PACIFIC GAS AND ELECTRIC COMPANY
Smart Grid Pilot Deployment Project
Application 11-11-017
Data Response

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PG&E Witness:	Kevin Dasso Dan Pearson Diadipya Patwa Steve Propper	Requester:	Arthur O'Donnell

QUESTION 1

PG&E's June 13 Rebuttal Testimony (pg. 1-9) introduced consideration of Pilot Plan criteria for evaluating pilot projects, as adopted by the Commission in D.12-04-045 (Demand Response OIR), and a similar set of criteria adopted in D.09-09-047 (2010-2012 Energy Efficiency Portfolios). For each of the six proposed pilot projects in A11-11-017, please describe how each matches these 9 Pilot Plan criteria:

Each Pilot Plan should illustrate the following elements:

1. New and innovative program design, concepts or technology that have not yet been tested or employed;
2. A specific statement of the concern, gap, or problem that the pilot seeks to address and the likelihood that the issue can be addressed cost-effectively through utility programs;
3. How the pilot matches the characteristics for Smart Grid technologies enumerated in SB 17 * (with three added characteristics adopted in D10-06-047).
4. Specific objectives and goals for the pilot;
5. A clear budget and timeframe to complete the pilot and obtain results. Pilots that are continuations of pilots from previous portfolios should clearly state how it differs from the previous phase;
6. Information on relevant standards or metrics or a plan to develop a standard against which the pilot outcomes can be measured;
7. Where appropriate, propose methodologies to test the cost effectiveness of the pilot;
8. A proposed EM&V plan; and.
9. A concrete strategy to identify and disseminate best practices and lessons learned from the pilot to all California utilities and to transfer those practices to resource programs, as well as a schedule and plan to expand the pilot to utility and hopefully statewide usage.

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Contents

ANSWER 1

PG&E provides the following response highlighting how each of the six pilot projects included in this Application (A.11-11-017) supports and match the pilot project criteria set forth in the 2012-2014 Demand Response Decision (D.12-04-045)

A. SUMMARY

This response describes in summary form how each of the pilot projects meet the Demand Response Decision criteria for pilot projects in D.12-04-045. However, PG&E's application, prepared testimony, workpapers and other data requests in this proceeding provide additional details regarding how the pilot projects meet the D.12-04-025. In addition, PG&E's proposed projects also meet other criteria adopted by the Commission for energy RD&D and technology demonstration projects in other decisions and proceedings, including, for example, (a) the statutory criteria for Smart Grid plans in SB 17; (b) the Commission's guidance on criteria for Smart Grid Deployment Plans in D.10-06-047 and Smart Grid metrics in D.12-04-045; (c) the statutory criteria for approval of utility RD&D expenditures in Public Utilities Code section 740.1; (d) the Commission's policies for energy RD&D described in the recent Electric Program Investment Charge (EPIC) decisions and staff report in R.11-10-003; (e) the Commission's criteria regarding deployment, technology evaluation and customer outreach in its Advanced Metering Infrastructure (AMI) decisions, including D.09-03-026 and D.06-07-027; and (f) the Commission's decisions on the utilities' applications for approval of American Recovery and Reinvestment Act (ARRA) projects, including D.10-09-018, rejecting a legal challenge to PG&E's Compressed Air Energy Storage RD&D project, and providing guidance on approval of RD&D projects where the benefits and cost-effectiveness of the technology cannot be demonstrated until the RD&D project is completed.

B. SMART GRID DISTRIBUTION PROJECTS

Smart Grid Line Sensor Pilot Project

1. **New and innovative program design, concepts or technology that have not yet been tested or employed;**

   Smart Grid Line Sensors are new and innovative technology that PG&E has not tested or employed on its distribution or Information Technology (IT) system. This new technology seeks to improve reliability and provide enhanced operation and planning information. Specifically, in piloting this new technology PG&E will examine their ability to (1) enhance grid outage detection, isolation, and restoration; and (2) enhance grid system monitoring and control.

   PG&E has not fully previously deployed or tested any Smart Grid Line Sensors on its distribution and information technology (IT) systems.

2. **A specific statement of the concern, gap, or problem that the pilot seeks to address and the likelihood that the issue can be addressed cost-effectively through utility programs;**

   Through the Smart Grid Line Sensor project PG&E will focus on testing Smart Grid Line Sensors that will assist in 1) reducing the outage area to be patrolled improving reliability by reducing response time and outage duration, and 2) provide for more granular loading information to assist in operations and planning decisions and enable increased penetration of intermittent power generation sources by basing interconnection requirements on actual field measurements.

   PG&E believes that the Smart Grid Line Sensor project will address these issues cost-effectively and provide significant benefits upon full deployment.**1**

3. **How the pilot matches the characteristics for Smart Grid technologies enumerated in SB 17 * (with three added characteristics adopted in D10-06-047).**

   The Smart Grid Line Sensor project is consistent with increase used of digital information to improve the reliability and efficiency of the grid characteristics listed in SB17.

a) Be self-healing and resilient – Using real-time information from embedded sensors and automated controls to anticipate, detect, and respond to system problems, a Smart Grid can automatically avoid or mitigate power outages, power quality problems, and service disruptions. (§ 8360 a, b, and d; § 8366 a, e, f, and g.)	The Smart Grid Line Sensor project will install line sensors that detect and communicate to operations personnel via a communications network if outage conditions are detected . Additionally, the installation of line sensors will assist operations and planning personnel to anticipate future system problems including increased penetration of intermittent power generation sources including rooftop PV systems.
b) Empower consumers to actively participate in operations of the grid – A Smart Grid should enable consumers to change their behavior around dynamic prices or to pay vastly increased rates for the privilege of reliable electrical service during high-demand conditions. (§ 8360 c, d, e, f, g, and h; § 8366 a, b, c, and d.)	This is not a major focus area of Smart Grid Line Sensor project.

1 PG&E Direct Testimony page 1-2, lines 30-32 and page 1-3 lines 1-18

c) Resist attack – A Smart Grid system should better identify and respond to man-made or natural disruptions. A Smart Grid system using real-time information should enable grid operators to isolate affected areas and redirect power flows around damaged facilities. (§ 8360 a, b, and d; § 8366 a, e, f, and g.)	As described in PG&E's Smart Grid Deployment Plan, effective cyber security controls and mechanisms are critical to the safe, reliable, and secure operation of Smart Grid technologies. As part of the Smart Grid Line Sensor project, PG&E will evaluate and test system interfaces to ensure security controls are in place. The investment associated with cyber security for this project is limited to secure file transfer systems.
d) Provide higher quality power that will save money wasted from outages – A Smart Grid system should create and provide more stable and reliable power to reduce down time. (§ 8360 a and b; § 8366 a, e, f, and g.)	This is not a major focus area of Smart Grid Line Sensor project.
e) Accommodate all generation and storage options – A Smart Grid system should continue to support traditional power loads, and also seamlessly interconnect with renewable energy, micro-turbines, and other distributed generation technologies at local and regional levels. (§ 8360 b, c, d, e, f, and g; § 8366 a, e, f, and g.)	The installation of Smart Grid Line Sensors will assist operations and planning personnel to anticipate and plan the infrastructure and interconnection requirements for increased penetration of intermittent power generation sources, storage and rooftop solar PV systems.
f) Enable electricity markets to flourish – A Smart Grid system should create an open marketplace where alternative energy sources from geographically distant locations can easily be sold to customers wherever they are located. Intelligence in distribution grids should enable small producers to generate and sell electricity at the local level using alternative sources such as rooftop-mounted photo voltaic panels, small-scale wind turbines, and micro hydro generators. (§ 8360 b, c, d, e, f, g, h, i, and j; § 8366 a, b, c, and d.)	This is not a major focus area of the Smart Grid Line Sensor project.

g) Run more efficiently – A Smart Grid system should optimize capital assets while minimizing operations and maintenance costs (optimized power flows reduce waste and maximize use of lowest-cost generation resources). (§ 8360 a; § 8366 g.)	The installation of line sensors will assist operations and planning personnel to optimize existing distribution system loading and anticipate future system problems by using the more granular loading information reducing operations and maintenance costs.
h) Enable penetration of intermittent power generation sources – As climate change and environmental concerns increase, the demand for renewable energy resources will also increase; since these are for the most part intermittent in nature, a Smart Grid system should enable power systems to operate with larger amounts of such energy resources. (§ 8360 c, g, and j; § 8366 a, b, c, and d.)	The installation of Smart Grid Line Sensors will assist operations and planning personnel to anticipate and plan the infrastructure and interconnection requirements for increased penetration of intermittent power generation sources including rooftop solar PV systems.
i) Enable maximum access by third parties to the grid, creating a welcoming platform for deployment of a wide range of energy technologies and management services;	This is not a major focus area of the Smart Grid Line Sensor project. However, as noted above, the project is expected to support increased penetration of distributed renewable resources.
j) Have the infrastructure and policies necessary to enable and support the sale of demand response, energy efficiency, distributed generation, and storage into energy markets as a resource among other things, on equal footing with traditional generation resources; and	This is not a major focus area of the Smart Grid Line Sensor project. However, as noted above, the project is expected to increase the penetration of distributed renewable resources.
k) Significantly reduce the total environmental footprint of the current electric generation and delivery system in California.	This is not a major focus area of the Smart Grid Line Sensor project. However, as noted above, the project is expected to increase the penetration of distributed renewable resources.

4. **Specific objectives and goals for the pilot;**

The goal of the Smart Grid Line Sensor Pilot project is to determine how PG&E can further reduce outage response time, improve outage location identification accuracy and provide field measurements of line loading information for improved system analysis.**2**

To achieve this goal PG&E will undertake a 4-year pilot that will;

- Scan the equipment industry for line sensors that are in production and or being used by other utilities
- Analyze technology requirements to support line sensors, including applications; cyber security; information architecture; standards; and telecommunications.
- In a laboratory environment, test the selected line sensors and identify the line sensors to use for the field pilot
- Deploy the selected line sensor products on up to 30 distribution feeders in three of PG&E's divisions and proceed to operate, evaluate and demonstrate the project in the field.

5. **A clear budget and timeframe to complete the pilot and obtain results. Pilots that are continuations of pilots from previous portfolios should clearly state how it differs from the previous phase;**

The budget and timeframe for the Smart Grid Line Sensors was provided in Table 2-2 for 2013 through 2016**3** with a detailed breakdown in Chapter 2 work papers, Page 2-11. Table 2-2 has been included below;

TABLE 2-2
PACIFIC GAS AND ELECTRIC COMPANY
LINE SENSOR PROJECT PILOT COSTS

Line No.	Title		2013 Forecast	2014 Forecast	2015 Forecast	2016 Forecast	Grand Total
1	Line Sensor	Capital	$2,550,722	$8,482,645	$2,382,015	$1,931,443	$15,346,825
2		Expense	$–	$198,834	$640,936	$721,025	$1,560,794

No prior pilots were completed or are in progress for the proposed technology.

6. **Information on relevant standards or metrics or a plan to develop a standard**

2 PG&E Direct Testimony page 1-6, lines 22-25
3 See PG&E Opening Testimony, Chapter 2, p. 2-13.

against which the pilot outcomes can be measured;

In its opening testimony filed on November 21, 2011, PG&E provided a listing of metrics[4] used to describe the benefits of full deployment. These are the same metrics that will be used to evaluate the results of this Smart Grid Line Sensor pilot. The metrics include:

- Avoided O&M costs (savings associated with reduced travel and patrol time)
- System Average Interruption Duration Index (SAIDI)
- Customer Average Interruption Duration Index (CAIDI)

PG&E will perform a statistical analysis to compare the variation in these metrics with and without the new technology. PG&E will also examine the effectiveness of the field measurement capabilities to improve system analysis.

7. **Where appropriate, propose methodologies to test the cost effectiveness of the pilot;**

   The methodologies to test the cost effectiveness of the pilot will be designed to capture the information to calculate the before and after metrics and future deployment costs noted in the response to question 6 above.

8. **A proposed EM&V plan; and.**

   The EM&V plan would be focused on the metrics provided in the response to question 6. However, during the analysis stage PG&E would seek to incorporate experience from other utilities and to the extent possible incorporate best practices.

9. **A concrete strategy to identify and disseminate best practices and lessons learned from the pilot to all California utilities and to transfer those practices to resource programs, as well as a schedule and plan to expand the pilot to utility and hopefully statewide usage.**

   PG&E will include results of this pilot in its annual Smart Grid report filed at the Commission and available to the public each year. PG&E will also include best practices and lessons learned in that report.

Smart Grid Voltage and Reactive Power (Volt/Var) Optimization Pilot Project

4 See, Workpapers Supporting Chapter 1, Smart Grid Policy, of PG&E Opening Testimony at pp 1-2,

1. **New and innovative program design, concepts or technology that have not yet been tested or employed;**

   The Voltage and Reactive Power (Volt/VAR) Optimization pilot project is an innovative technology that seeks to optimize operating voltage and reactive power resulting in reduced customer energy usage and reduced utility system losses, once deployed in the pilot and system wide deployment. Specifically, this project seeks to (1) enhance grid system monitoring and control; and (2) manage grid system voltage and losses**5**

   PG&E has not deployed or tested a Volt Var Optimization system on its distribution or information technology (IT) systems.

2. **A specific statement of the concern, gap, or problem that the pilot seeks to address and the likelihood that the issue can be addressed cost-effectively through utility programs;**

   Through the Volt Var Optimization project, PG&E will focus on testing software that will control and use real-time information from SCADA distribution feeder equipment and SmartMeters to manage the distribution circuit voltage. PG&E believes that the Volt Var Optimization project will address these issues cost-effectively potentially providing significant benefits upon full deployment.**6**

3. **How the pilot matches the characteristics for Smart Grid technologies enumerated in SB 17 * (with three added characteristics adopted in D10-06-047).**

   4. The Volt Var Optimization project is consistent with increase used of digital information to improve the reliability and efficiency of the grid characteristics listed in SB17.

a) Be self-healing and resilient – Using real-time information from embedded sensors and automated controls to anticipate, detect, and respond to system problems, a Smart Grid can automatically avoid or mitigate power outages, power quality problems, and service disruptions. (§ 8360 a, b, and d; § 8366 a, e, f, and g.)	This is not a major focus area of the Volt Var Optimization project.
b) Empower consumers to actively participate in operations of the grid – A Smart Grid should enable consumers to change their behavior around dynamic prices or to pay vastly increased rates for the privilege of reliable electrical service during	This is not a major focus area of the Volt Var Optimization project.

5 PG&E Direct Testimony page 1-7 lines 15-18
6 PG&E Direct Testimony page 1-2, lines 30-32 and page 1-3 lines 1-18

high-demand conditions. (§ 8360 c, d, e, f, g, and h; § 8366 a, b, c, and d.)	
c) Resist attack – A Smart Grid system should better identify and respond to man-made or natural disruptions. A Smart Grid system using real-time information should enable grid operators to isolate affected areas and redirect power flows around damaged facilities. (§ 8360 a, b, and d; § 8366 a, e, f, and g.)	As described in PG&E's Smart Grid Deployment Plan, effective cyber security controls and mechanisms are critical to the safe, reliable, and secure operation of Smart Grid technologies. As part of the Volt Var Optimization project, PG&E will evaluate and test system interfaces to ensure security controls are in place. The investment associated with cyber security for this project is limited to secure file transfer systems.
d) Provide higher quality power that will save money wasted from outages – A Smart Grid system should create and provide more stable and reliable power to reduce down time. (§ 8360 a and b; § 8366 a, e, f, and g.)	The Volt Var Optimization project will optimize the distribution primary and secondary voltage creating stable and reliable power.
e) Accommodate all generation and storage options – A Smart Grid system should continue to support traditional power loads, and also seamlessly interconnect with renewable energy, micro-turbines, and other distributed generation technologies at local and regional levels. (§ 8360 b, c, d, e, f, and g; § 8366 a, e, f, and g.)	The Volt Var Optimization project will demonstrate the ability of PG&E's current distribution system to reliability and cost-effectively integrate and manage the variations in voltage associated with intermittent distributed generation, especially solar PV generation.

f) Enable electricity markets to flourish – A Smart Grid system should create an open marketplace where alternative energy sources from geographically distant locations can easily be sold to customers wherever they are located. Intelligence in distribution grids should enable small producers to generate and sell electricity at the local level using alternative sources such as rooftop-mounted photo voltaic panels, small-scale wind turbines, and micro hydro generators. (§ 8360 b, c, d, e, f, g, h, i, and j; § 8366 a, b, c, and d.)	The Volt Var Optimization project will demonstrate the ability of PG&E's current distribution system to reliability and cost-effectively integrate and manage the variations in voltage associated with intermittent distributed generation, especially solar PV generation.
g) Run more efficiently – A Smart Grid system should optimize capital assets while minimizing operations and maintenance costs (optimized power flows reduce waste and maximize use of lowest-cost generation resources). (§ 8360 a; § 8366 g.)	The Volt Var Optimization project uses real time information from SCADA distribution devices and SmartMeters to manage the distribution circuit voltage from the substation to the customer service point (distribution primary, secondary and service systems). By managing the distribution circuit voltage PG&E can system losses and assist customers in reducing their energy usage.
h) Enable penetration of intermittent power generation sources – As climate change and environmental concerns increase, the demand for renewable energy resources will also increase; since these are for the most part intermittent in nature, a Smart Grid system should enable power systems to operate with larger amounts of such energy resources. (§ 8360 c, g, and j; § 8366 a, b, c, and d.)	The Volt Var Optimization project will demonstrate the ability of PG&E's current distribution system to reliability and cost-effectively integrate and manage the variations in voltage associated with intermittent distributed generation, especially solar PV generation.
i) Enable maximum access by third parties to the grid, creating a welcoming platform for deployment of a wide range of energy technologies and management services;	This is not a major focus area of the Volt Var Optimization project. However, managing distribution system voltage is critical to enable increased use of distributed renewable resources owned and operated by third parties.
j) Have the infrastructure and policies necessary to enable and support the sale of demand response, energy efficiency, distributed generation, and storage into energy markets as a resource among other	The Volt Var Optimization project may provide the ability for distribution operators to reduce the distribution system voltage during system or local emergencies supporting demand

things, on equal footing with traditional generation resources; and	response capabilities.
k) Significantly reduce the total environmental footprint of the current electric generation and delivery system in California.	The Volt Var Optimization project manages the distribution voltage from the substation to the customer service point. In managing the distribution voltage system losses and customer energy usage are reduced which reduces the needs for electric generation and delivery in California.

5. **Specific objectives and goals for the pilot;**

The goal of the Volt/VAR optimization project is to evaluate the ability of different systems to reduce customer energy usage and reduce utility system losses by managing the distribution voltage from the substation to the customer's service point**7**. To do so,

- PG&E will scan the industry for Volt/VAR optimization systems that are in production and or being used by other utilities
- PG&E then will analyze the technology requirements to support Volt/VAR optimization system.
- Following this analysis, PG&E will begin lab testing of Volt/VAR optimization systems and devices against standards and for compliance with agreed-upon specifications to ensure compliance, including testing associated software applications.
- Finally, following successful lab testing, PG&E will install the Volt/VAR optimization and telecommunications system on up to 12 distribution feeders in three of PG&E's divisions.

6. **A clear budget and timeframe to complete the pilot and obtain results. Pilots that are continuations of pilots from previous portfolios should clearly state how it differs from the previous phase;**

The budget and timeframe for the Smart Grid Line Sensors is provided in Table 2-3**8** below 2013 through 2016. A further breakdown of these costs by labor, material, software, etc. is included in the Workpapers Supporting Chapter 2, Smart Grid Distribution Projects, at pp 2-13.

TABLE 2-3
PACIFIC GAS AND ELECTRIC COMPANY
VOLT/VAR OPTIMIZATION PILOT COSTS

7 PG&E Direct Testimony page 2-13, lines 9-12
8 Table 2-3 was included on pp. 2-20 of PG&E Direct Testimony filed on November 21, 2012.

Line No.	Title		2013 Forecast	2014 Forecast	2015 Forecast	2016 Forecast	Grand Total
1	VVO – Volt Var Optimization	Capital	$3,856,449	$14,645,070	$9,355,506	$8,734,806	$36,591,831
2		Expense	$–	$298,439	$925,350	$1,012,305	$2,236,095

There are no prior pilots completed or in progress for Volt Var Optimization project.

7. **Information on relevant standards or metrics or a plan to develop a standard against which the pilot outcomes can be measured;**

In the Workpapers Supporting Chapter 1, Smart Grid Policy, at page 1-3, PG&E provided metrics used to consider the benefits of full deployment which will be additionally used to evaluate the results of the Volt/VAR optimization. The metrics are:

- Avoided energy and procurement costs
- Avoided Generation Capacity
- Avoided CO2 emissions

PG&E will perform a statistical analysis to compare the variation in these metrics with and without the new technology.

8. **Where appropriate, propose methodologies to test the cost effectiveness of the pilot;**

The methodologies to test the cost effectiveness of the pilot will be designed to capture the information to calculate the before and after metrics and future deployment costs noted in the response to question 6 above.

9. **A proposed EM&V plan; and.**

Any EM&V plan that PG&E develops will be focused on the metrics provided in the response to question 6. However, during the analysis stage PG&E would seek to understand these metrics from other utilities and determine comparabilityed to PG&E's expected metric outcomes and incorporate best practicesto the extent possible.

10. **A concrete strategy to identify and disseminate best practices and lessons learned from the pilot to all California utilities and to transfer those practices to resource programs, as well as a schedule and plan to expand the pilot to utility and hopefully statewide usage.**

PG&E will include results of this pilot in its annual Smart Grid report filed at the Commission and available to the public each year. PG&E will also include best practices and lessons learned in that report.

Smart Grid Detect and Locate Distribution Line Outages and Fault Circuit Conditions Project

1. **New and innovative program design, concepts or technology that have not yet been tested or employed;**

   The Detect and Locate Distribution Line Outages and Faulted Circuit Conditions Project is a pilot project that seeks to test new and innovative technology aimed at improving system safety and reliability. Through this new technology, PG&E seeks to (1) enhance grid outage detection, isolation, and restoration; and (2) enhance grid system monitoring and control and is consistent with SB 17 Smart Grid characteristics of improved reliability of the electric system.**9**.

   PG&E has not tested or employed any portion of the Detect and Locate Distribution Line Outages and Faulted Circuit Conditions Project on its distribution or information technology (IT) systems.

2. **A specific statement of the concern, gap, or problem that the pilot seeks to address and the likelihood that the issue can be addressed cost-effectively through utility programs;**

   Through the Detect and Locate Distribution Line Outages and Faulted Circuit Conditions project PG&E will focus on testing software that will use real-time information from embedded sensors to more precisely identify actual locations of damaged equipment, reduce operations and maintenance costs and improve system safety.

   PG&E believes that the Detect and Locate Distribution Line Outages and Faulted Circuit Conditions Project will address these issues cost-effectively with significant benefits upon full deployment.**10**

3. **How the pilot matches the characteristics for Smart Grid technologies enumerated in SB 17 * (with three added characteristics adopted in D10-06-047).**

   The Detect and Locate Distribution Line Outages and Faulted Circuit Conditions project is consistent with increase used of digital information to improve the reliability and efficiency of the grid characteristics listed in SB17.

a) Be self-healing and resilient – Using real-time information from embedded sensors and automated controls to anticipate, detect, and	The Detect and Locate Distribution Line Outages and Faulted Circuit Conditions project uses real time information from embedded sensors to more precisely identify actual locations of damaged

9 PG&E Direct Testimony page 1-7 lines 30-32 and page 1-8 lines 1-2
10 PG&E Direct Testimony page 1-2, lines 30-32 and page 1-3 lines 1-18

respond to system problems, a Smart Grid can automatically avoid or mitigate power outages, power quality problems, and service disruptions. (§ 8360 a, b, and d; § 8366 a, e, f, and g.)	equipment. Additionally, in the future this system may have a waveform analysis capability that can assist in stopping outages prior to equipment failure and or assisting in finding and stopping power quality issues affecting customers.
b) Empower consumers to actively participate in operations of the grid – A Smart Grid should enable consumers to change their behavior around dynamic prices or to pay vastly increased rates for the privilege of reliable electrical service during high-demand conditions. (§ 8360 c, d, e, f, g, and h; § 8366 a, b, c, and d.)	This is not a major focus area of the Detect and Locate Distribution Line Outages and Faulted Circuit Conditions project.
c) Resist attack – A Smart Grid system should better identify and respond to man-made or natural disruptions. A Smart Grid system using real-time information should enable grid operators to isolate affected areas and redirect power flows around damaged facilities. (§ 8360 a, b, and d; § 8366 a, e, f, and g.)	As described in PG&E's Smart Grid Deployment Plan, effective cyber security controls and mechanisms are critical to the safe, reliable, and secure operation of Smart Grid technologies. As part of the Detect and Locate Distribution Line Outages and Faulted Circuit Conditions project, PG&E will evaluate and test system interfaces to ensure security controls are in place. The investment associated with cyber security for this project is limited to secure file transfer systems.
d) Provide higher quality power that will save money wasted from outages – A Smart Grid system should create and provide more stable and reliable power to reduce down time. (§ 8360 a and b; § 8366 a, e, f, and g.)	The Detect and Locate Distribution Line Outages and Faulted Circuit Conditions project may, in the future have a waveform analysis capability that can assist in stopping outages prior to equipment failure and or assisting in finding and stopping power quality issues affecting customers.
e) Accommodate all generation and storage options – A Smart Grid system should continue to support traditional power loads, and also seamlessly interconnect with renewable energy, micro-turbines, and other distributed generation technologies at local and regional levels. (§ 8360 b, c, d, e, f, and g; § 8366 a, e, f, and g.)	This is not a major focus area of the Detect and Locate Distribution Line Outages and Faulted Circuit Conditions project.

f) Enable electricity markets to flourish – A Smart Grid system should create an open marketplace where alternative energy sources from geographically distant locations can easily be sold to customers wherever they are located. Intelligence in distribution grids should enable small producers to generate and sell electricity at the local level using alternative sources such as rooftop-mounted photo voltaic panels, small-scale wind turbines, and micro hydro generators. (§ 8360 b, c, d, e, f, g, h, i, and j; § 8366 a, b, c, and d.)	This is not a major focus area of the Detect and Locate Distribution Line Outages and Faulted Circuit Conditions project.
g) Run more efficiently – A Smart Grid system should optimize capital assets while minimizing operations and maintenance costs (optimized power flows reduce waste and maximize use of lowest-cost generation resources). (§ 8360 a; § 8366 g.)	This is not a major focus area of the Detect and Locate Distribution Line Outages and Faulted Circuit Conditions project.
h) Enable penetration of intermittent power generation sources – As climate change and environmental concerns increase, the demand for renewable energy resources will also increase; since these are for the most part intermittent in nature, a Smart Grid system should enable power systems to operate with larger amounts of such energy resources. (§ 8360 c, g, and j; § 8366 a, b, c, and d.)	This is not a major focus area of the Detect and Locate Distribution Line Outages and Faulted Circuit Conditions project.
i) Enable maximum access by third parties to the grid, creating a welcoming platform for deployment of a wide range of energy technologies and management services;	This is not a major focus area of the Detect and Locate Distribution Line Outages and Faulted Circuit Conditions project.
j) Have the infrastructure and policies necessary to enable and support the sale of demand	This is not a major focus area of the Detect and Locate Distribution Line Outages and Faulted Circuit Conditions project.

response, energy efficiency, distributed generation, and storage into energy markets as a resource among other things, on equal footing with traditional generation resources; and	
k) Significantly reduce the total environmental footprint of the current electric generation and delivery system in California.	This is not a major focus area of the Detect and Locate Distribution Line Outages and Faulted Circuit Conditions project.

4. **Specific objectives and goals for the pilot;**

The goal of this project is to evaluate, through the use of a fault-finding software system or systems, plausible improvements in locating failed equipment that cause outages and determine if there are additional benefits of providing more accurate outage locations to utility first responders**11**. To do so,

- PG&E will scan the equipment industry for fault detection software systems that are in production and or being used by other utilities.
- PG&E will analyze the technology requirements to support fault-finding systems and software.
- PG&E will then test the software, systems and related devices against standards defined above and specifications to ensure compliance.
- Finally, PG&E will install fault-finding software systems and telecommunications system on up to 15 distribution feeders in two of PG&E's divisions

5. **A clear budget and timeframe to complete the pilot and obtain results. Pilots that are continuations of pilots from previous portfolios should clearly state how it differs from the previous phase;**

The budget and timeframe for the Detect and Locate Distribution Line Outages and Faulted Circuit Conditions Project is provided in Table 2-3**12** below for 2013 through 2016. A detailed breakdown of these costs is included on pp. WP 2-15, of the Workpapers supporting Chapter 2, Smart Grid Distribution Project.**13**

TABLE 2-4
PACIFIC GAS AND ELECTRIC COMPANY
DETECT AND LOCATE DISTRIBUTION LINE OUTAGES AND FAULTED CIRCUIT CONDITIONS PROJECT PILOT COSTS

11 PG&E Direct Testimony page 1-7, lines 23-29
12 See Chapter 2, Smart Grid Distribution Project, of PG&E Direct Testimony at pp 2-24
13 PG&E Direct Testimony page 2-20 and Chapter 2 work papers page 2-15

Line No.		2013 Forecast	2014 Forecast	2015 Forecast	2016 Forecast	Grand Total
1	Capital	$1,732,839	$8,118,595	$1,293,661	$1,239,107	$12,384,202
2	Expense	$–	$105,356	$252,896	$266,909	$625,161

Additionally, PG&E provided estimates of the future deployment costs from 2017-2023 after completion of the successful pilot from 2013-2016 in its Chapter 1 work papers, Page WP 1-4,.

No prior pilots were completed or are in progress for the proposed technology

6. **Information on relevant standards or metrics or a plan to develop a standard against which the pilot outcomes can be measured;**

PG&E provided a listing of metrics in the Workpapers Supporting Chapter 1, Smart Grid Policy, at page 1-2, for which it used to consider the benefits of full deployment. These are the same metrics that will be used to evaluate the results of the pilot. The metrics include the following:

- Avoided O&M costs (savings associated with reduced travel and patrol time)
- System Average Interruption Duration Index (SAIDI)
- Customer Average Interruption Duration Index (CAIDI)
- System Average Interruption Frequency Index (SAIFI)
- Momentary Average Interruption Frequency Index (MAIFI)
- Deployment cost forecasts from the pilot to a proposed system level deployment

PG&E will perform a statistical analysis to compare the variation in these metrics with and without the new technology. PG&E will also examine the effectiveness of the system to detect and possibly locate high impedance fault conditions to improve system safety.

7. **Where appropriate, propose methodologies to test the cost effectiveness of the pilot;**

The methodologies to test the cost effectiveness of the pilot will be designed to capture the information to calculate the before and after metrics and future deployment costs noted in the response to question 6 above.

8. **A proposed EM&V plan; and.**

The EM&V plan would be focused on the metrics provided in the response to question 6. However, during the analysis stage, PG&E would seek to incorporate experience from

other utilities to the extent possible incorporate best practices.

9. **A concrete strategy to identify and disseminate best practices and lessons learned from the pilot to all California utilities and to transfer those practices to resource programs, as well as a schedule and plan to expand the pilot to utility and hopefully statewide usage.**

   PG&E will include results of this pilot in its annual Smart Grid report filed at the Commission and available to the public each year. PG&E will also include best practices and lessons learned in that report.

C. TECHNOLOGY, EVALUATION AND STANDARDS TESTING (TEST) INITIATIVE

The (Technology Evaluation and Standards Testing) TEST initiative is not a pilot like the three distribution projects or the short-term demand forecasting project. Instead, the TEST is an initiative that proposes a set of new activities to enhance PG&E's Smart Grid technology development capabilities. However, PG&E believes that the Commission's criteria for evaluating emerging technology projects, as outlined in Decision (D.)08-06-027 and reaffirmed recently in D.12-04-045, is a useful criteria for evaluating PG&E's TEST initiative. D.12-04-045 describes these criteria is as follows:

> *"In D.08-06-027, the Commission determined that given the continuing evolution in DR techniques, enabling technologies, and evaluation methods, California benefits from investing in research and development that will encourage the adoption of cost-effective DR. We find it reasonable to continue funding Emerging Technology projects for all three utilities. Our review of utility Emerging Technology proposals indicates that the programs address appropriate technologies needing evaluation and appear reasonable in terms of budget requests. Unless otherwise noted herein, we approve the Emerging Technology proposals as requested. We authorize the proposed 2012-2014 Emerging Technology budgets as requested for each utility.*
>
> *As in D.08-06-027, we continue to emphasize the importance of ensuring that the research and development undertaken is understood by this Commission and can be shared with other research entities. We require the three utilities to provide semi-annual reports regarding their Emerging Technology projects. These reports shall summarize each project, the potential benefits of the technology or technique, the activities undertaken as part of the project, and provide any available data and results. The Utilities shall follow the reporting format previously developed by staff for this purpose (and as modified by staff in the future), and provide reports on the previous year's Emerging Technology activities by March 31 and September 30 of each year."*

D.12-04-045, pp. 145- 146. However, PG&E also believes the nine Pilot Plan criteria**14** enumerated by the Commission provide additional useful criteria for understanding the proposed TEST initiative, consistent with the emerging technology criteria. Below, PG&E highlights how the TEST initiative matches the nine-point criteria plan laid out in D.12-04-045.

1. **New and innovative program design, concepts or technology that have not yet been tested or employed;**

   The TEST initiative is a new and innovative program design for PG&E. This initiative will employ an integrated and cross-cutting approach to technology development, involving collaboration among internal PG&E departments including Information Technology (IT) and PG&E's lab-based testing facilities at the San Ramon Technology Center.

   As PG&E has demonstrated in its Smart Grid Deployment Plan**15** and this application, the complexity of technology in the electric system is increasing significantly, as new distributed resources are interconnected and new demands are made of the system. In addition, new communications and sensor technologies are becoming more technically and economically feasible for potential use to improve the safety, reliability, and operating efficiency of the electric distribution grid. To scale up and deploy these new applications and technologies, PG&E must test, evaluate, and integrate new technology into its operations.**16** PG&E through the TEST initiative will lay the foundation that will facilitate the testing, scaling up and deployment of these technologies. To do so the TEST initiative will undertake three key activities:

   - **Technology Evaluation**: Industry scanning and benchmarking to understand new emerging Smart Grid technologies and applications being developed by peer utilities, vendors and other 3rd parties.**17**
   - **Standards Development & Certification:** Engagement by PG&E staff in national Smart Grid standards development organizations, and coordination of certification and/or interoperability testing across priority standards areas.**18**
   - **Technology Testing:** Lab-based testing of new emerging Smart Grid products and prototypes, using PG&E's lab facilities and real-world simulation environments.**19**

2. **A specific statement of the concern, gap, or problem that the pilot seeks to**

14 Footnote section in final decision
15 Application 11-06-006
16 PG&E Rebuttal Testimony, page 3-3
17 PG&E Direct Testimony, page 3-5
18 PG&E Direct Testimony, page 3-10
19 PG&E Direct Testimony, page 3-16

address and the likelihood that the issue can be addressed cost-effectively through utility programs;

The purpose of the TEST initiative is to fill a very specific gap in Smart Grid technology coordination, project development, external research review, standards development and compliance testing, and lab-based technology testing. PG&E provided detail in its direct testimony on the particular problems that the TEST initiative will address, and described the methodologies under which the various Smart Grid technologies would be tested.**20**

In brief, the technology applications on which PG&E proposes to focus testing include:

- Integrating Increasing Penetration of Renewable Resources
- Integrating Distributed Storage and Advanced Distribution Automation
- Integrating Electric Vehicles Into Grid Operations
- Coordinating Communication and Control Equipment Development and Specifications
- Meeting Emerging Smart Grid Cyber-Security Requirements**21**

While PG&E staff conducts general technology evaluation as part of its normal course of business, most of this staff evaluates conventional technologies, not new Smart Grid technologies as contemplated by SB 17, the Commission's Smart Grid policy decisions, and California's energy and environmental policies. The current staff level is insufficient to conduct the technology evaluation that is necessary for achievement of Smart Grid goals.**22**

3. **How the pilot matches the characteristics for Smart Grid technologies enumerated in SB 17 * (with three added characteristics adopted in D10-06-047).**

The table below shows how the TEST Initiative supports the Smart Grid characteristics described in SB 17 and the Commission's decision D.10-06-047

a) Be self-healing and resilient – Using real-time information from embedded sensors and automated controls to anticipate, detect, and respond to system problems, a Smart Grid can automatically avoid or mitigate power outages, power quality problems, and service disruptions. (§ 8360 a, b, and d; §	Self-healing characteristics and resiliency are a top priority of the proposed TEST initiative. PG&E is currently scaling up the use of SCADA control and FLISR self-healing technologies across its distribution system. The TEST initiative will increase PG&E staff engagement in standards development and certification work, to make sure that new standards (for example, for substation communications **23**) ensure interoperability between PG&E's already-

20 PG&E Direct Testimony, pages 3-14 to 2-15
21 PG&E Direct Testimony, p. 3-16
22 PG&E Rebuttal Testimony, page 3-17

8366 a, e, f, and g.)	deployed SCADA and FLISR technologies, and new communications and control technologies entering the market. One of the 5 focus areas for dedicated testing staff is "Coordinating Telecommunication & Control Equipment Development & Specifications". The TEST initiative will also enable testing of SCADA and FLISR technologies in combination with customer generation and storage, to assure that PG&E's self-healing technologies operate reliably in the presence of these systems.**24** Finally, the TEST initiative will improve PG&E's ability to scan the industry for new emerging technologies of this type, with more advanced communications and optimization capabilities.
b) Empower consumers to actively participate in operations of the grid – A Smart Grid should enable consumers to change their behavior around dynamic prices or to pay vastly increased rates for the privilege of reliable electrical service during high-demand conditions. (§ 8360 c, d, e, f, g, and h; § 8366 a, b, c, and d.)	This is not a major focus area of the TEST initiative. Separate technology evaluation work, funded under the SmartMeter Upgrade project as well as Demand Response proceedings, focuses on enabling this characteristic.
c) Resist attack – A Smart Grid system should better identify and respond to man-made or natural disruptions. A Smart Grid system using real-time information should enable grid operators to isolate affected areas and redirect power flows around damaged facilities. (§ 8360 a, b, and d; § 8366 a, e, f, and g.)	Cyber-security is a top priority of the proposed TEST initiative. New cyber-security requirements for utility communications and control systems are a key driver of emerging new industry technology standards. The TEST initiative will increase PG&E's engagement in standards development and certification work, to help PG&E understand emerging standards, and, where possible, to better shape those standards to PG&E's specific system configurations and use cases. Additionally, one of the 5 focus areas for dedicated testing staff is "Meeting Emerging Smart Grid Cyber-Security Requirements".**25**

24 See PG&E Rebuttal Testimony, pages 3-8 and 3-9 for potential issues with inverter certification
25 PG&E Direct Testimony, page 3-19 to 3-20

d) Provide higher quality power that will save money wasted from outages – A Smart Grid system should create and provide more stable and reliable power to reduce down time. (§ 8360 a and b; § 8366 a, e, f, and g.)	Power quality is an area of concern that must be addressed with higher penetrations of distributed renewable resources on the grid. One area of focus of the TEST initiative is integration of renewable resources. Power Quality issues will be characterized and technologies to address the issues identified and tested via the TEST initiative. Further, the TEST initiative will improve PG&E's ability to scan the industry for new emerging technologies of this type.
e) Accommodate all generation and storage options – A Smart Grid system should continue to support traditional power loads, and also seamlessly interconnect with renewable energy, micro-turbines, and other distributed generation technologies at local and regional levels. (§ 8360 b, c, d, e, f, and g; § 8366 a, e, f, and g.)	Integrating distributed generation and storage is a top priority of the TEST initiative. One of the 5 focus areas for dedicated testing staff is "Integrating Increasing Penetration of Renewable Resources".**26** This staff will help PG&E measure and understand the effects, and develop solutions to mitigate the system impacts, of high penetrations of distributed generation. Another focus area for testing staff is "Integrating Distributed Storage and Advanced Distribution Automation,". **27** These staff will help PG&E test and characterize the impact of distributed storage (as stand-alone and as part of distributed generation systems) on the distribution grid. Staff will also test new and enhanced distribution automation equipment and more sophisticated control systems (distributed equipment controllers and Distribution Management System upgrades) which can help integrate energy storage into the grid.

26 PG&E Direct Testimony, page 3-16 to 3-17
27 PG&E Direct Testimony, page 3-17

f) Enable electricity markets to flourish – A Smart Grid system should create an open marketplace where alternative energy sources from geographically distant locations can easily be sold to customers wherever they are located. Intelligence in distribution grids should enable small producers to generate and sell electricity at the local level using alternative sources such as rooftop-mounted photo voltaic panels, small-scale wind turbines, and micro hydro generators. (§ 8360 b, c, d, e, f, g, h, i, and j; § 8366 a, b, c, and d.)	The TEST initiative will support this characteristic by helping improve PG&E's monitoring and measurement of distributed generation. For example, PG&E believes using SmartMeters in combination with new "smart" inverters may be able to provide critical capabilities for measuring actual generator output for future electric service options. The TEST initiative will enable the testing and development of this technology. Better information about the actual output of distributed generation will help PG&E accommodate this output and also help facilitate new types of market transactions with this output.
g) Run more efficiently – A Smart Grid system should optimize capital assets while minimizing operations and maintenance costs (optimized power flows reduce waste and maximize use of lowest-cost generation resources). (§ 8360 a; § 8366 g.)	This is a top priority of the TEST initiative. Technology testing prior to deployment seeks to avoid costs of large-scale capital investments in unproven or immature technologies, as well as future O&M costs associated with enhancements, upgrades, and repairs. The initiative also seeks to increase efficiency by developing technology solutions to problems that would otherwise require more costly, conventional methods to address. The TEST initiative plans to leverage newly-available data from SmartMeters and increased SCADA, to improve efficiency and accuracy of capacity planning.**28** One of the 5 focus areas for dedicated testing staff is "Integrating Electric Vehicles Into Grid Operations". **29** This staff will help PG&E measure and understand the effects, and develop cost-effective solutions to mitigate the system impacts, of high penetrations of electric vehicles. Proposed industry scanning activities will also identify additional technology solutions to help PG&E increase operational efficiency.

28 See discussion in PG&E Rebuttal testimony on page 3-9 and 3-10, and page 3-13
29 PG&E Direct Testimony, page 3-18

h) Enable penetration of intermittent power generation sources – As climate change and environmental concerns increase, the demand for renewable energy resources will also increase; since these are for the most part intermittent in nature, a Smart Grid system should enable power systems to operate with larger amounts of such energy resources. (§ 8360 c, g, and j; § 8366 a, b, c, and d.)	As described in e) and f) above, enablement of distributed renewable generation is a top priority of the TEST initiative.
i) Enable maximum access by third parties to the grid, creating a welcoming platform for deployment of a wide range of energy technologies and management services;	This is not a major focus area of the TEST initiative. While enabling maximum access by third parties to the grid is an underlying goal of PG&E's work on industry standards for HAN communications and customer systems, (funded through other programs such as SmartMeter and Demand Response), the TEST initiative does not propose to focus its activities in this area.
j) Have the infrastructure and policies necessary to enable and support the sale of demand response, energy efficiency, distributed generation, and storage into energy markets as a resource among other things, on equal footing with traditional generation resources; and	See comments above for characteristics e), f), h), and i) related to proposed initiatives to help integrate distributed generation and storage. Efforts related to demand response and energy efficiency are not proposed to be funded under the TEST initiative.
k) Significantly reduce the total environmental footprint of the current electric generation and delivery system in California.	The TEST initiative provides broad support for this characteristic, through its proposed efforts to integrate increasing amounts of distributed generation, energy storage, and electric vehicles. Proposed industry scanning activities will also help identify additional solutions to help PG&E reduce the environmental footprint of its electric generation and delivery system.

4. **Specific objectives and goals for the pilot;**

The goal of the TEST initiative is to create a Smart Grid technology development

capability that will facilitate the integration and testing of new Smart Grid technologies, evaluation and development of Smart Grid standards, as well as the improvement of PG&E's understands of new Smart Grid technologies through the benchmarking of experiences of others**30**. PG&E will achieve this goal

- Through increased visibility into industry research
- Through increased standards development and certification
- Through the evaluation and testing of various Smart Grid technologies.

In pursing this goal, PG&E will develop the capability necessary to achieve the goals outlined in its Smart Grid Deployment Plan.

5. **A clear budget and timeframe to complete the pilot and obtain results. Pilots that are continuations of pilots from previous portfolios should clearly state how it differs from the previous phase;**

   The budget and implementation timeframe for the TEST initiative was provided in Table 3-3 included in Chapter 3, Technology Evaluation and Standards Testing, of PG&E's Direct Testimony in this proceeding, **31** with a detailed breakdown of the cost elements provided in the Workpapers Supporting Chapter 3**32**.

6. **Information on relevant standards or metrics or a plan to develop a standard against which the pilot outcomes can be measured;**

   The TEST initiative is not a pilot project like others in this application. The purpose of the initiative is to provide technology development capability that PG&E needs to achieve the goals of its Smart Grid Deployment Plan. As such, the outcomes of the initiative will be evaluated in the broad context of the Deployment Plan goals. The Commission has approved metrics by which PG&E will report on its annual progress toward these goals (Decision D.12-04-025), in the following areas: Customer / AMI, Plug-in Electric Vehicles, Storage, and Grid Operations. The decision also created three working groups to recommend additional metrics, as needed.

   The TEST initiative will enable PG&E's reporting against current and future Smart Grid metrics, by improving its ability to monitor Smart Grid-related changes over time. For example, the TEST initiative seeks to help PG&E monitor and measure the increasing power output and energy delivered from distributed generation, as well as the impacts of electric vehicles and grid-connected storage equipment. The initiative also will help measure these impacts on overall grid indicators related to system load and reliability.

30 See Chapter 1, Smart Grid Policy, of PG&E Opening Testimony, at pp 1-8, Line 15-19.
31 PG&E Direct Testimony, page 3-23
32 Workpapers Supporting Chapter 3, TEST, pp W P3-1 to WP 3-5

Equally importantly, the TEST initiative will provide the foundational technology development and testing capabilities to help PG&E address potential challenges associated with increasing distributed generation, electric vehicles, and storage. This will help PG&E support the achievement of state policy targets for distributed generation and grid modernization, as measured by the Smart Grid metrics.

7. **Where appropriate, propose methodologies to test the cost effectiveness of the pilot;**

In the same way that the outcomes of the TEST initiative must be measured against the broad goals of the Smart Grid Deployment Plan rather than against narrow metrics more appropriate for pilots, the cost-effectiveness of the initiative must also be understood in a broader context. Cost-effectiveness will be shown through reports on the initiative's activities over time, rather than through specific milestones or metrics. In this proceeding, PG&E has described the objectives of the initiative as well as the expected benefits**33**, which should demonstrate the initiative's cost-effectiveness over time.

In the short-term, TEST initiative staff will address challenges from new technologies currently appearing on the grid. A major focus area will be ensuring the safe and reliable interconnection of distributed generation systems, avoiding potential safety hazards, reliability problems, and other more costly methods of ensuring safe operation of unproven system configurations.**34** Over the longer term, PG&E expects to achieve the more significant benefits associated with technology evaluation and testing prior to deployment. A key benefit will be the avoided costs of large-scale capital investments in unproven or unready technologies based on information provided by vendors or by other utilities whose system configurations were not comparable to PG&E's. PG&E has referred to two such instances of avoided costs in this proceeding.**35**

Increased standards development and certification activity also has the potential to drive savings for PG&E. Improving national standards for utility technologies helps achieve more flexible and lower-cost solutions. Additionally, by shaping national standards and the certification processes for those standards, PG&E may be able to rely more confidently on such standards in the future, and thereby avoid the necessity of some future technology testing.

8. **A proposed EM&V plan; and.**

Given that the TEST initiative is an initiative rather than a pilot project, PG&E believes

33 PG&E Direct Testimony, page 3-3, pages 3-20 to 3-22; Responses to DRA_02-16 through _02-19; PG&E Rebuttal Testimony, pages 3-8 to 3-10

34 See discussion of inverter technologies in operation with multiple units on a circuit, in PG&E Rebuttal Testimony, page 3-8 and 3-9.

35 PG&E Rebuttal Testimony, page 3-7 and 3-8

that a formal Evaluation, Measurement & Verification (EM&V) plan may not be appropriate for the initiative. The approved Smart Grid metrics from D.12-04-025 provide a broad set of measures for the effectiveness of PG&E's Smart Grid technology development capability. PG&E plans to report annually on the activities of the TEST initiative as part of its Smart Grid annual report.

9. **A concrete strategy to identify and disseminate best practices and lessons learned from the pilot to all California utilities and to transfer those practices to resource programs, as well as a schedule and plan to expand the pilot to utility and hopefully statewide usage.**

   PG&E plans to report on the activities and outcomes of the TEST initiative in its annual Smart Grid report under the Smart Grid OIR decision. PG&E will disseminate best practices and lessons learned as part of its participation in industry organizations, research collaborative, and standards development organizations. PG&E also proposes to increase its participation in these industry organizations using funding under the TEST initiative. PG&E will disseminate best practices and lessons learned from specific public grant-funded research initiatives (which PG&E also proposes to increase using funding under the TEST initiative).

D. SHORT TERM LOAD FORECAST SMART GRID PILOT PROJECT

1. **New and innovative program design, concepts or technology that have not yet been tested or employed;**

   The short term demand forecast pilot project is a innovative program design to PG&E that will rely on more granular sources of data to determine short-term electricity demand forecasts. PG&E currently employs a "top-down" approach to creating short-term electricity demand forecasts as described in the direct testimony**36**. This is the same "top-down" approach used by other entities such as CAISO. As part of this proposed pilot project, PG&E will use additional sources of data such as SmartMeters™ and Supervisory Control and Data Acquisition (SCADA) data from PG&E's transmission and distribution network to determine if more accurate load forecasts can be achieved, in comparison to current practice.

2. **A specific statement of the concern, gap, or problem that the pilot seeks to address and the likelihood that the issue can be addressed cost-effectively through utility programs;**

   While PG&E's current approach of "top-down" forecasts for short-term electricity demand forecasts produces reasonable demand forecasts, this method, does not account for the

36 PG&E Direct Testimony, pp 4-2

impacts of micro-climates within PG&E's service area. The direct testimony provides an example where the effects of coastal fog are combined with the effects of high temperatures in the Central Valley to determine a temperature index for PG&E's entire service area. Through this project, PG&E will evaluate the feasibility of improving the accuracy of its short-term demand forecast by using more granular information.**37**

Through the proposed short-term demand forecast pilot project, PG&E aims to demonstrate and evaluate the costs and benefits of using more granular information for the purposes of forecasting short-term electricity demand. The cost and benefits estimates derived from the pilot project will be used to determine whether a broader, system-wide deployment is warranted.**38**

3. **How the pilot matches the characteristics for Smart Grid technologies enumerated in SB 17 * (with three added characteristics adopted in D10-06-047).**

The short-term demand forecasting pilot project is consistent with increased use of digital information to improve the reliability and efficiency of the grid characteristic listed in SB17.

a) Be self-healing and resilient – Using real-time information from embedded sensors and automated controls to anticipate, detect, and respond to system problems, a Smart Grid can automatically avoid or mitigate power outages, power quality problems, and service disruptions. (§ 8360 a, b, and d; § 8366 a, e, f, and g.)	This is not a major focus area of the short-term demand forecasting pilot project.
b) Empower consumers to actively participate in operations of the grid – A Smart Grid should enable consumers to change their behavior around dynamic prices or to pay vastly increased rates for the privilege of reliable electrical service during high-demand conditions. (§ 8360 c, d, e, f, g, and h; § 8366 a, b, c, and d.)	This is not a major focus area of the short-term demand forecasting pilot project.

37 PG&E Direct testimony, pp. 4-3
38 PG&E Direct testimony, pp. 4-1

c) Resist attack – A Smart Grid system should better identify and respond to man-made or natural disruptions. A Smart Grid system using real-time information should enable grid operators to isolate affected areas and redirect power flows around damaged facilities. (§ 8360 a, b, and d; § 8366 a, e, f, and g.)	As described in PG&E's Smart Grid Deployment Plan, effective cyber security controls and mechanisms are critical to the safe, reliable, and secure operation of Smart Grid technologies. As part of the short-term demand forecasting pilot project, PG&E will evaluate and test system interfaces to ensure security controls are in place. The investment associated with cyber security for this project is limited to secure file transfer systems.
d) Provide higher quality power that will save money wasted from outages – A Smart Grid system should create and provide more stable and reliable power to reduce down time. (§ 8360 a and b; § 8366 a, e, f, and g.)	This is not a major focus area of the short-term demand forecasting pilot project.
e) Accommodate all generation and storage options – A Smart Grid system should continue to support traditional power loads, and also seamlessly interconnect with renewable energy, micro-turbines, and other distributed generation technologies at local and regional levels. (§ 8360 b, c, d, e, f, and g; § 8366 a, e, f, and g.)	This is not the primary focus of this pilot project. If short-term demand forecasting pilot project is successful and it is fully deployed, the project would influence the types of resources that are available and used to meet demand.
f) Enable electricity markets to flourish – A Smart Grid system should create an open marketplace where alternative energy sources from geographically distant locations can easily be sold to customers wherever they are located. Intelligence in distribution grids should enable small producers to generate and sell electricity at the local level using alternative sources such as rooftop-mounted photo voltaic panels, small-scale wind turbines, and micro hydro generators. (§ 8360 b, c, d, e, f, g, h, i, and j; § 8366 a, b, c, and d.)	This is not a major focus area of the short-term demand forecasting pilot project.

g) Run more efficiently – A Smart Grid system should optimize capital assets while minimizing operations and maintenance costs (optimized power flows reduce waste and maximize use of lowest-cost generation resources). (§ 8360 a; § 8366 g.)	If the short-term demand forecasting pilot project is successful and it is fully deployed, the additional sources of digital information could improve the reliability and efficiency of the grid by ensuring that sufficient resources are matched and available to meet demand.
h) Enable penetration of intermittent power generation sources – As climate change and environmental concerns increase, the demand for renewable energy resources will also increase; since these are for the most part intermittent in nature, a Smart Grid system should enable power systems to operate with larger amounts of such energy resources. (§ 8360 c, g, and j; § 8366 a, b, c, and d.)	This is not a major focus area of the short-term demand forecasting pilot project.
i) Enable maximum access by third parties to the grid, creating a welcoming platform for deployment of a wide range of energy technologies and management services;	This is not a major focus area of the short-term demand forecasting pilot project.
j) Have the infrastructure and policies necessary to enable and support the sale of demand response, energy efficiency, distributed generation, and storage into energy markets as a resource among other things, on equal footing with traditional generation resources; and	This is not a major focus area of the short-term demand forecasting pilot project.
k) Significantly reduce the total environmental footprint of the current electric generation and delivery system in California.	This is not a major focus area of the short-term demand forecasting pilot project.

4. **Specific objectives and goals for the pilot;**

The goal of this project is to determine if improved and more accurate short-term

electricity demand forecasts can be achieved by using more granular sources of data for forecasting purposes.**39** PG&E will seek to achieve this goal by implementing a set of activities in three distinct project phases**40**;

- *Analysis Phase* - PG&E will select a region for forecasting and identify the existing data sources available to prepare a forecast.
- *Build phase* - PG&E will integrate the identified data sources into a central repository where the raw data will be processed and housed for input into a demand forecasting process.
- *Pilot phase* - PG&E will run, in parallel with its existing forecasting process, a separate forecast using the granular inputs for the region selected for the pilot, making adjustments to software as needed, and compare the forecast with the existing forecasting process.

5. **A clear budget and timeframe to complete the pilot and obtain results. Pilots that are continuations of pilots from previous portfolios should clearly state how it differs from the previous phase;**

The budget and implementation timeframe for this project included below, was provided in Table 4-1, included in Chapter 4, Short Term Demand Forecasting Smart Grid Pilot Project, of PG&E's Direct Testimony,**41** with a detailed breakdown of the cost elements provided in the Workpapers supporting Chapter 4.

TABLE 4-1
PACIFIC GAS AND ELECTRIC COMPANY
SHORT-TERM DEMAND FORECAST SMART GRID PILOT PROJECT COSTS

Line No.	Items	2013	2014	2015	2016	Total
1	Energy Procurement Costs	$590,774	$493,853	$507,423	$521,501	**$2,113,551**
2	Information Technology Costs	1,984,587	6,677,357	1,666,788	1,706,698	**$12,035,430**
3	Total	$2,575,361	$7,171,210	$2,174,211	$2,228,199	**$14,148,981**

No prior pilots were completed or are in progress for the proposed functionality.

6. **Information on relevant standards or metrics or a plan to develop a standard against which the pilot outcomes can be measured;**

39 PG&E Direct Testimony, pp 4-3
40 PG&E Direct Testimony, pp 4-4
41 PG&E Direct Testimony pp. 4-8

PG&E will perform a statistical analysis to compare the accuracy of the forecasts produced from this pilot project to the accuracy of the existing forecasting process. PG&E will compare the following items:

- Variation between day-ahead forecasts
- Variation between day-ahead forecasts and real-time forecasts
- Variation between real-time forecast**42**

7. **Where appropriate, propose methodologies to test the cost effectiveness of the pilot;**

   The methodologies to test the cost effectiveness of the pilot will be designed to capture the information to calculate the before and after metrics and future deployment costs noted in the response to question 6 above.

8. **A proposed EM&V plan; and.**

   PG&E will design and implement an EM&V plan consistent with the EM&V plans developed for the other pilot projects, using the specific metrics and performance goals set for this pilot project.

9. **A concrete strategy to identify and disseminate best practices and lessons learned from the pilot to all California utilities and to transfer those practices to resource programs, as well as a schedule and plan to expand the pilot to utility and hopefully statewide usage.**

   PG&E plans to report annually on the activities of the Short-Term Demand Forecast Smart Grid Pilot Project as part of its annual Smart Grid annual report. However, PG&E will ensure any disclosure is consistent with Decision 06-06-066, which requires details of historical load information be held confidential for a period of one-year.

E. SMART GRID CUSTOMER OUTREACH AND EDUCATION PILOT PROJECT

1. **New and innovative program design, concepts or technology that have not yet been tested or employed;**

   The test and refine methodology proposed in the pilot is unique in that it more heavily relies on customer research and message testing to guide the pilot outreach described in the application, as well as future widespread Smart Grid deployments. PG&E will take

42 PG&E Direct Testimony, pp. 4-7

this opportunity to learn from its customers, understand their specific needs (and the varying needs of different customer segments throughout its service territory) and adapt a flexible outreach strategy that aims to meet their expectations and raise awareness and understanding of Smart Grid technology.

PG&E fully expects that this pilot will yield additional – and potentially unexpected – results, which are critical in forming a longer term Smart Grid customer engagement strategy that is sustainable. It is exactly this customer-driven outreach development that sets this pilot apart from any other Smart Grid-related outreach work. Additionally, PG&E plans to utilize best practices in marketing and customer engagement not just from within the energy and public utility industry, but from outside as well – applying insight from best-in-class marketing from industries such as a consumer technology, telecommunications and the retail sectors.

As learned from SmartMeter™ and early time varying pricing outreach, it is critical that PG&E conduct foundational outreach regarding new technology, and related product and service offerings, and understands early areas for potential customer interest, question or concern. As it relates to Smart Grid customer outreach and education, PG&E is not pre-disposing that customers will adopt technology or immediately understand how to participate in the Smart Grid. In fact, early surveys and research point to the opposite. Further, a particularly important nuance is that PG&E is not proposing to preordain the customer-facing messages it will use in early Smart Grid outreach and education, but instead solicit and understand *from* the customer their understanding, preferences and needs regarding the Smart Grid and Smart Grid-enabled products and services.

See page 5-2 of rebuttal testimony for further detail. Also see page 5-2, beginning line 28 of direct testimony pointing to PG&E's proposed test and methodology approach.

2. **A specific statement of the concern, gap, or problem that the pilot seeks to address and the likelihood that the issue can be addressed cost-effectively through utility programs;**

PG&E conducted its own survey with customers before filing its Smart Grid Deployment Plan to understand general awareness and understanding of the Smart Grid. The findings from the research were also used to inform the proposed Customer Outreach and Education Pilot.

As stated in PG&E's Smart Grid Deployment Plan, June 30, 2011, Chapter 8, page 203, and reiterated on page 5-11 of rebuttal testimony, this early research pointed to three key findings: (1) the Smart Grid is largely unknown to residential customers, but (2) favorability increases with information and (3) there is a high level of interest in the Smart Grid.

PG&E believes that the proposed Customer Outreach and Education Pilot directly addresses this identified issue and will close the gap between interest and understanding of the facts, benefits and costs related to the Smart Grid and Smart Grid-enabled products and services. The pilot is specifically designed to be flexible, relying heavily on customer research and message testing that can and will be refined before any mass or territory-wide outreach.

Additionally, the technology pilots proposed in this application offer the Customer Outreach and Education Pilot an opportunity to test these messages on specific projects, and with targeted customers in specific geographic areas or with identified education needs (as directed by the proposed customer research in this pilot). This ensures PG&E has a clear understanding of customer interest, question and need related to customer-facing Smart Grid upgrades that can more cost effectively inform more wide-scale Smart Grid customer education and outreach as outlined in PG&E's Smart Grid Deployment Plan.

3. **How the pilot matches the characteristics for Smart Grid technologies enumerated in SB 17 * (with three added characteristics adopted in D10-06-047).**

   The Customer Outreach and Education Pilot speaks to the "empower consumers to actively participate in operations of the grid" characteristic enumerated in SB 17. Before PG&E can successfully empower customers to participate in Smart Grid related technology, PG&E must first understand the areas of interest among customers – and test specifically what Smart Grid-related messages, products and services best resonate with customers and motivate them to be interested in and participate with Smart Grid technology.

4. **Specific objectives and goals for the pilot;**

   The goal of this project is to use a locally targeted approach to test customer response to integration of Smart Grid messaging with various energy education campaigns and increase customer understanding on the facts, benefits and costs associated with the implementation of Smart Grid technologies.

5. **A clear budget and timeframe to complete the pilot and obtain results. Pilots that are continuations of pilots from previous portfolios should clearly state how it differs from the previous phase;**

   The budget and timeframe for the Smart Grid Customer Outreach and Education Pilot Project is provided in Table 5-2**43** below for 2013 through 2016.

43 See Chapter 5, Smart Grid Customer Outreach and Education Pilot Project, of PG&E Direct Testimony at pp 5-9

TABLE 5-1
PACIFIC GAS AND ELECTRIC COMPANY
SUMMARY OF CUSTOMER OUTREACH AND ACQUISITION COSTS

Line No.	Customer Outreach and Acquisition	2013	2014	2015	2016	Total (2013-2016)
1	Outreach Labor	$300	$300	$300	$300	$1,200
2	Organizational Change and Employee Training	–	–	–	500	500
3	Research and Analysis	310	250	260	100	920
4	Communication and Outreach	2,015	2,190	2,265	2,190	8,660
5	Customer Impact and ES&S Comms	250	250	300	300	1,100
6	Subtotal	$2,875	$2,990	$3,125	$3,390	$12,380
7	Non-Labor Escalation	$135	$219	$308	$357	$1,018
8	Labor Escalation	21	22	25	48	117
9	Subtotal	$156	$241	$333	$405	$1,135
10	Total	$3,031	$3,231	$3,458	$3,795	$13,515

6. Information on relevant standards or metrics or a plan to develop a standard against which the pilot outcomes can be measured;

The metrics that PG&E expects to achieve as a result of the pilot are detailed below**44**.

> *"At the conclusion of PG&E's Smart Grid Customer Outreach Pilot, PG&E will (1) better understand customers' interest in the type, frequency and level of detail that they need and expect around Smart Grid; (2) determine the appropriate targeting of Smart Grid messages to particular geographies and with specific customer groups to meet the needs of customers; (3) educate targeted customers objectively about the facts, benefits and costs associated with the implementation of Smart Grid technologies, including the pilot Smart Grid projects proposed in the Smart Grid Deployment Project application and identified in PG&E's Smart Grid Deployment Plan and the Commission's Smart Grid policy decisions; (4) identify areas of issues, concern or risk perceived by customers related to the deployment of Smart Grid technology; (5) refined and determined an ongoing customer outreach and engagement strategy for large-scale Smart Grid deployment throughout PG&E's service territory; and (6) gain additional knowledge about customer interest and preferences that can be applied to future customer outreach and education about specific Smart Grid-related service and products."*

44 See Chapter 5, Customer Outreach and Education, of PG&E's Rebuttal testimony, pp 5-7, lines 10-26

the metrics PG&E aims to achieve as a result of the pilot will develop a baseline and standard from which wide-scale Smart Grid deployment customer outreach and education can be measured and benchmarked. Additionally, PG&E and this Customer Outreach and Education Pilot support the Smart Grid Metrics Decision**45**, which states the importance of close and ongoing customer research and outreach to establish and achieve longer-term Smart Grid goals

7. **Where appropriate, propose methodologies to test the cost effectiveness of the pilot;**

   From a cost-effectiveness standpoint, PG&E's proposed four year budget of $13.5 million for the pilot is conservative and reasonable, given the need to pilot outreach approaches and methodologies that provide statistically-significant insights and data across PG&E's demographically and geographically diverse base of 10 million customers in northern and central California.

   Additionally, conducting research, message testing and early outreach on a pilot and targeted scale allows PG&E to refine its approach before larger-scale deployment of Smart Grid technology. This refinement at a pilot level is more cost-effective in the long-run, and allows PG&E to respond to necessary changes in creative or outreach channel selection with flexibility and lower cost.

8. **A proposed EM&V plan; and.**

   PG&E's EM&V Plan for evaluating the results of its Smart Grid customer outreach and education pilot would use criteria for EM&V of similar customer outreach and marketing activities in the EE and DR areas, and would be developed and implemented after consultation and guidance from CPUC EM&V staff.

9. **A concrete strategy to identify and disseminate best practices and lessons learned from the pilot to all California utilities and to transfer those practices to resource programs, as well as a schedule and plan to expand the pilot to utility and hopefully statewide usage.**

   PG&E intends to share the best practices and lessons learned from the pilot in a number of forums. First, PG&E will report the progression of its pilot in the annual Smart Grid Report and in the Smart Grid Metrics groups established by the Smart Grid Metrics decision. Second, PG&E is happy to informally report out best practices and lessons learned in the pilot as they become available. PG&E already shares best practices in marketing and customer engagement with the other California utilities through the Integrated Demand Side Management (IDSM) Task Force that meets quarterly. PG&E

45 See Decision 12-04-025 April 19, 2012, Decision Adopting Metrics to Measure the Smart Grid, Deployments of Pacific Gas and Electric Company, Southern California Edison Company and San Diego Gas & Electric Company.

proposes continuing to use this forum to share best practices and lessons learned related to the Smart Grid, due to the integrated nature of Smart Grid technology and relevancy to the customer outreach initiatives related AMI, EE and DR programs, products and services.