress. The development of the enterprise-wide data repository commenced in October 2011 and will be completed by December 2014. The Central Valley Region data conversion has been completed and the GIS system has been deployed for that region.

Benefits Description: 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.

Benefit Category: 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	**Completed - $0 Million**

Description: The Condition Based Maintenance (CBM) Substation Project was a PG&E initiative to convert substation inspections collected on paper to a centralized electronic form. Centralizing the data aids in identifying problematic substation assets based on inspected condition trends in a predictive manner. The CBM technology solution for substation provides the platform for equipment inspection readings, temperature, and other data points to provide equipment predictive maintenance. 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.

Funding Source: This project is funded under PG&E's FERC approved Transmission Owner past rate cases and PG&E's 2011 GRC.

Status: Work on this project commenced on July 2009. The project deployment was completed in February 2013; and ongoing enhancements are under consideration, including a major upgrade of the system software. The remote devices, Toughbooks, used by field employees are scheduled for lifecycle replacement and the team is in the process of selecting the replacement devices.

Benefit Description: The CBM will allow decisions to be made, based on equipment condition or events, reducing unplanned work. CBM centralizes the collection of substation inspection and maintenance data electronically for expedited retrieval.

Benefit Category: Smart Utility – this project enables a centralized system to archive electronically collected inspection data that can be used for electronic compliance retrieval, to assist in analyzing asset operating data against the equipment capabilities and specifications to make informed decisions on maintenance decisions.

Network Supervisory Control and Data Acquisition (SCADA) Monitoring Project	**$6.5 Million in 2013**

Description: The project is installing 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 includes 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 is being used for triggering of alarms, and as part of the Condition Based Maintenance system for operation and maintenance activities. The data is also used for asset management decisions on maintenance and replacement of network equipment. 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.

Funding Source: This project is funded by PG&E's 2014 GRC.

Status: This project is currently in progress. PG&E has a total of twelve network groups. Two network groups are complete (Z-34-1 and Z-34-2), and the third network group (Y-4) will be completed in November 2014 with the fourth group (Z-1) completed by July of 2015. These completed network groups have been added to the PI Historian system which is the data accumulator for all of the data. This data in turn is coupled with the Condition Based Maintenance (CBM) system described above which allows PG&E to transition from time based replacement and maintenance to condition based replacement and maintenance. This results in a safer system while at the same time generating a savings by deferring work until the condition of the

equipment warrants.

Benefit Description: The new control features included as part of this project will improve personnel safety and overall system operability.

Benefit Category: Smart Utility – this project provides information for PG&E to better manage its assets and make informed maintenance, repair and upgrade decisions.

Load Forecasting Automation Program	**Completed - $0 Million**

Description: 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.

Funding Source: This project was funded in PG&E's 2011 GRC.

Status: This project implementation was completed in October 2012, following the training of 70+ distribution engineers on the application. The program is currently being used to produce circuit and bank level forecasts for 2013 - 2015, which allows the engineers to forecast with a greater accuracy at the circuit and bank level of the system. Future enhancements to program and forecasting methodology changes may be implemented, but at this time the project is considered deployed and operating.

Benefit Description: Automatic load forecasting will drive benefits associated with improved distribution system planning.

Benefit Category: Engaged Consumer and Smart Utility – This project 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.

Smart Grid Short-Term Demand Forecasting Pilot Project	**$0.25 Million**

Description: 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 systems that incorporate more granular sources of data for a specific region within PG&E's service territory.

Funding Source: This project is funded under Smart Grid Pilot Deployment Project Decision 13-03-032.

Status: The CPUC approved this project in March 2013 (D.13-03-032; A.11-11-017). This project has completed all key milestones for Phase 1. In July 2014, the CPUC granted PG&E authority to proceed to Phase 2 of this pilot project (Advice Letter

4429-E). Benefit Description: This pilot project seeks to demonstrate if more granular sources of data can improve the accuracy of PG&E's demand forecast within a selected region and if the implementation to PG&E's entire service area would be cost-effective. Benefit Category: Smart Market and Smart Utility – this project uses SCADA data and SmartMeter™ usage data to determine if there is an improvement to the accuracy of PG&E's short-term electric demand forecasts to meet PG&E's retail load obligations.

2.7. 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. Following the conclusion of the ADAPT project, PG&E has undertaken the implementation of a second project, the Identity and Access Management (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 2.12 to 2.16 of this report.

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's Risk Management Framework as described later in this document.

The following section provides an update on all completed, in-progress, or planned projects through June 2014 unless otherwise noted.

Advanced Detection and Analysis of Persistent Threats (ADAPT) Cyber Security Project	**Completed - $0 Million**
Description: 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.

Funding Source: This project was funded in PG&E's 2011 GRC.

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

Benefit Description: 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 Platform, Case Management, Vendor Management, Enhanced Remote Access, and Physical Access Management.

Benefit Category: Engaged Consumer, Smart Market, and Smart Utility – The ADAPT project, enhances controls across the entire PG&E infrastructure and is not limited to the Smart Grid. Each of the Engaged Consumer, 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 (IAM) Project	**$16 Million**

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.

Funding Source: This project is funded in PG&E's 2011 and 2014 GRCs.

Status: This project started in March 2012. This is a multi-year project expect to complete in 2016. This project is in progress.

Benefit Description: As of July 2014, PG&E has decreased the risk of unauthorized physical and logical access through: automated creation of network login credentials for approved and authorized users; automated removal of access from up to 231 separate facility access control systems for decommissioned users; centralized server access provisioning/de-provisioning, monitoring and reporting; and improved governance processes for enterprise user access functions contributing to a reduction in Segregation of Duties violations by 91%.

Benefit Category: Engaged Consumer, Smart Market, and Smart Utility – The IAM project, enhances controls across the entire PG&E infrastructure and is not limited to the Smart Grid. Each of the Engaged Consumer, 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 log in to PG&E's 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.

2.8. Integrated and Cross-Cutting Systems Projects

Integrated and cross-cutting systems refer to projects that support multiple smart grid domains, such as grid communications, application platforms, data management and analytics, advanced technology testing, and workforce development and technology training. An integrated approach for 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 and 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, Energy Independence and Security Act (EISA), CPUC Decision 10-06-047, Assembly Bill (AB) 32 and Executive Order S-305 , SB 078 and SB X1-2.

The following section provides an update on all completed, in-progress or planned projects through June 2014 unless otherwise noted.

Applied Technology Services (ATS) Distribution Test Yard (DTY)	**Completed - $6.8 Million since inception**
Description: The DTY will serve as an electrical laboratory that includes simulated distribution capabilities for monitoring and evaluating various new distribution tools, equipment, and applications. It will include the necessary primary line equipment with isolated communications networks to allow safe and thorough testing without risking network security issues. This DTY is part of the overall ATS end to end test capability for distribution systems of the future. Funding Source: This project was funded in PG&E's 2011 GRC. Status: This project is complete. The DTY facility was commissioned in September 2012. Benefit Description: This project will improve PG&E's distribution capabilities and overall system reliability. Benefit Category: Engaged Consumer, Smart Markets and Smart Utility – Cross-cutting initiatives apply across all three segments.	

SmartMeter™ Operations Center (SMOC)	**Completed - $0 Million**
Description: The SMOC project implements telecommunication network operations management capabilities to 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 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. An IT Operations Center will be created in the future to combine capabilities to support SmartMeter™ and Smart Grid strategies. This extended center will incorporate the SMOC and other IT operations centers to become the central hub to manage the operations of the SmartMeter™ network, future grid related telecommunications network, and the core PG&E business telecommunications network. Funding Source: This project was funded through PG&E's 2011 GRC. Status: PG&E completed the implementation of this project in July 2012. Benefit Description: This project will help evaluate and attain policy objectives in clean energy goals in an efficient manner. Benefit Category: Engaged Consumer, Smart Markets and Smart Utility – Cross-cutting initiatives apply across all three segments.	

Data Historian Foundation Project	Completed - $0.52 Million

Description: This project will implement enhanced data historian software for managing and analyzing operational data with select user groups in electric transmission, gas operations, power generation, and energy procurement. When deployed and integrated with other electric systems such as EMS and SCADA, the new data historian will serve as the central data archiving and analysis system for all-time series operational data. This solution enables PG&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.

Funding Source: This project was funded under PG&E's Transmission Owner Rate Case, Gas Transmission and Storage Rate Case, and 2014 GRC.

Status: This project commenced in January 2011 and was completed in July 2014.

Benefit Description: This project will enable the company to make intelligent decision for the planning process and deliver operational enhancements.

Benefit Category: Engaged Consumer, Smart Markets and Smart Utility – Cross-cutting initiatives apply across all three segments.

Telecommunications Architecture	$4 Million

Description: Telecommunications Architecture allows PG&E to meet near term and long term 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&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.

A blend of technologies will be needed to address the diverse performance needs and geography of the PG&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.

Funding Source: This project is being funded in PG&E's 2011 and 2014 GRCs.

Status: This project is currently in progress and is expected to be completed in 2017. PG&E has completed implementation of the core of the Multi-Protocol Label Switching (MPLS) network and is continuing its construction to expand the network and migrate services to it. Multiple Virtual Routing and Forwarding Domains have been constructed enhancing security and availability of critical applications. Investigation of additional wireless edge technologies has begun to expand communications

ability, reducing latency and increasing capacity.

Benefits Description: Benefits are estimated at $10 million in lifecycle asset replacement avoidance.

Benefit Category: Engaged Consumer, Smart Markets and Smart Utility – Cross-cutting initiatives apply across all three segments.

Information Management Architecture	**$2.5 Million**

Description: PG&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:

- Master Data Management across business processes and systems.
- Enhancement of PG&E's current operational data store capabilities.
- Common services including Service Oriented Architecture and framework to support Smart Grid systems and data interoperability.
- Enhanced business intelligence and analytic capabilities to support storing and processing of disparate sources of data.
- Data governance program and standards to support the enhanced information architecture and management foundation.

Funding Source: This program is being funded in PG&E's 2011 GRC and future related applications.

Status: PG&E began work on the Interval Data Analytics project in August 2012, which enables the company to enhance its operational data storage capabilities and business intelligence and analytic capabilities.

Benefit Description: Improved access to SmartMeter™ data and integration with customer data is supporting advancements in consumption analysis, distribution loading analysis, transmission loading analysis, EE/DR analysis, and rate analysis and design.

Benefit Category: Engaged Consumer, Smart Markets and Smart Utility – Cross-cutting initiatives apply across all three segments.

California Energy Systems for the 21st Century (CES-21) Program	**$0 Million**

Description: The CES-21 Program is a public-private collaborative research and development project between PG&E, Southern California Edison Company (SCE), San Diego Gas & Electric Company (SDG&E), and Lawrence Livermore National Laboratory (LLNL). The CES-21 Program's objective is to address challenges of cyber security and grid integration of the 21st century

energy system for California.

In Decision 14-03-029, which modified D.12-12-031 to comply with Senate Bill 96, the Commission authorized the three utilities to recover up to $35 million over five years for the CES-21 Program and limited research areas to cyber security and grid integration. On April 25, 2014, the three utilities filed a joint Advice Letter (PG&E AL 4402-E) requesting approval for two research projects and the Cooperative Research and Development Agreement (CRADA). Approval of this Advice Letter is expected in Q4 2014.

Funding Source: In Decision 14-03-029, the Commission authorized the three utilities to recover up to $35 million over five years for the CES-21 Program.

Status: The three utilities are awaiting Commission approval of the joint Advice Letter to commence this Program.

Benefit Description: The CES-21 Program has the potential to deliver significant benefits to California's electric customers. California customers will benefit greatly from avoided or shortened outages due to cyber-attacks. Automated response capabilities may reduce the number of outages, minimize their impact, and improve recovery times. The grid integration project may reduce operating and capital costs and improve reliability by reducing the uncertainty about the adequacy of planned resource to integrate greater amounts of intermittent renewables.

Benefit Category: Engaged Consumer, Smart Markets and Smart Utility – Cross-cutting initiatives apply across all three segments.

Electric Program Investment Charge (EPIC) Project	**$3.5 Million**

Description: As a result of the CPUC's Phase 2 EPIC Decision 12-05-037, PG&E, the other California IOUs, and the CEC are executing on the approved 2012-2014 Triennial Investment Plan and program framework to provide ongoing support for the development and deployment of next generation clean energy technologies. The EPIC program demonstrates promising new Smart Grid technologies focused on four key areas: Renewables and DER Integration; Grid Modernization and Optimization, Customer Service and Enablement; and Cross-Cutting and Foundation Strategies. Project specific information about EPIC can be found in PG&E's EPIC 2013 Annual Report, which was filed on February 28, 2014.

Funding Source: This project is funded in Decision 12-05-037. The Commission authorized the three IOUs to collect funding for the EPIC program in the total amount of $162M annually beginning January 1, 2013 and continuing through December 31, 2020. The total collection amount shall be adjusted on January 1, 2015 and January 1, 2018 to commensurate with the average change in the Consumer Price Index. PG&E's share is 50.1%.

Status: In November 2013, the CPUC approved PG&E's 2012-2014 Triennial Investment Plan filed on November 1, 2012. Additionally, CPUC approval is pending for PG&E's 2015-2017 Triennial Investment Plan filed on May 1, 2014.

Benefit Description: EPIC projects are expected to improve the safety, reliability and affordability of the electric system in California while supporting state energy policy goals.

Benefit Category: Engaged Consumer, Smart Markets and Smart Utility – Cross-cutting initiatives apply across all three segments.

Workforce Development and Technology Training	N/A

Description: PG&E is committed to developing a Smart Grid workforce. Enhanced workforce skills and knowledge are required for successful support of smarter grid design, deployment, operation, maintenance, safety, and customer care. PG&E develops internal training programs through experience, including with demonstration pilot projects, and scales them for broader deployment.

Funding Source: This work is funded through PG&E's GRCs.

Status: PG&E is continuing to enhance workforce skills to support a smarter, more integrated grid.

Benefit Description: Improved access to a skilled workforce necessary to implement the Smart Grid deployment to benefit grid reliability, increasing grid complexity, and technology integration that will help PG&E meet its energy goals in the state of California.

Benefit Category: Engaged Consumer, Smart Markets and Smart Utility – Cross-cutting initiatives apply across all three segments.

Supplier Diversity	N/A

Description: Throughout the process of identifying qualified suppliers to participate in the initial testing and limited pilots, PG&E emphasized the criticality of diverse supplier inclusion. PG&E continues to highlight the importance of education, mentoring and careful planning for the full participation of DBEs as business solution partners and subcontractors over the life of this program. In the initial phase of the Smart Grid evaluation process, PG&E has hired several DBE firms providing legal services, computer systems, staff augmentation, and office and electrical supplies. As a result, at mid-year 2014, PG&E Smart Grid supplier spending was in-line with the company's year-to-date supplier diversity goals.

As part of the advance planning and education effort, PG&E provided specific Smart Grid and general business opportunities to DBEs, including:

- Smart Grid & Energy Analytics Job Fair and Vendor Showcase held at PG&E's Pacific Energy Center ('PEC') featuring several major firms in the Smart Grid industry, each demonstrating their technologies, and interviewing for open positions and subcontracting opportunities.
- PG&E PEC classes on Smart Grid technology and PG&E roadmaps that are open to the public at no cost, and intended to help prime suppliers, DBEs and other small businesses better understand the scope and timing of PG&E's planned Smart Grid efforts over the next ten to fifteen years.
- PG&E's sponsorship of DBE firms in the University of California Advanced Technology Management Institute (ATMI) executive management training for companies poised for growth in emerging technologies like Smart Grid.
- PG&E's sponsorship of DBE firms in the UCLA Anderson School of Business, Management Development for

Entrepreneurs (MDE) executive business management training.

- DBE supplier development opportunities through PG&E's Technical Assistance Program (TAP), which include ISO 9001 and ISO 14001 certification training scholarships, DBE sponsorships to select industry trade shows, invitations to matchmaking events and other educational workshops.

2.9. Customer Roadmap

In its March 2012 Smart Grid Workshop Report, CPUC Staff requested the following information to be included in the IOUs' Smart Grid Annual Reports:

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.[5]

As requested by CPUC Staff, PG&E is providing marketing and outreach information using the sample template in Appendix 1 to the Smart Grid Workshop Report 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. Since the Marketing, Education, and Outreach proposal in the Smart Grid pilot deployment Application 11-11-017 was denied, the only outreach that provides support to the Smart Grid initiative is conducted through funding approvals of individual program and their initiatives as listed in Table 2-1.

Initiative Detail: For each of the project areas identified in the Customer Engagement timeline, PG&E has provided detail on existing or proposed outreach in accordance with the proposed template from the Commission's Smart Grid Workshop Report.

Table 2-1 below provides an annual illustration of PG&E's customer engagement timeline.

[5] See Smart Grid Workshop Report: Staff Comments and Recommendations, March 1, 2012, page 10.

Table 2-1: Customer Engagement Timeline

	2013	2014	2015*	2016*
Enablement Tools:				
My Energy Web presentment tools	X	X	X	X
Universal Audit Tools	X	X	X	X
Energy Alerts	X	X	X	X
Home Energy Reports	X	X	X	X
Home Area Network (HAN); Smart Thermostat, etc.	X	X	X	X
Third-party customer data access tools (e.g. Green Button, Green Button Connect, Customer Data Access)	X	X	X	X
Customer Premise Devices:				
SmartMeter™	X	X		
SmartAC™	X	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	X
Peak Day Pricing	X	X	X	X

Note:

*The activities for 2015 and 2016 are dependent on receiving authorization from the Commission to continue funding these programs in each of the appropriate programs proceedings.

2.10. Overview of Customer Engagement Plan

PG&E believes that 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. 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 had 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 in PG&E's Customer Outreach and Education Pilot. However, since the Outreach proposal in Application 11-11-017 was denied, the outreach

that supports the Smart Grid initiative can only be conducted through marketing of individual programs if they are approved in new cycles with outreach funds allocated. PG&E's outreach efforts over the reporting period have been focused on meeting goals of each program.

2.11. Smart Grid Engagement by Initiative Area

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

Enablement Tool: Power Management Tools	
Project Description	Marketing, Education & Outreach (ME&O) to educate customers about the various tools available to see their power usage, manage their energy use, and leveraging available interval data with options to interact with their energy usage in ways that are convenient and suit their preferences.
Target Audience	Focused on Residential and SMB Customers.
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)	• While customers are increasingly interested in digital communications, not all customers are web savvy or inclined to adopt new technology right away. • Low awareness of some of the enablement tools. • Low engagement within tools like My Energy once customers sign-up to see their power.
Strategy to Overcome Roadblocks	• Continue to offer residential 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. • Continue to market enablement tools that will assist customers in managing energy. • Show customers how other customers like them have benefited from engaging with their energy usage information.

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™ & Home and Business Area Networks, (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	"PG&E offers devices that provide visibility into energy usage to help manage energy use and costs."
Source of Message	Utility
Current Customer Engagement Road Block(s)	• Continued benefits education on benefits of SmartMeter™ technology. • Privacy and RF concerns with wireless devices. • Upfront investment is required in certain programs such as solar (DG).
Strategy to Overcome Roadblocks	• Provide customers with factual information about devices like SmartMeter™, focusing on the benefits and energy management tools it enables. • Continue to market solar (DG) rebates that are available, and offer assistance through dedicated Web and call center resources.

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™. Focuses on SMB customers defaulting to PDP and engaging transitioned PDP customers to utilize energy management tools.
Sample Message	"Rate options offer customers new ways to conserve energy and save money."
Source of Message	Utility
Current Customer Engagement Road Block(s)	• Need to clearly communicate nuances of rates and ensure customers understand how they can benefit. • TOU and critical peak pricing requires action from the customer on event days. • Overcoming sentiment that new rates will result in higher bills for customers.
Strategy to Overcome Roadblocks	• 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. • 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. • Bundling the enablement tools available to customers, so that customers can conduct rate comparisons and understand their energy costs in more detail.

2.12. Key Risks

As part of the continuous review of its key risks, PG&E has concluded that there has been no appreciable change to those risks over the past year.

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 Information and Operations 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 on 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.

2.13. 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’s Smart Grid Pilot Deployment Project (A. 11-11-017) 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."[6] 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.

2.13.1. Managing Cyber Security Risk through Control Baseline

PG&Es 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

[6] CPUC September 19, 2012 Policy Paper: Cybersecurity and the Evolving Role of State Regulation: How it Impacts the California Public Utilities Commission.

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 CPUC 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, and 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

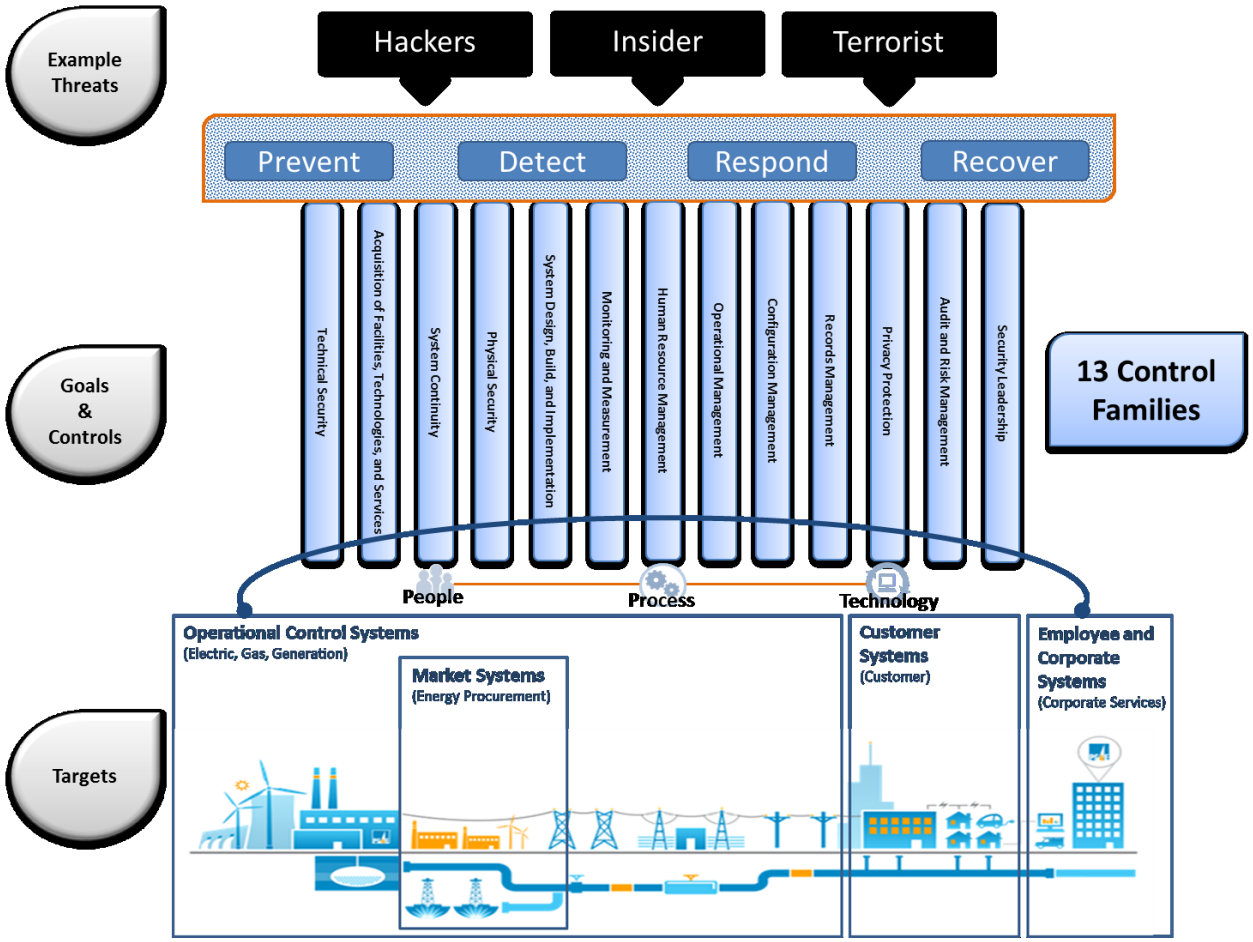
This control layer provides assurance around protecting the supply chain for investments in areas such as cloud services or new and emerging Smart Grid end point devices. PG&E has developed common procurement language based off of industry best practices that is being used for new contracts and contract 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 four utility defined "risk areas": Operational Control Systems, Market Systems, Customer Systems, and Employee and Corporate Systems.

Figure 2-1: PG&E's Cybersecurity Controls - Overview



2.13.2. 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 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 2.7, *Security (Physical and Cyber)*

Projects, of this report, PG&E provided an update on the ADAPT project and the IAM Initiatives, two important cybersecurity cross-cutting initiatives that enhance PG&E's 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.

2.14. Updates to 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. In the latter half of 2012, PG&E conducted an assessment covering Customer Energy Usage Data (CEUD) that is accessed, collected, stored, used, and disclosed in accordance with the decision.

KPMG Peat Marwick LLP (KPMG) was engaged to conduct an independent assessment of PG&E's CEUD privacy and security controls. The assessment covered a review of the management control framework in place to achieve compliance with the CPUC's decision. The insights that KPMG has provided – in its report delivered on February 22, 2013 – into the PG&E

internal controls will be very useful in enhancing our existing privacy framework to ensure the protection of CEUD.

KPMG recognized the strengths in PG&E's privacy and security controls, as well as our continuing efforts to improve. Specifically, KPMG found that (1) PG&E has visibility into the processing and transfer of Commercial End-Use Survey and personal information, (2) qualified employees sit in key positions throughout the company to help ensure privacy protection, and (3) PG&E has built privacy and security controls into its processes for the collection, handling, and storage of CEUD.

KPMG's assessment made five "Observations" reflecting potential improvements that PG&E could make to its existing privacy framework. None of these are "High-Risk," i.e., KPMG did not find any "[i]ssue (that) poses a significant risk of data breach, and/or risk of noncompliance with CPUC requirements." PG&E has initiated an improvement plan to address KPMG's observations, and remains committed to continuing to work with the CPUC, vendors, and most importantly, customers, to ensure customer energy usage data is protected and to maintain and expand the trust we have built with them over the years.

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 (www.privacybydesign.ca) adopted by SDG&E to further the privacy initiative and controls already deployed across PG&E.

2.15. 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's 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
  - 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 in Figure 2-2 below.

Figure 2-2: PG&E's Security Industry Leadership and Engagement

#	Acronym	Organization	Function	Capacity / Role
1	AGA	American Gas Association	Cybersecurity Working Group	Member
2	BPC	Bipartisan Policy Center	Cybersecurity Task Force	Member
3	DHS	Department of Homeland Security	Dam Sector Coordinating Council	Member
4	DOE / NIST	Department of Energy	Electric Sector Risk Management Process	Advisor
5	DOE / White House	Department of Energy	Cybersecurity Capability Maturity Model	Advisor
6	DOE CEDS / Labs	Department of Energy Cybersecurity of Energy Delivery Systems	Supply Chain Integration For Integrity	Advisor
7	EEI	Edison Electric Institute	Cybersecurity Working Group	Member
8	EEI	Edison Electric Institute	Threat Scenario Project	Member
9	EEI	Edison Electric Institute	Business Continuity Working Group	Member
10	FBI	Federal Bureau of Investigations	Infraguard	Member
11	INGAA	Interstate Natural Gas Association of America	Cybersecurity Working Group	Member
12	JTTF	Joint Terrorism Task Force	Information Sharing and Industry Collaboration	Member
13	NASPI	North American SynchroPhasor Initiative	Initiative Working Group	Member
14	NBISE	National Board of Information Security Examiners	Smart Grid Cybersecurity Panel	Advisor
15	NCRIC	Northern California Regional Intelligence Center	Steering Committee	Member
16	NEI	Nuclear Energy Institute	Cybersecurity Task Force	Member
17	NERC	North American Reliability Corporation	Bulk Electric System Security Metric Working Group	Chair
18	NERC	North American Reliability Corporation	Critical Infrastructure Protection Committee (CIPC)	Voting Member
19	NESCO	National Electric Sector Cybersecurity Organization	Information Sharing and Industry Collaboration	Member
20	NIST	National Institute of Standards and Technology	Cybersecurity Working Group	Task Lead and Voting Member
21	OpenSG	Open Smart Grid	Security Working Group	Member
22	PSERC	Power Systems Engineering Research Center	Cyber Risk Modeling and Mitigation & Attack-Resilient Control Algorithms	Advisor
23	SunGard	SunGard	Resiliency Advisory Committee	Vice-Chair
24	Trans Forum	North American Transmission Forum	Security Practices Working Group	Member
25	UNITE	Investor Owned Utility Consortium	Security Directors Council	Member
26	WECC	Western Electricity Coordinating Council	Critical Infrastructure and Information Management Subcommittee	Member

2.16. Key Risks Conclusion

PG&E continues to improve upon its ability to measure, manage, communicate, and mitigate potential cybersecurity, privacy, 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's 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

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's position that these consensus metrics will provide parties and the Commission with information that will allow for better understanding of PG&E's Smart Grid investments and provide the foundation for moving forward with Smart Grid investments.

3.1. 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	246 meters
Percentage of Total Meters	0.00477%
Note: Reporting date: July 1, 2013 through June 30, 2014.	

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 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 2012):	
Residential	0 MW
Non-Residential < 200 kW	11 MW
Non-Residential ≥ 200 kW	108 MW
Other (Agricultural)	26 MW
Total	145 MW
From the Winter Peak (November 2012 – April 2013):	
Residential	0 MW
Non-Residential < 200 kW	0 MW

Non-Residential ≥ 200 kW	0 MW
Other (Agricultural)	0 MW
Total	0 MW
Note: Includes load reduction from demand response programs and time-varying rates that is enabled by automated technologies.	

Metric 3: Percentage of DR enabled by AutoDR in each individual DR impact program.

Percentage of PG&E Demand Response Enabled by AutoDR in Each Individual DR Impact Program (2013)	
Metric	Value
Percentage of DR enabled by AutoDR – Demand Bidding Program (DBP)	53%
Percentage of DR enabled by AutoDR – Peak Day Pricing (PDP) program	6%
Percentage of DR enabled by AutoDR – Capacity Bidding Program (CBP)	24%
Percentage of DR enabled by AutoDR – Aggregator Managed Portfolio (AMP)	17%
Note: Percentage represents the Verified kW load reductions (engineering analysis) available for Demand Response programs in 2013, 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, California Alternate Rates for Energy (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	799	<1%
Non-Residential < 200 kW	9	<1%
Non-Residential ≥ 200 kW	0	0%
Other	0	0%
Total	808	<1%
CARE	0	0%
Non-CARE	808	<1%
Total (CARE and Non-CARE)	808	<1%
Climate Zone P	12	<1%

Climate Zone R	3	<1%
Climate Zone S	15	<1%
Climate Zone T	47	<1%
Climate Zone V	179	<1%
Climate Zone W	1	<1%
Climate Zone X	11	<1%
Climate Zone Y	540	<1%
Climate Zone Z	0	0%
Total by Climate Zone	808	<1%
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.		

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	244,927	5%
Non-Residential < 200 kW	399,099	60%
Non-Residential ≥ 200 kW	9,507	1%
Other	0	0%
Total	653,533	12%
CARE	35,195	3%
Non-CARE	618,338	15%
Total (CARE and Non-CARE)	653,533	12%
Climate Zone P	27,252	15%
Climate Zone Q	819	22%
Climate Zone R	91,156	16%
Climate Zone S	129,815	15%
Climate Zone T	112,093	9%
Climate Zone V	7,139	12%
Climate Zone W	47,161	17%
Climate Zone X	231,631	12%
Climate Zone Y	6,073	9%
Climate Zone Z	394	2%

Total by Climate Zone	653,533	12%
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.		

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 HAN 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	135	9%
Escalated customer complaints related to the functioning of a PG&E-administered HAN with registered consumer devices	2	0.1%
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.		

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	20,932	0.41%
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: 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 at the request of customers	6,136	0.12%
Advance meters tested measuring usage outside the Commission-mandated accuracy bands	24	0.39%
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 [A]	1,978,978	38%
Customers using a PG&E web-based portal to enroll in PG&E energy information programs	99,439	2%
Customers who have authorized PG&E to provide a third-party with energy usage data	60,835	1.2%
[A] This number represents the unique number of customers who have clicked on the "My Usage" tab within My Energy at least one time during the reporting period (July 1, 2013 through June 30, 2014). PG&E has 5.2 million customers with electric SmartMeters™		

3.2. 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	4,049 customers
Number of E-9B Customers	211 customers
Number of EV-A Customers	6,403 customers
Number of EV-B Customers	50 customers
Note: 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).	

3.3. 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, 2013 through December 31, 2013. 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
	599,072 MWh
Energy Storage interconnected at the distribution system level	6 MW
	42 MWh
Note: As highlighted in this Smart Grid Project Update, a 2 MW / 14 MWh battery storage system was commissioned at a PG&E substation near Vacaville in August 2012 and a 4 MW / 28 MWh battery storage system on a distribution circuit in San Jose California in May 2013.	

3.4. Grid Operations Metrics

Metric 1: The system-wide total number of minutes per year of sustained outage per customer served as reflected by the System Average Interruption Duration Index (SAIDI) Major Events Included and Excluded for each year starting on July 1, 2013 through June 30, 2014. 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	126.2
SAIDI – Major Events Excluded	112.7

Metric 2: How often the system-wide average customer was interrupted in the reporting year as reflected by the System Average Interruption Frequency Index (SAIFI), Major Events Included and Excluded for each year starting on July 1, 2013 through June 30, 2014. 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	1.093
SAIFI – Major Events Excluded	1.040

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, 2013 through June 30, 2014. 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	1.517
MAIFI – Major Events Excluded	1.455

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, 2013 through June 30, 2014.

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	410	0.007%
Circuits experiencing greater than 12 sustained outages per year	5	0.16%
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. 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)		

Metric 5: System load factor and load factor by customer class for each year starting on January 1, 2013 through December 31, 2013. Data is unavailable for any other time frame.

PG&E's Load Factors	
Metric	Value
System Load Factor	55.95%
Residential Load Factor	37.10%
Non-Residential < 200 kW Load Factor	Small L&P: 48.02% Medium L&P: 50.11%
Non-Residential ≥ 200 kW Load Factor	Large L&P: 66.64%
Other (agriculture) Load Factor	51.95%
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.	

Metric 6: Number of and total nameplate capacity of customer-owned or operated, grid-connected distributed generation facilities. The data are cumulative through June 30, 2014.

Number and Total Nameplate Capacity of PG&E's Customer-owned or operated Grid connected Distributed Generation Facilities		
Metric	Number of facilities	Capacity (MW)
Distributed generation facilities (solar PV)	124,853	1,136.6
Distributed generation facilities (non-solar)	528	394.8
Distributed generation facilities (solar PV and non-solar)	125,381	1,600.1

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.

D.12-04-025 defines Distributed Generation as "Customer-owned or operated generating systems that are enrolled with a utility in the Self Generation Incentive Program (SGIP) or the California Solar Initiative (CSI) or otherwise operating under a Feed In Tariff (FIT)". Significant customer-side Distributed Generation capacity has been interconnected outside of the CSI and SGIP programs. Therefore, data includes all NEM and non-export Rule 21 interconnected facilities.

For Rule 21 facilities, capacity for solar generating facilities is reported as the PV CEC-AC rating, while for non-solar facilities, capacity is reported as the maximum inverter capacity. Please note that in last year's annual report, PV capacity was reported as the maximum inverter capacity of the system.

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, 2013 through June 30, 2014.

Total Electricity Deliveries from PG&E's Customer-owned or Operated Grid-connected Distributed Generation Facilities		
Metric	Deliveries from Feed in Tariff (FIT) Projects (GWh)	Excess Generation from Net Surplus Compensation (NSC) Customers* (GWh)
July-2013	5.7	2.7
August-2013	6.5	1.7
September-2013	5.3	2.7
October-2013	4.7	2.7
November-2013	3.5	2.3
December-2013	3.5	5.9
January-2014	4.1	4.7
February-2014	4.3	3.7

March-2014	7.6	3.8
April-2014	9.0	2.6
May-2014	9.9	2.5
June-2014	10.6	1.9
Total July 1, 2013 to June 30, 2014	74.6	37.1
By Sub-LAP		
CAISO Sub-LAP_PGCC-APND	1.2	1.3
CAISO Sub-LAP_PGEB-APND	2.7	6.3
CAISO Sub-LAP_PGF1-APND	4.7	3.3
CAISO Sub-LAP_PGFG-APND	0.0	2.2
CAISO Sub-LAP_PGHB-APND	0.0	0.1
CAISO Sub-LAP_PGLP-APND	25.2	2.4
CAISO Sub-LAP_PGNB-APND	0.0	2.0
CAISO Sub-LAP_PGNC-APND	0.0	3.0
CAISO Sub-LAP_PGNV-APND	14.2	1.8
CAISO Sub-LAP_PGP2-APND	0.1	1.1
CAISO Sub-LAP_PGSA-APND	4.0	6.8
CAISO Sub-LAP_PGSB-APND	0.0	2.2
CAISO Sub-LAP_PGSF-APND	0.0	0.9
CAISO Sub-LAP_PGSI-APND	15.3	1.9
CAISO Sub-LAP_PGSN-APND	0.0	0.2
CAISO Sub-LAP_PGST-APND	7.2	1.5
Total	74.6	37.1

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.

*Excess generation from Net Surplus Compensation (NSC) customers is based on the annual true-up date on which the customer is compensated.

Metric 8: Number and percentage of distribution circuits equipped with automation or remote control equipment, including SCADA systems. The measure is for July 1, 2013 through June 30, 2014.

Number and Percentage of PG&E's 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	2,102	65.1%
Note: 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.		

CHAPTER 4

CONCLUSION

4. Conclusion

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

> *"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 PG&E's electric network, from generation to the customer's premise"*

Over the past reporting period, PG&E has remained aligned with this vision and made significant Smart Grid investments. By installing advanced automation technology across 500 distribution circuits to reduce service interruptions, PG&E has continued to show its commitment to reliability. PG&E also continues to promote customer needs, such as supporting distributed energy resources with its voltage control and various EPIC pilots. Pilots related to PEVs will also help PG&E evaluate customer interest and foster adoption.

PG&E maintains a strong commitment to supplier diversity and continues to focus on exceeding the Commission's supplier diversity goals set forth in General Order 156. PG&E intends to continue this successful track record and will review strategies related to its Smart Grid Pilot Projects, which were approved by the Commission in Decision 13-03-032.

As PG&E continues its Smart Grid deployments, the focus will remain on providing safe, reliable, and affordable power for its customers. Already, customers are seeing benefits from previous investments. In addition, benefits from investments made during this past year are beginning to accrue. By continuing to reliably meet customer needs, like enabling distributed energy resources and PEVs, PG&E's customers will continue to benefit from this Smart Grid journey.

CHAPTER 5

APPENDIX

PACIFIC GAS AND ELECTRIC COMPANY

2014 Annual Smart Grid Report

List of Projects and Recorded Costs from July 1, 2013 through June 30, 2014

Project Name	Recorded Amount
Customer Engagement and Empowerment Projects	
Intermittent Renewable Resource Management (IRRM) Pilot Phase 1	$0 Million
Intermittent Renewable Resource Management (IRRM) Pilot Phase 2	$1.04 Million
Proxy Demand Resources (PDR) Program – Phase 1	$0 Million
Demand Response Transmission & Distribution (T&D) System Integration	$0.17 Million
AC Cycling Next Generation Technology Assessment	$0.67 Million
Plug-in Hybrid Electric Vehicle/Electric Vehicle (PHEV/EV) Smart Charging Pilot	$0 Million
Demand Response Plug-In Electric Vehicle (DR PEV) Pilot	$0.12 Million
SmartMeter™ Program[7]	$2.34 Billion
The Green Button Initiative	$0 Million
Green Button Connect (GBC) Beta	$0.54 Million
Energy and Carbon Management System (C3)	$0 Million
My Energy Web Tools	$0 Million
Universal Audit Tools (UAT)	$0.8 Million
Energy Alerts	$0.1 Million
Home Energy Reports	$8 Million
Customer Data Access Project	$0.45 Million
Energy Data Access	$0.02 Million
HAN Enablement Program – Phase 1 & Phase 2	$1.39 Million
Home Area Network (HAN) Demand Response (DR) Integration Pilot Project	$6.57 Million
Time Varying Rates (TVR)	$12 Million
Automated Demand Response (AUTO-DR) Program	$3.3 Million
Opower/Honeywell Smart Thermostat Assessment Pilot	$0.13 Million
Business Energy Reports	$0 Million
Distribution Automation and Reliability Projects	
Distribution Substation Supervisory Control and Data Acquisition (SCADA) Program	$99.2 Million[8]
Cornerstone Improvement Project – Feeder Automation	$145.2 Million[9]
Distribution Management System (DMS) Project	$5.3 Million
Sodium Sulfur (NaS) Battery Energy Storage System (BESS) Demonstration Projects	$33.0 Million

[7] Cost since project inception through the Program's close on December 31, 2013.

[8] Cost since project inception.

[9] Cost since project inception.

Smart Grid Fault Location, Isolation, and Service Restoration (FLISR)	$0.7 Million
Install Smart Grid Line Sensors Pilot	$0.94 Million
Voltage and Reactive Power (Volt/Var) Optimization System Pilot	$3.32 Million
Detect and Locate Faulted Circuit Conditions Pilot	$0.71 Million
Transmission Automation and Reliability Projects	
Compressed Air Energy Storage (CAES) Demonstration Project	$10.3 Million
Transmission Substation SCADA Program	$80.9 Million[10]
Modular Protection Automation and Control (MPAC) Installation Program	$284 Million[11]
Regional Synchrophasor Investment Project	$41.7 Million
Substation Automation Interoperability Upgrade	$0 Million
Asset Management and Operational Efficiency Projects	
Transformer Load Management Project	$0 Million
Condition-Based Maintenance (CBM) – Distribution Network Project Release	$0.7 Million
SmartMeter™ Outage Management Integration Project	$0 Million
Electric Distribution Geographic Information System and Asset Management Project	$35.1 Million
Condition-Based Maintenance (CBM) – Substation Project	$0 Million
Network Supervisory Control and Data Acquisition (SCADA) Monitoring Project	$6.5 Million[12]
Load Forecasting Automation Program	$0 Million
Smart Grid Short Term Demand Forecasting Pilot Project	$0.25 Million
Security (Physical and Cyber) Projects	
Advanced Detection and Analysis of Persistent Threats (ADAPT) Cyber Security Project	$0 Million
Identity and Access Management Project	$16 Million
Integrated and Cross-cutting Systems Projects	
Applied Technology Services (ATS) Distribution Test Yard (DTY)	$6.8 Million[13]
SmartMeter™ Operations Center (SMOC) Project	$0 Million
Data Historian Foundation Project	$0.52 Million
Telecommunications Architecture	$4 Million
Information Management Architecture	$2.5 Million
California Energy Systems for the 21st Century (CES-21) Program	$0 Million
Electric Program Investment Charge (EPIC) Project	$3.5 Million

[10] Cost since project inception.

[11] Cost since project inception.

[12] Cost recorded in 2013.

[13] Cost since project inception.