BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of the California Energy Commission for Approval of Electric Program Investment Charge Proposed 2015 through 2017 Triennial Investment Plan.	A.14-04-034 (Filed April 29, 2014)
And Related Matters.	A.14-05-003 A.14-05-004 A.14-05-005

2016 ANNUAL ELECTRIC PROGRAM INVESTMENT
CHARGE REPORT OF PACIFIC GAS AND ELECTRIC
COMPANY (U 39 E)

CHRISTOPHER J. WARNER

Pacific Gas and Electric Company
77 Beale Street, B30A
San Francisco, CA 94105
Telephone: (415) 973-6695
Facsimile: (415) 973-5520
E-Mail: CJW5@pge.com

Attorneys for
PACIFIC GAS AND ELECTRIC COMPANY

Dated: February 28, 2017

Application of the California Energy Commission for Approval of Electric Program Investment Charge Proposed 2015 through 2017 Triennial Investment Plan.	A.14-04-034 (Filed April 29, 2014)
And Related Matters.	A.14-05-003 A.14-05-004 A.14-05-005

2016 ANNUAL ELECTRIC PROGRAM INVESTMENT CHARGE REPORT OF PACIFIC GAS AND ELECTRIC COMPANY (U 39 E)

Pursuant to Decision (D.)12-05-037 – *Phase 2 Decision Establishing Purposes and Governance for Electric Program Investment Charge (EPIC) and Establishing Funding Collections for 2013-2020*, D.13-11-025 and D.15-04-020, Pacific Gas and Electric Company (PG&E) hereby submits the 2016 Annual Report for the Electric Program Investment Charge (EPIC) Program. This is PG&E's fifth annual report pertaining to its 2012-2014 EPIC Triennial Investment Plan, and second annual report pertaining to its 2015-2017 EPIC Triennial Investment Plan. In compliance with Ordering Paragraph 16 of D.12-05-037, a copy will also be served on all parties in the most recent EPIC proceedings; the most recent general rate cases of PG&E, Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E); and each successful and unsuccessful applicant for an EPIC funding award during the previous calendar year.

///

///

///

///

///

///

///

///

1

The Annual Report is attached as Attachment A[1].

        Respectfully Submitted,

        CHRISTOPHER J. WARNER

By: */s/ Christopher J. Warner*
             CHRISTOPHER J. WARNER

Pacific Gas and Electric Company
77 Beale Street, B30A
San Francisco, CA 94105
Telephone: (415) 973-6695
Facsimile: (415) 973-5520
E-Mail: CJW5@pge.com

Attorney for
PACIFIC GAS AND ELECTRIC COMPANY

Dated: February 28, 2017

1/   Attachments A and B to the report will be electronically filed using the Commission's e-file system. Attachment C has been uploaded onto an archival grade DVD and will be provided to the Commission's Docket Office for handling.

PACIFIC GAS AND ELECTRIC COMPANY

ATTACHMENT A

2016 EPIC ANNUAL REPORT

PACIFIC GAS AND ELECTRIC COMPANY

ELECTRIC PROGRAM INVESTMENT CHARGE (EPIC)
2016 ANNUAL REPORT

FEBRUARY 28, 2017

PG&E

Pursuant to Decision (D.) 12-05-037 – Phase 2 Decision Establishing Purposes and Governance for Electric Program Investment Charge (EPIC) and Establishing Funding Collections for 2013-2020, Pacific Gas and Electric (PG&E) hereby files the 2016 Annual Report for the Electric Program Investment Charge Program.

In compliance with Ordering Paragraph (OP) 16, a copy will also be served on all parties in the most recent EPIC proceedings; the most recent general rate cases of PG&E, Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E); and each successful and unsuccessful applicant for an EPIC funding award during the previous calendar year.

Service Lists - A.12-11-001, A.12-11-002, A.12-11-003, A.12-11-004, A.15-09-001, A.16-09-001, A.14-11-003, A.14-05-005, A.14-05-003, A.14-05-004, A.14-04-034

PACIFIC GAS AND ELECTRIC COMPANY
ELECTRIC PROGRAM INVESTMENT CHARGE (EPIC)
2016 ANNUAL REPORT
FEBRUARY 28, 2017

TABLE OF CONTENTS

i

TABLE OF CONTENTS
(CONTINUED)

PACIFIC GAS AND ELECTRIC COMPANY
ELECTRIC PROGRAM INVESTMENT CHARGE (EPIC)
2016 ANNUAL REPORT
FEBRUARY 28, 2017

TABLE OF CONTENTS
(CONTINUED)

List of Tables

1. Executive Summary

a. Overview of Programs/Plan Highlights

Pursuant to the California Public Utilities Commission (CPUC) Decision (D.) 12-05-037, Pacific Gas and Electric Company (PG&E) and the other Administrators of the Electric Program Investment Charge (EPIC) Program were directed to file annual reports each year beginning February 28, 2013 through February 28, 2020 with the Director of the CPUC's Energy Division.[1] Annual Reports shall be served on all parties in the most recent EPIC proceeding, all parties to the most recent general rate case of each electric utility, and to each successful and unsuccessful applicant for an EPIC funding award during the previous calendar year. In compliance with OP 16 of D.12-05-037, and consistent with the Annual Report outline developed collaboratively by the EPIC Administrators and the Office of Ratepayer Advocates,[2] PG&E files its fifth annual report, documenting program and project activities since project inception through December 31, 2016.

In D.12-05-037, the Commission authorized funding in the areas of applied Research and Development (R&D), Technology Demonstration and Deployment (TD&D), and Market Facilitation. The Investor-Owned Utility (IOU) Administrators' role was limited to TD&D only.

On November 19, 2013, the CPUC issued D.13-11-025, which authorized the first triennial investment period of 2012-2014 (referred to as EPIC 1). On April 15, 2015, the CPUC issued D.15-04-020, which approved the second triennial investment plan period of 2015-2017 (referred to as EPIC 2). This report summarizes PG&E's projects' progress and status for both approved funding cycles, which includes TD&D projects in progress in the following areas:

1. **Renewables and Distributed Energy Resource Integration** – Integrate distributed energy resources, generation and storage; improve transparency of resource information; increase generation flexibility.

2. **Grid Modernization and Optimization** – Optimize existing grid assets; prepare for emerging technologies; design and demonstrate grid operations of the future.

3. **Customer Service and Enablement** – Drive customer service excellence through new offerings for our customers and enable greater customer choice; integrate Demand-Side Management (DSM) for grid optimization.

4. **Cross Cutting/Foundational Strategies and Technologies** – Support next generation infrastructure, including smart grid architecture, cybersecurity, telecommunications and standards, as well as other "foundational" activities in support of all three program areas above.

PG&E continues to be strongly committed to the EPIC Program and the value it provides to its customers, as it offers the opportunity to cost-effectively develop and demonstrate innovative technologies which can advance our core values of Safety, Reliability, and Affordability.

---

[1] The four EPIC Program Administrators are PG&E, SCE, SDG&E and the California Energy Commission (CEC).

[2] This annual report outline is based on the adopted EPIC Administrator Annual Report Outline as described in Attachment 5 of D.13-11-025.

Through these projects, the EPIC Program also contributes learnings that support important California clean energy policy goals, such as Greenhouse Gas (GHG) reduction goals and renewable energy targets.

Additionally, the main goals of EPIC align closely with PG&E's Grid of Things™ strategy, which drives the advancement of innovative technologies that support our core values and an evolving grid. The Grid of Things™ vision calls for the integration of new energy devices and technologies with the grid and, by virtue of their grid connectivity, allows our customers to capture greater value from their energy technology investments, including rooftop solar, electric vehicles, energy storage, demand response technologies, and other such technologies. PG&E is the key builder and enabler of this interconnected and integrated platform that will continue to help define and shape California's future energy landscape.

PG&E's TD&D Program Highlights

PG&E is pleased to report the significant achievement of closing a total of fourteen EPIC 1 projects in 2016, which brings the total number of completed EPIC projects to 15. In 2017, PG&E will continue to execute two EPIC 1 projects and seventeen EPIC 2 projects. PG&E will also continue to explore the launch of currently inactive projects as part of EPIC 2. For detailed information on the developments and status of each project, see Appendix A.

In 2016, the below fourteen EPIC 1 projects have closed:

1. 1.01 Energy Storage for Market Operations
2. 1.05 New Forecast Methods for Improved Storm Damage Modeling
3. 1.09A Close Proximity Switching
4. 1.09B and 1.10B - Network Conditioned-Based Maintenance
5. 1.09C Discrete Series Reactors (DSR)
6. 1.14 Next Generation SmartMeter™ Telecom Network Functionalities
7. 1.15 Grid Operations Situational Intelligence
8. 1.16 Vehicle-to-Grid Operational Integration
9. 1.18 Appliance-Level Load Disaggregation
10. 1.19 Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform
11. 1.21 Automatic Identification of Distributed Photovoltaic (PV) Resources
12. 1.23 Photovoltaic (PV) Submetering
13. 1.24 Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction
14. 1.25 Direct Current (DC) Fast Charging Mapping

Upon completion of these projects, PG&E will leverage their learnings and may operationalize associated results, where applicable and cost-effective. The results of PG&E technology demonstrations are also highly applicable to other industry stakeholders. For example, utilities

may apply the learnings from the approaches used in project *1.21 Automatic Identification of PV Resources* to develop the algorithm that detects a suspected unauthorized Photovoltaic (PV) system, or can leverage the methodology used in project *1.14 Next Generation SmartMeter™ Telecom Network Functionalities* to determine available bandwidth of the Advanced Metering Infrastructure (AMI) network. Examples of industry stakeholders that may benefit from these outcomes include other utilities, vendors, and manufacturers. Each project's purpose, methods, findings, results, and industry-relevant learnings are further documented in the individual final reports (attached in Appendices B through O).[3]

EPIC 1

In the first triennial cycle, the EPIC 1 portfolio demonstrated PG&E's ability to adopt a new model for managing, aligning, tracking and executing research, development and demonstration (RD&D) activities. This portfolio covered a wide spectrum of technologies that helps make the electrical grid safer, more reliable and more affordable for customers. Some notable examples of EPIC 1 achievements include:

- *EPIC 1.01 Energy Storage for Market Operations:* PG&E deployed the first utility-owned battery storage resources that automate a response to participate in real-time and day-ahead California Independent System Operator (CAISO) market signals. Findings show that Frequency Regulation was the highest value product ($2,000-$7,000/megawatt); however, these utility-scale battery resources were proven to still not be cost effective in the current CAISO market. However, by actively participating in the CAISO market, this project identified and addressed several key barriers to achieving benefits of energy storage systems in the future.

- *EPIC 1.05 New Forecast Methods for Improved Storm Damage Modeling:* PG&E's EPIC project team demonstrated a new, mesoscale[4] meteorological model that provides more granular and accurate weather forecasting. This model serves as an input into PG&E's storm damage prediction model and to other forecasting applications, such as catastrophic wildfire risk, large storms and PV generation. More granular and accurate weather data and forecasting may shorten emergency response times, further optimize resource allocations, and further enhance the safety of our field workers and customers. The model also provide a better understanding of solar load on the grid in support of improved load management and planning, which can potentially increase affordability for our customers through reduced energy procurement and curtailment related costs.

---

[3] As specified in D.13-11-025 OP 14, Administrators must include with their EPIC annual report a final report on project completed during the previous year.

[4] The mesoscale model employs a more granular horizontal spatial resolution of 3 kilometer (km) as opposed to the PG&E's previous model resolution of 12 km.

- *EPIC 1.09A Close Proximity Switching:* This project informed the design of and demonstrated three robotic devices which allow PG&E workers to more safely operate certain subsurface or underground (UG) oil switches that have been known for high risk of failure. The devices do this by allowing the user to operate those switches from a safe distance (~25 feet), providing a larger clearance area that better protects both the workers and the public.

- *EPIC 1.09C Discrete Series Reactors*: PG&E informed the development and demonstration of a device which can detect potential overloads and line impedance increases in order to shift load to parallel facilities if needed. These devices were deployed directly onto transmission conductors in a field demonstration, proving the device capability which may ultimately support use cases where it may be possible to potentially delay costly new transmission line or reconductoring projects, improving affordability for our customers.

- *EPIC 1.14 Next Generation SmartMeter™ Telecom Network Functionalities:* Through this project, PG&E explored new use cases that leverage the Advanced Metering Infrastructure (AMI) network. These use cases included improving outage reporting functionalities of PG&E's SmartMeter™ devices, a methodology to determine available bandwidth, and therefore room, for additional network traffic, and leveraging the AMI network as a communications channel for a variety of smart grid devices, such as streetlights, SCADA control signals and cellular telecom equipment.

- *EPIC 1.15 Grid Operations Situational Intelligence (GOSI):* The volume of data available for utilities presents a great opportunity to better serve our customers. This project optimized real-time operations with situational intelligence pulling from diverse data sources to give grid operators a more complete operational perspective. This allows users to make improved operational decisions by allocating resources more efficiently, which may improve safety, reliability and affordability for our customers.

- *EPIC 1.21 Automatic Identification of Distributed* Photovoltaic *(PV) Resources*: Ensured customer safety and compliance with interconnection, operating and metering requirements (established by Electric Rule 21) through the identification of PV systems that do not have an approved interconnection application on file. Identified customers were then automatically notified if their solar system was out of compliance, with PG&E support ready to help with next steps.

- *EPIC 1.25 Direct Current (DC) Fast Charging Mapping:* PG&E identified optimal locations within PG&E's territory for the placement of Direct Current Fast Charging stations based on factors, such as cost, available service transformer capacity, traffic patterns, and site host and driver preferences. With the rise of electric vehicle adoption in California, this project helps to ensure that investments in higher power charging are both optimized for the customer needs, as well as have the potential for lower installation costs.

These projects' achievements enabled PG&E to file three provisional patents, one for the development of the Smart Pole Meter and Meter Socket (EPIC 1.14 Next Generation SmartMeter™ Telecom Network Functionalities), one for an algorithm to help identify downed wires (EPIC 1.14 Next Generation SmartMeter™ Telecom Network Functionalities), and one for an algorithm which can detect unauthorized PV interconnections (EPIC 1.21 Automatic Identification of Distributed PV Resources). These patents provide a potential future revenue generating opportunity that would be shared with PG&E's customers and shareholders,[5] and ultimately supports improved affordability if the patents lead to increased revenue. PG&E continues to consider opportunities to license these patents, as well as opportunities to identify additional Intellectual Property in these and other projects.

The results of a number of EPIC projects also found that more data, analysis, or technology advancement is necessary before the technology demonstrated is considered for adoption on a larger scale. Below are examples of two projects with this outcome, which ultimately supports affordability for our customers by not adopting the technology at scale before refinements are made to make the technology more viable:

- *EPIC 1.18 – Appliance-Level Load Disaggregation:* This project conducted a demonstration to evaluate and compare disaggregation vendors' ability to itemize monthly appliance-level usage for residential customers. In the end, vendor platforms were not able to accurately identify all of the appliance level categories or meet the customers' expectations for real-time visibility into their appliance use. Therefore, the project's findings demonstrated that the load disaggregation technology that is currently available in the market is in need of further improvement to the accuracy of the detection algorithms before it can be scaled for this purpose.

- *Project 1.23 - Photovoltaic (PV) Submetering:* This project focused on developing, testing, and validating a way of collecting or estimating solar generation output data to enable customers to view their estimated solar generation data through integration with PG&E's YourAccount website (previously known as MyEnergy). However, the algorithm developed was only able to generate accurate and reliable estimates for fully non-shaded systems where PG&E had complete data on the PV system characteristics (e.g., system tilt and azimuth) and where there were no difficulty to model weather circumstances present (e.g., fog or marine layer). As a result, the technology was proven not ready to more broadly scale until those data gaps are addressed.

EPIC 2

The projects from EPIC 2 have an even more increased focus on long-term objectives and in many cases are built on the foundation of previous technology investments. Examples of this include analytics projects that use data made available by the AMI network to provide further grid insights, and new use cases to continue to help enable the quickly emerging Distributed

---

[5] The revenue sharing mechanism is based on the guidance provided in CPUC D.13-110-25 OP 34, which states "(IOUs) must apply a 75 percent/25 percent (ratepayer/shareholder) revenue sharing mechanism for net revenues (from future or ongoing royalties, license fees, and other "financial benefits of Intellectual Property (IP)") related to financial benefits of IP that was developed under investor-owned utility contracts with Electric Program Investment Charge funds."

Energy Resource (DER) industry. Additionally in EPIC 2, PG&E further explored opportunities to leverage connections between projects with similar objectives that can benefit by leveraging each other's technologies. When feasible, this approach can lower project cost through sharing resources, while also exploring the integration challenges of how the technologies may interact, which will become increasingly important in the future high-DER connected grid.

For example, four projects have co-located at the Swift feeder in San Jose to generate additional learnings from the interaction of these new technologies. EPIC Project *2.02 Distributed Energy Resource Management System (DERMS)* will monitor, optimize and dispatch utility owned and behind the meter (BTM) DERs, including PV with Smart Inverters and Battery Storage devices which will be demonstrated through the following two projects: *EPIC 2.03A – Test PV Smart Inverter Enhanced Capabilities* and *EPIC 2.19C – Enable Distributed Demand-Side Strategies & Technologies*. Additionally, the DERMS platform leverages phase mapping carried out as a foundational step of *EPIC 2.14 – Automatically Map Phasing Information*. The grid of the future will not feature just one type of advanced technology, but a suite of technologies working in concert. These interrelated projects cost-effectively reinforce each other's quality of learnings by testing multiple complementary technologies together.

Below are a few examples of the achievements made by EPIC 2 projects in 2016:

- *EPIC 2.02 – Distributed Energy Resource Management System (DERMS):* Successfully developed a solution architecture, designed integrations with Third-Party DER aggregators for DERMS to communicate with, and completed the installation of initial DERMS software to prepare for field demonstrations of DERMS use cases in 2017. This project will enhance PG&E capabilities to operate a more dynamic grid with high rates of DER penetration, while also improving customer choice by cost-effectively enabling higher penetration of distributed PV generation and customer sited energy storage.

- *EPIC 2.22 – Demand Reduction for Targeted Analytics:* As the first targeted demand side reduction solution leveraging high resolution customer interval and asset SCADA data, this project includes the development of two unique algorithms: (1) estimations for required customer demand reduction individually and aggregated to asset-level; and (2) customer targeting to leverage multiple DERs and programs in concert to address forecasted capacity challenges at specific assets. To date the project has completed a first version of the operational optimization engine that uses a centralized platform that integrated various internal datasets.

- *Project 2.23 – Integrating Distributed Energy Resources (DER) into Utility Planning Tools*: This project has successfully made new enhancements to the utilities' distribution planning tools, LoadSEER and CYME, to more readily incorporate AMI data and enable better understanding of the impacts of DER deployments at the circuit level. The project combined available SCADA load information data with three years of historical interval meter data for all five million PG&E electric customers and created a catalog of over 320,000 load shapes, which creates a granular load shape specific to each feeder. This effort ultimately supports PG&E's ability more accurately identify areas where DER adoption may increase or decrease the need for a significant infrastructure investment.

As an innovative integrated and cost-effective way to explore technology demonstration projects, PG&E's EPIC Program continues to form the foundational learnings that lead to opportunities to improve the safety, reliability and affordability of the electric grid, while increasing customer choice at the grid edge. These achievements help prepare PG&E and the utility industry for upcoming challenges of a changing grid landscape.

b. Status of Programs

In D.13-11-025, the CPUC approved 27 of the 29 projects proposed by PG&E in the EPIC 1 Plan since two projects were formally withdrawn by PG&E prior to the issuance of this decision.[6] In D.15-04-020, the Commission approved 31 projects proposed by PG&E in the EPIC 2 Plan.[7]

PG&E implemented an internal governance structure intended to ensure that approved projects within the TD&D Program adhere to the EPIC guiding principles and requirements, as well as the potentially changing marketplaces and evolving technologies to continue to meet customer needs while maintaining safety, reliability, and affordability of the grid. As previously indicated in the 2015 PG&E EPIC Annual Report, PG&E may utilize remaining funds by either adding funding to active projects or further pursuing on hold projects.

Below is a table that summarizes the projects' funding status by area and triennial investment plan program cycle as of December 31, 2016.

---

[6] In the EPIC 1 Plan Application (A.12-11-003), PG&E originally proposed 26 projects. Project 1.09 was subsequently split into three projects and project 1.10 was split into two projects resulting in a total of 29 projects. The projects formally withdrawn by PG&E were projects 1.04 and 1.07.

[7] In the EPIC 2 Plan Application (A.14-05-003), PG&E originally proposed 30 projects. Per CPUC D.15-04-020 to include an assessment of the use and impact of EV energy flow capabilities, Project 2.3 was split into two projects, resulting in a total of 31 projects.

Table 1. Summary of Project Status and Funding by Program Cycle

EPIC Program Areas	EPIC 1	EPIC 2	Total
Renewables / DER Resource Integration	**Projects: 3** • 1.01 Energy Storage for Market Operations • 1.02 Energy Storage for Distribution Operations • 1.05 New Forecast Methods for Improved Storm Damage Modeling ***Committed Funding: $7.0M - $8.5M**	**Projects: 5** • 2.02 Pilot Distributed Energy Management Systems • 2.03A Test Smart Inverter Enhanced Capabilities – PV • 2.03B Test Smart Inverter Enhanced Capabilities – EV • 2.04 DG monitoring & Voltage Tracking • 2.05 Inertia Response Emulation **Committed Funding: $10.6M - $13.8M**	**Projects: 8** **Committed Funding: $17.6M - $22.3M**
Grid Modernization & Optimization	**Projects: 7** • 1.08 Distribution System Safety & Reliability through New Data Analytics Techniques • 1.09A Close Proximity Switching • 1.09B/1.10B - Network Conditioned-Based Maintenance • 1.09C Discrete Series Reactors • 1.14 Next Gen. SmartMeter™ Telecom Network Funct. • 1.15 Grid Operations Situational Intelligence • 1.16 Vehicle-to-Grid Operational Integration **Committed Funding: $16.9M - $20.7M**	**Projects: 4** • 2.07 Real Time Loading Data for Distribution Operations & Planning • 2.10 Emergency Preparedness Modeling • 2.14 Automatically Map Phasing Information • 2.15 Synchrophasor Applications for Generator Dynamic Model Validation **Committed Funding: $7.3M - $8.9M**	**Projects: 11** **Committed Funding: $24.2M - $29.6M**
Customer Service & Enablement	**Projects: 7** • 1.18 Appliance-Level Load Disaggregation • 1.19 Enhanced Data Techniques & Capabilities via the SmartMeter™ Platform • 1.21 Automatic Identification of Distributed PV Resources • 1.22 Electric Vehicle Submetering • 1.23 Photovoltaic (PV) Submetering • 1.24 Demand-Side Mgmt. (DSM) for T&D Cost Reduction • 1.25 Direct Current (DC) Fast Charging Mapping **Committed Funding: $11.0M - $13.5M**	**Projects: 4** • 2.19 Enable Distributed Demand-Side Strategies & Technologies • 2.21 Home Area Network (HAN) for Commercial Customers • 2.22 Demand Reduction through Targeted Data Analytics • 2.23 Integrate Demand Side Approaches into Utility Planning **Committed Funding: $6.9M - $8.5M**	**Projects: 11** **Committed Funding: $17.9M - $22.0M**
Cross-Cutting/ Foundational	**Projects: 0** **Committed Funding: $0M**	**Projects: 4** • 2.26 Customer & Distribution Automation Open Architecture Devices • 2.27 Next Generation Integrated Smart Grid Network Mgmt. • 2.28 Smart Grid Communications Path Monitoring • 2.29 Mobile Meter Applications **Committed Funding: $5.3M - $6.5M**	**Projects: 4** **Committed Funding: $5.3M - $6.5M**
Summary	**Total Funded Projects: 17** **Total Committed Funding: $34.9M - $42.7M** **Total Project Funding Encumbered: $22.6M** **Total Project Funding Spent to Date: $31.7M** **Total Administrative Costs Spent to Date: $2.4M**	**Total Funded Projects: 17** **Total Committed Funding: $30.1M - $37.7M** **Total Project Funding Encumbered: $13.6M** **Total Project Funding Spent to Date: $13.0M** **Total Administrative Costs Spent to Date: $0.7M**	**Total Funded Projects: 34** **Total Committed Funding: $65.0M - $80.4M** **Total Project Funding Encumbered: $36.2M** **Total Project Funding Spent to Date: $44.7M** **Total Administrative Costs Spent to Date: $3.1M**

* Committed projects are prioritized through an internal governance process in order to manage committed funding. Remaining funds may, as needed, be redirected to other approved projects in order to efficiently utilize customer funds.

2. Introduction and Overview

a. Background on EPIC

Funding for EPIC is authorized in Public Utilities Code (Pub. Util. Code) Section 399.8, which governed the Public Goods Charge (PGC) until expiration on January 1, 2012. The Commission opened an Order Instituting Rulemaking (R.11-10-003) to establish the Electric Program Investment Charge to preserve funding for the public ratepayer benefits associated with the renewables and RD&D activities provided by the electric PGC. The rulemaking included two phases with Phase I to establish the EPIC Program on an interim basis in 2012, and Phase II to establish purposes and governance for EPIC to continue from 2013-2020.[8] The EPIC Program Administrators include the CEC, and three IOUs: PG&E, SCE, and SDG&E.

In its Phase I *Decision Establishing Interim Research, Development and Demonstrations and Renewables Program Funding Levels* (D.11-12-035), the CPUC established 2012 funding at approximately $142 million and authorized PG&E, SCE and SDG&E to institute the EPIC Program, effective January 1, 2012, to collect funds for renewables programs, and RD&D programs at the same level authorized in 2011. Additionally, the surcharge was imposed on all distribution customers, based on the existing rate allocation between customer classifications, and collected in the Public Purpose Program component of rates.

On May 24, 2012, the Commission issued its Phase II *Decision Establishing Purposes and Governance for Electric Program Investment Charge and Establishing Funding Collections for 2013-2020.* The decision established an annual funding amount of $162 million annually for the 2012-2014 EPIC Program cycle (EPIC 1) and set the funding allocations among the three IOUs as 50.1 percent, 41.1 percent and 8.8 percent for PG&E, SCE and SDG&E, respectively.[9] On April 15, 2015, the CPUC issued D.15-04-020, which approved the second triennial investment plan period of 2015-2017 (EPIC 2).

The EPIC Program is designed to assist the development of pre-commercialized, new and emerging clean energy technologies in California, while providing assistance to commercially viable projects. The goal of the EPIC Programs is to support projects that help advance new technologies that further safety, reliability and affordability while advancing California's clean energy goals, including Senate Bill 17 Smart Grid Goals and Pub. Util. Code Section 740.1 goals focused on renewables integration and resource conservation, as well as GHG emissions reductions, economic development and low-emission vehicle and transportation support. EPIC supported activities are mapped to the different elements in the electricity-system value chain consisting of: Grid Operations/Market Design, Generation, Transmission, Distribution and Demand-Side Management (DSM).

b. EPIC Program Components

Authorized by D.12-05-037, the EPIC Program is to fund investments in the following three areas: (1) Applied Research and Development; (2) TD&D; and (3) Market Facilitation, consisting of market research, regulatory permitting and streamlining, and workforce development activities. PG&E and the other IOU Administrators were designated to administer

---

[8] See Phase I D.11-12-035 and Phase II D.12-05-037.

[9] OP 7 of D.12-05-037 requires the total collection amount to be adjusted on January 1, 2015 and January 1, 2018 commensurate with the average change in the Consumer Price Index for Urban Wage Earners and Clerical Workers for the third quarter, for the previous three years.

EPIC funds only in the area of TD&D. The CEC was designated to administer funds in all of the remaining areas, including a portion of TD&D.

c. EPIC Program Regulatory Process

The Phase II decision provides the regulatory process and governance for the EPIC Program. The decision requires EPIC Program Administrators to submit Triennial Investment Plans to cover three-year cycles for 2012-2014, 2015-2017, and 2018-2020. The investment plans must include details about planned investments, as well as criteria for selecting and evaluating proposals. Each plan must be evaluated and approved by the Commission prior to program implementation. To date, Administrators have filed two Triennial Investment Plans for 2012-2014 and 2015-2017. In addition, Administrators are required to file annual reports on February 28, 2013 through February 28, 2020, as well as final reports for each project.

d. Coordination

In order to ensure adequate coordination of the EPIC Program, the EPIC Administrators continue to participate in regular review meetings, conduct joint webinars and workshops, and regularly collaborate on EPIC-related matters. The EPIC Administrators generally meet bi-weekly to discuss EPIC and their respective objectives for the program, as well as to ensure collaboration and avoid duplication.

The IOU Administrators also continue to work together to leverage consistent approaches, where feasible, for meeting the objectives of the EPIC Program. This collaboration resulted in the development of a common EPIC framework, approved by the Commission in D.13-11-025, to guide the individual IOU investment plans.

e. Transparent and Public Process

The Program's Administrators hold stakeholder workshops during the planning and implementation of the EPIC Triennial Investment Plans to ensure stakeholder concerns and feedback are received and properly addressed. These stakeholder workshops to prepare for the Third Triennial Investment Plan are being planned for execution at the beginning of 2017 in advance of the EPIC 3 Application on May 1, 2017.

Additionally, Administrators continue to engage with industry stakeholders by participating in and presenting at conferences, as well as hosting two workshops/symposiums annually. In 2016, EPIC Administrators jointly organized a workshop in Westminster, CA on June 22, 2016 and a Symposium on December 1, 2016 in Sacramento, CA, which consisted of three tracks: (1) Energy Efficiency; (2) Electricity Generation; (3) and Power System Modernization. These workshops have provided a successful mechanism to engage with industry stakeholders and bring transparency to the projects and program.

Notice for these events is provided to a broad range of stakeholders including technology vendors, researchers, academics and energy consultants. The utilities and the CEC will continue to maintain transparency in the process via webinars, workshops and discussions with the CPUC.

Furthermore, PG&E's EPIC Program continues to remain accessible to the interested public. PG&E's EPIC website (www.pge.com/epic) includes EPIC Program information and updates, as well as EPIC annual reports and projects' final reports.

3. Budget

a. Authorized Budget

The following table outlines the total Program, Administrative and CPUC regulatory oversight budget for each triennial cycle.

Table 2. Total Authorized Budget by Program Cycle

Total Authorized Budgets	PG&E Program Budget *(TD&D only)*	PG&E Admin. Budget *(TD&D only)*	CEC Program Budget* *(TD&D, Applied R&D, & Market Facilitation)*	CEC Admin Budget* *(TD&D, Applied R&D, & Market Facilitation)*	CPUC Regulatory Oversight Budget
EPIC 1: 2012-2014	$43.3 Million	$4.9 Million	$166.2 Million	$18.5 million	$1.2 million
EPIC 2: 2015-2017	$45.7 Million	$5.1 Million	$182.9 Million	$20.4 million	$1.3 million

portion remitted by PG&E

b. Commitments[10]/Encumbrances[11]

The following table outlines the PG&E total financial commitments and encumbrances, as well the remittances made to both the CEC and CPUC beginning from program inception through December 31, 2016.

Table 3. Total Commitments/Encumbrances by Program Cycle

Commitments/ Encumbrances	PG&E Total Commitments	PG&E Total Encumbrances	CEC Program Remittance	CEC Admin Remittance	CPUC Remittance
EPIC 1: 2012-2014	$34.9 - $42.7 Million	$22.6 million	$166.2 million	$18.5 million	$1.2 million
EPIC 2: 2015-2017	$30.1 -$37.6 million	$13.7 million	$34.9 million	$14.3 million	$0.9 million

---

10 Per CPUC D. 13-11-025, "committed funds" are monies budgeted for a particular project. The committed fund range is defined as project approved through PG&E's internal governance process.

11 Per CPUC D. 13-11-025, "encumbered funds" refer to monies specified within contracts signed during a previous triennial investment plan cycle and associated with specific activities under that contract.

c. Dollars Spent on In-House Activities

The following table outlines the PG&E total in-house project expenditures and administrative costs, beginning from program inception through December 31, 2016.

Table 4. Total Dollars Spent on In-House Activities by Program Cycle

Program Cycle	PG&E In-House TD&D Project Expenditures	PG&E In-House Program Administrative Costs
EPIC 1: 2012-2014	$11.4 million	$1.3 Million
EPIC 2: 2015-2017	$5.4 Million	$0.6 Million

d. Fund Shifting Above 5 Percent between Program Areas

All PG&E projects are within TD&D; therefore, there has been no fund shifting between program areas.

e. Uncommitted/Unencumbered Funds[12]

Projects without committed funding are pending further project and benefits analysis. The range of uncommitted funds is dependent on the range of authorized budget and committed funds as identified in Sections 3a and 3b, respectively. The following table outlines the PG&E uncommitted/unencumbered funding for each program cycle as of December 31, 2016.

Table 5. Total Uncommitted/Unencumbered Funds by Program Cycle

Program Cycle	Uncommitted/Unencumbered Project Funds
EPIC 1: 2012-2014	$0.6 million – $8.4 million
EPIC 2: 2015-2017	$8.1 million – $15.6 million

4 Projects

a. Summary of Project Funding

For a summary of project funding please refer to Table 1 in Section 1b.

b. Project Status Report (*See* Appendix A)

See Project Status Report, Appendix A, with project details as of December 31, 2016. The Project Status Report is based on the format provided in Attachment 6 of D.13-11-025.

---

12 "Uncommitted" and "Unencumbered" funds refer to monies that are not identified in solicitation plans or obligated to a particular project—these funds are considered unspent.

c. Description of Projects

The project descriptions and updates included below are for both EPIC 1 and EPIC 2 projects as of December 31, 2016. Projects that are on-hold have been included in the summary.

Project #1.01 Energy Storage for Market Operations

i. Investment Plan Period
    - 1st Triennial (2012-2014)
ii. Assignment to Value Chain
    - Grid Operation/Market Design
iii. Objective
    - Develop technologies and strategies for efficient and optimized bidding and scheduling of Energy Storage Technologies (EST) in California Independent System Operator (CAISO) markets and demonstrate those strategies using Pacific Gas and Electric Company's existing Sodium Sulfur Battery Energy Storage Systems (NaS BESS).
    - This project addresses the following CPUC proceedings:
        - This project will count towards the Investor-Owned Utility energy procurement targets as set forth in D.10-03-040, the Energy Storage Procurement Framework.
        - As applicable, operational experiences gained from this project can inform outstanding policy and implementation issues as identified in Energy Storage Order Instituting Rulemaking 15-03-011.
iv. Scope
    - Develop and deploy technology to enable fully automated resource response to CAISO market awards.
    - Quantify the values that battery resources can capture in CAISO markets.
    - Establish financial performance of battery resource participation in CAISO markets.
v. Deliverables
    - Demonstrate automated and remote control application for generic energy storage resources to interface with existing Supervisory Control and Data Acquisition systems.
    - Report financial performance from participation in CAISO markets.
    - Report comparison of actual performance vs. hypothetical performance quoted in industry reports.
    - Comply with regulatory requirements and establish a framework/recommendations for accounting standards applicable to energy storage.

vi.   Metrics
- 1i - Nameplate capacity (megawatts) of grid-connected energy storage.
- 3a - Maintain/Reduce operations and maintenance costs.
- 6a - CAISO NGR financial settlements.
- 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code (Pub. Util. Code) § 8360).
- 7c - Dynamic optimization of grid operations and resources, including appropriate consideration for asset management and utilization of related grid operations and resources, with cost-effective full cyber security (Pub. Util. Code § 8360).
- 7l - Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services (Pub. Util. Code § 8360).
- 9c - EPIC project results referenced in regulatory proceedings and policy reports (Business Plan references: CPUC R.10-12-007).

vii.   Schedule
- 3 years

viii.   EPIC Funds Encumbered
- $616,857

ix.   EPIC Funds Spent
- $1,833,110

x.   Partners (if applicable)
- N/A

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- Pay for performance

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project completed in 2016.
- Engaged with CAISO to identify and resolve implementation issues with the CAISO Non-Generator Resource (NGR) model for Limited Energy Storage Resources based on operational experience, quantified financial revenues of the CAISO Day Ahead (DA) and Real-Time (RT) energy markets, and achieved NGR model design improvements through the Energy Storage and Distributed Energy Resources (DER) initiative, such as including state of charge in the day-ahead market bid parameters
- Project close report finalized and attached to Annual Report.

Project #1.02 Energy Storage for Distribution Operations

i. Investment Plan Period
    - 1st Triennial (2012-2014)
ii. Assignment to Value Chain
    - Distribution; Grid Operation/Market Design
iii. Objective
    - Demonstrate the ability of a utility operated energy storage asset to address capacity overloads on the distribution system and improve reliability.
    - This project addresses the following California Public Utilities Commission (CPUC) proceedings:
        - This project will count towards the Investor-Owned Utility energy procurement targets as set forth in D.10-03-040, the Energy Storage Procurement Framework.
        - As applicable, operational experiences gained from this project can inform outstanding policy and implementation issues as identified in Energy Storage OIR R.15-03-011.
iv. Scope
    - Deploy utility operated energy storage asset at a single site.
    - Demonstrate peak shaving use case along with other site-specific use cases as suggested by distribution operators.
v. Deliverables
    - Identify energy storage site based on project objectives.
    - Identify an economic modeling tool to compare the planned traditional utility with alternatives using distributed resources or demand-side investments.
    - Construct and integrate energy storage system.
    - Test system and analyze results to prove project objectives.
vi. Metrics
    - 1c - Avoided procurement and generation costs.
    - 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code (Pub. Util. Code) § 8360).
    - 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources (Pub. Util. Code § 8360).
    - 9c - EPIC project results referenced in regulatory proceedings and policy reports (Business Plan references: Deferring a capacity upgrade has been identified as a key potential value of Energy Storage Technologies (EST) and noted in filings with the CPUC/Assembly Bill 2514.
vii. Schedule
    - 2.75 years
viii. EPIC Funds Encumbered
    - $2,548,062
ix. EPIC Funds Spent
    - $2,228,757
x. Partners (if applicable)
    - N/A

xi.   Match Funding (if applicable)
- No

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project is in the Build/Test phase.
- Completed project design and procured all equipment.
- Completed all civil and electrical construction on site.
- Proved Distributed Network Protocol 3 (DNP3) communications and bank load management Supervisory Control and Data Acquisition (SCADA) control scheme for energy storage controller in lab setting.
- Next steps are to energize facility, complete performance testing, test and confirm via data analysis bank load management SCADA control scheme in real world operations, collect data and issue final report.

Project #1.03 Mobile and Stationary Energy Storage Synergies

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Grid Operation/Market Design

iii.   Objective
- The project aims to reduce existing barriers to deployment of battery energy storage systems by demonstrating whether post-electric vehicle (EV) "second life" batteries can cost-effectively perform electric distribution services. The project will demonstrate the potential for reduced energy storage system costs via a) the development of an integration platform for deploying such batteries (Phase 1) and b) the use of lower cost "second life" batteries in the integrated platform (Phase 2).

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #1.04 Expand Test Lab And Pilot Facilities for New Energy Storage Systems. Formally Withdrawn. CPUC A.12-11-003, 10/15/2013.

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- N/A

iii.   Objective
- N/A

iv.   Scope
- N/A

v.   Deliverables
- N/A

vi.   Metrics
- N/A

vii.   Schedule
- N/A

viii.   EPIC Funds Encumbered
- N/A

ix.   EPIC Funds Spent
- N/A

x.   Partners (if applicable)
- N/A

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- N/A

xiv.   Treatment of Intellectual Property (if applicable)
- N/A

xv.   2016 Status Update
- Formally Withdrawn.

Project #1.05 New Forecast Methods for Improved Storm Damage Modeling

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Distribution

iii.   Objective
- Demonstration of emerging capabilities in mesoscale modeling to provide more granular and accurate weather forecasting input to Pacific Gas and Electric Company's (PG&E) storm damage prediction model, and to other PG&E forecasting applications, like catastrophic wildfire risk and Photovoltaic (PV) generation.
The main goal is more effective and granular damage prediction, and therefore more efficient response to storm events.

iv.   Scope
- Project focus is on development, deployment, and implementation of an operational version of the Weather Research and Forecasting (WRF) mesoscale model to support PG&E's forecasting program related to fire, storms and solar production.
- Not in scope for this project are enhancements to PG&E's Restoration Work Plan other than improved forecast damage numbers.

v.   Deliverables
- Fully functional mesoscale modeling system known as POMMS (PG&E Operational Mesoscale Modeling System) that will provide the following:
  - Detailed weather input into PG&E's damage prediction modeling system (SOPP).
  - Next generation wildfire threat awareness system.
  - Historical and forecast solar irradiance data to internal PG&E stakeholders.

vi.   Metrics
- 3a - Maintain/Reduce operations and maintenance costs.
- 4a - GHG emissions reductions (MMTCO2e).
- 5c - Forecast accuracy improvement.
- 5e - Utility worker safety improvement and hazard exposure reduction.

vii.   Schedule
- 3.25 years

viii. EPIC Funds Encumbered
- $535,055

ix.   EPIC Funds Spent
- $821,150

x.   Partners (if applicable)
- N/A

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii. Funding Mechanism (if applicable)
- Pay for performance

xiv.   Treatment of Intellectual Property (if applicable)

- Intellectual Property potential being explored

xv.   2016 Status Update

- Project completed in 2016.
- The project provided improved storm damage modeling guidance for numerous storm events during the year.
- The fire danger model development was completed and placed into operations during the 2016 fire season given its improved guidance over the existing fire danger rating system, and was shared with broader fire science community.
- The solar irradiance database and web portal was developed and demonstrated, including the function to compute PV power output (KW). This data can improve the ability to assess current and future grid impacts from PV generation to inform operational decisions with regards to planning and energy procurement.
- Project close report finalized and attached to Annual Report.

Project #1.06 Demonstrate Communication Systems Allowing the CAISO to Utilize Available Renewable Generation Flexibility

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Grid Operation/Market Design

iii.   Objective
- This project would demonstrate the use of accepted communications protocols to allow the California Independent System Operator (CAISO) to send an operating signal to reduce output under specified conditions, as allowed by contracts.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- N/A

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- N/A

x.   Partners (if applicable)
- N/A

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- N/A

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project is currently on-hold.

Project #1.07 Demonstrate Systems to Ramp Existing Gas-Fired Generation More Quickly to Adapt to Changes in Variable Energy Resources Output

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- N/A

iii.   Objective
- N/A

iv.   Scope
- N/A

v.   Deliverables
- N/A

vi.   Metrics
- N/A

vii.   Schedule
- N/A

viii.   EPIC Funds Encumbered
- N/A

ix.   EPIC Funds Spent
- N/A

x.   Partners (if applicable)
- N/A

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- N/A

xiv.   Treatment of Intellectual Property (if applicable)
- N/A

xv.   2016 Status Update
- Formally Withdrawn CPUC A.12-11-003.

Project #1.08 Distribution System Safety and Reliability Through New Data Analytics Techniques

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Transmission; Distribution

iii.   Objective
- Develop and demonstrate a new data analytics technique to improve distribution system safety and reliability. The project specifically developed and tested a System Tool for Asset Risk (STAR), which is an enterprise software application that Electric Operations will use to calculate and display (graphically and geospatially) risk scores for electric transmission, substation and distribution assets. The STAR will enable an automated, system-wide application to improve risk identification, prioritization, and investment decisions to support electric system safety.

iv.   Scope
- Demonstrate whether the ever-increasing amounts of data can be mined and combined for targeted, cost-effective use for improved asset management.
- Potential scenarios include risk-based asset management, safety hazard mitigation and proactive outage prediction using self-serve and virtual integration environments.

v.   Deliverables
- Overview of existing applications and data sources.
- Assessment of existing data source quality.
- High-level future business processes by functional area.
- Inventory of asset risk algorithms (formulas or complexity) for "In Scope" asset classes.
- High-level Change Management Approach.
- Prioritized and phased implementation plan.
- Cost estimate for full implementation of the STAR project.
- Proof of concept prototype.

vi.   Metrics
- 7c - Dynamic optimization of grid operations and resources; including appropriate consideration for asset management and utilization of related grid operations and resource, with cost-effective full cyber security (Public Utilities Code §8360).
- 3a - Maintain/Reduce operations and maintenance costs: With the improved understanding of risk, there could be a better tool for evaluating projects such as asset replacement.

vii.   Schedule
- 2.25 years

viii.   EPIC Funds Encumbered
- $1,249,505

ix.   EPIC Funds Spent
- $2,112,640

x.   Partners (if applicable)
- N/A

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- Pay for performance

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project completed in 2015.
- Final report included in previous 2015 EPIC Annual Report.

Project #1.09A Close Proximity Switching

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Transmission; Distribution

iii.   Objective
- This project explores and seeks to discover effective, new tools to safely operate "Solid Blade in Oil Rotatory Switches."

iv.   Scope
- Test new tools and techniques for safe operation of Solid Blade in Oil Rotatory Switches.
- Evaluate alternatives to decrease probability of injury to workers and public.
- Help design a robotic tool to allow remote operation.
- Develop the necessary parts/adaptors to be used on various types (manufacturer, brand, age, etc.) of Solid Blade in Oil Rotatory Switches.

v.   Deliverables
- A working prototype for the various Solid Blade in Oil Rotatory Switch tools.

vi.   Metrics
- 5a - Outage number, frequency and duration reductions.
- 5e - Utility worker safety improvement and hazard exposure reduction.

vii.   Schedule
- 2.5 years

viii.   EPIC Funds Encumbered
- $301,808

ix.   EPIC Funds Spent
- $515,268

x.   Partners (if applicable)
- N/A

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project completed in 2016.
- Project completed close out phase, including the comparison of three vendors and the EPIC close report.
- Project close report finalized and attached to Annual Report.

Project #1.09B and 1.10B - Network Conditioned-Based Maintenance

i. Investment Plan Period
    - 1st Triennial (2012-2014)
ii. Assignment to Value Chain
    - Transmission; Distribution
iii. Objective
    - The project focus is on development, testing, deployment, and implementation of new technologies, construction methods and techniques, and cost reduction techniques in support of the Supervisory Control and Data Acquisition (SCADA) monitoring systems used on the Distribution Networks. The monitoring system consists of a complex and extensive set of components used to assess the health and condition of the network transformers on a continuous basis. This research is looking at potential failure points on the monitoring system components and what technologies and improvements can be applied to increase life expectancy of these components and reduce production and maintenance costs for this system and similar systems.
iv. Scope
    - Assess new technologies and feasibility of application on the Distribution Networks.
    - Primary focus on technologies, components and work methods to extend the life expectancy of monitoring systems equipment and reduce long term maintenance costs.
v. Deliverables
    - Modified or improved components identified for use on Distribution Network Monitoring System.
    - Improved installation and construction work methods.
    - Economic model for maintenance variables based on life expectancy testing of components.
    - Changes to components.
vi. Metrics
    - 3a - Maintain/Reduce operations and maintenance costs.
    - 3b - Maintain/Reduce capital costs.
    - 5d - Public safety improvement and hazard exposure reduction.
    - 5e - Utility worker safety improvement and hazard exposure reduction.
vii. Schedule
    - 3.25 years
viii. EPIC Funds Encumbered
    - $484,250
ix. EPIC Funds Spent
    - $547,753
x. Partners (if applicable)
    - N/A
xi. Match Funding (if applicable)
    - N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- Pay for performance

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project completed in 2016.
- Project completed accelerated lifecycle testing to establish a baseline for the robustness of SCADA condition monitoring equipment exposed to underground vault environmental conditions over an elongated period of time, and evaluated potential failure points within the components.
- Project demonstrated life extension approaches by identifying and demonstrating improvements to increase life expectancy of components and reduce life-cycle costs.
- Project evaluated data integrity by identifying opportunities to enhance the efficacy of maintenance and replacement programs by determining methods to enhance the data integrity of the condition monitoring information being collected by the SCADA system.
- Project close report finalized and attached to Annual Report.

Project #1.09C Discrete Series Reactors

i. Investment Plan Period
    - 1st Triennial (2012-2014)
ii. Assignment to Value Chain
    - Transmission
iii. Objective
    - Gain operating experience with Discrete Series Reactors (DSR) to determine whether such devices would be cost effective and operate reliably and safely on Pacific Gas and Electric Company's (PG&E) transmission system.
iv. Scope
    - Install and test 90 DSR units on the Las Positas-Newark 230 kV line.
    - Install and test Server at PG&E's San Francisco General Office (SFGO) headquarters, complete with Smart Wire System Manager Software.
    - Communication links between the DSRs and server to support the DSR monitoring and control.
v. Deliverables
    - Installation, testing and analysis of DSR and server communication links.
    - Job Estimate to engineer, procure, construct and test the DSRs.
    - White paper describing project including go/no go recommendation.
    - Final report describing overall project, including finding from the operations and testing of DSR units and a recommendation as to whether or not to install the DSRs elsewhere in the PG&E system.
vi. Metrics
    - 3a - Maintain/Reduce operations and maintenance costs.
    - 3b - Maintain/Reduce capital costs.
    - 5a - Outage number, frequency and duration reductions.
    - 5b - Electric system power flow congestion reduction.
vii. Schedule
    - 3.25 years
viii. EPIC Funds Encumbered
    - $1,449,835
ix. EPIC Funds Spent
    - $2,440,930
x. Partners (if applicable)
    - N/A
xi. Match Funding (if applicable)
    - N/A
xii. Match Funding Split (if applicable)
    - N/A
xiii. Funding Mechanism (if applicable)
    - Pay for Performance
xiv. Treatment of Intellectual Property (if applicable)
    - N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update

- Project completed in 2016.
- Performed Power Line Carrier Testing to confirm that line protection is acceptable with the DSR units in the inject mode.
- Performed operational testing to demonstrate the performance of the DSRs, including firmware and software improvements to achieve high availability.
- Project close report finalized and attached to Annual Report.

Project #1.10A Dissolved Gas Analysis

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Transmission; Distribution

iii.   Objective
- Develop tools and algorithms that analyze data from monitoring equipment installed on substation equipment (distribution and transmission) that tests for dissolved gasses or other precursor data that would assist in understanding the condition of the equipment.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #1.10C Underground Cable Analysis

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Distribution

iii.   Objective
- Develop tools and algorithms that analyze load and operating characteristic data from underground cables in order to develop an understanding of potential failure points, cable maintenance needs, and cable life expectancy.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #1.11 Demonstrate Self-Correcting Tools to Improve System Records and Operations

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Transmission; Distribution

iii.   Objective
- Demonstrate tools that identify and "register" existing assets to improve the integration between utility planning and operations. As part of the demonstration, implement "self-correcting" technologies that identifies plan vs. actual discrepancies and updates system records automatically. High priority use cases include: (1) Mapping of transformers to primary phase; (2) Mapping of customers to transformers; and (3) Precision mapping of Pacific Gas and Electric Company's overhead and underground network.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #1.12 Demonstrate New Technologies That Improve Wildlife Safety and Protect Assets From Weather-Related Degradation

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Transmission; Distribution

iii.   Objective
- Demonstrate new strategies and technologies to improve animal and bird protection, reduce outages caused by animals and birds, and protect assets from expensive weather-related degradation such as fog-related corrosion.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #1.13 Demonstrate New Communication Systems to Improve Substation Automation and Interoperability

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Transmission; Distribution

iii.   Objective
- Demonstrate new strategies and technologies to convert and integrate multiple existing proprietary technologies within the substation environment for more effective operations. Substation are key operational hubs and represent significant investments, which must be further leveraged by engaging with vendors to create the next generation of interoperable substation services and products.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii. EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #1.14 Next Generation SmartMeter™ Telecom Network Functionalities

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Distribution; Grid Operation/Market Design; Demand-Side Management

iii.   Objective
- This project explores and discovers effective new network applications and devices to leverage and improve the SmartMeter™ communications network.

iv.   Scope
- Leverage the existing SmartMeter™ network to support additional applications. Inform future uses of the SmartMeter™ network as to message capability, security, latency, and engineering constraints. Specifically focus on:
  – Test new devices to support network functions and capabilities not previously envisioned (e.g., new data streams, faster data collection).
  – Evaluate alternatives to decrease future upgrade, maintenance and/or operational costs.
  – Demonstrate different network applications, each focused on separate use cases.

v.   Deliverables
- Evaluate new applications and devices, their associated data traffic impact on the SmartMeter™ network, and recommend which items warrant consideration for full-scale deployment.
- Develop business case based on findings for full deployment consideration.

vi.   Metrics
- 7f - Deployment of cost-effective smart technologies, including real time, automated, interactive technologies that optimize the physical operation of appliance and consumer devices for metering, communications concerning grid operations and status, and distribution automation (Public Utilities Code (Pub. Util. Code) §8360).
- 7k - Develop standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid (Pub. Util. Code §8360).
- Note: Each technology demonstrated may have additional specific benefits to name. For instance, the following could apply: improved communication for power restoration, improved control of streetlights, etc.

vii.   Schedule
- 3 years

viii.   EPIC Funds Encumbered
- $3,986,281

ix.   EPIC Funds Spent
- $4,114,721

x.   Partners (if applicable)
- N/A

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)
- Provisional patent filed for Smart Pole Meter and Meter Socket, and for development of Wire Down Algorithm.

xv.   2016 Status Update
- Project completed in 2016.
- Completed remaining 4 of 17 use cases, which included demonstrating the use of the SmartMeter™ Network as a communications channel for various smart grid devices and processes, including Distribution Automation, low-profile meters for wireless cellular clients, and devices to monitor transformers in small spaces.
- Low Profile Meter (LPM) developed and installed in Smart Poles and deployed 50 LPMs in San Jose. Low profile meter specification and marketing documentation prepared and patent submitted.
- Developed methodology for quantifying available bandwidth on the SmartMeter™ Radio Mesh Network, and determined that, on average, there was significant available bandwidth.
- Enhanced existing outage notification capabilities of SmartMeter™ devices and developed an Outage "Restoration Dashboard" visualization tool.
- Developed algorithm for detecting wires down using SmartMeter™ messages and analytics and patent submitted.
- Project close report finalized and attached to Annual Report.

Project #1.15 Grid Operations Situational Intelligence

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Distribution; Grid Operation/Market Design; Demand-Side Management

iii.   Objective
- The objective of this pilot is to develop and pilot a real-time data visualization software platform for use by Electric Distribution Operations end users. Data will be integrated from various data sources and displayed on Distribution Control Center video walls and individual desktop computers, with potential for future scalability to handheld devices.

iv.   Scope
- Scope includes the integration of data (network model, loading, SmartMeter™ devices, outages, fire, weather, etc.) and a real-time data visualization platform for Distribution Operations.
- The Distribution Management System (DMS) platform and predictive analytics are not included in the scope.

v.   Deliverables
- Demonstrate Real-time Data Visualization Platform, including data integration from a variety of data sources and a visual interface that includes geospatial, list, and trending layers.

vi.   Metrics
- 5a - Outage number, frequency and duration reductions.
- 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360).
- 3a - Maintain/Reduce operations and maintenance costs.

vii.   Schedule
- 3.25 years

viii. EPIC Funds Encumbered
- $1,334,030

ix.   EPIC Funds Spent
- $4,132,741

x.   Partners (if applicable)
- N/A

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii. Funding Mechanism (if applicable)
- Pay For Performance

xiv. Treatment of Intellectual Property (if applicable)
- New Intellectual Property (IP) has been created through co-development with the vendor. PG&E retains ownership rights to the IP and will provide free unlimited use rights to California Investor-Owned Utilities per the California Public Utilities Commission decision

xv. 2016 Status Update
- Project completed in 2016.
- Demonstrated a technology platform to visualize grid operations data to improve both real-time and short-term operational decisions, such as outage anticipation, construction planning, circuit loading research, and emergency operations.
- The project developed key data, system, and user experience learnings through integrating more than 20 data sources into a single visualization tool allowing users to view complex data sources in ways that were not possible through current solutions.
- Used agile methodology to incorporate user feedback from operators to support function development.
- Project close report finalized and attached to Annual Report.

Project #1.16 Vehicle-to-Grid Operational Integration

i. Investment Plan Period
    - 1st Triennial (2012-2014)
ii. Assignment to Value Chain
    - Distribution
iii. Objective
    - Leverage plug-in hybrid vehicle technology emerging in Pacific Gas and Electric Company (PG&E) fleet to generate utility-grade power, supporting distribution circuits during planned or unplanned outage events.
iv. Scope
    - Develop nominally 120 kilowatt exportable power capabilities from a plug-in hybrid electric truck. Seek to create the protocols necessary to safely connect the truck to the appropriate grid connection points. The portfolio of fleet vehicles (higher and lower weight classes) may broaden the range of available power ratings demonstrated by the project.
v. Deliverables
    - Develop operating requirements for the vehicle.
    - Understand engineering challenges with high power export with collaborative supplier development to solve.
    - Develop safety and interconnection protocols to connect the vehicle to the grid leveraging existing protocols for temporary local generator set connection.
    - Define and document power requirements for different outage/usage scenarios.
    - Develop operating protocols (when and how the vehicles will be used).
    - Develop unplanned outage protocols.
    - Develop the hardware and software (if required) to connect the vehicle to PG&E's system.
    - Build vehicles for field testing.
vi. Metrics
    - 5a - Outage number, frequency and duration reductions.
    - 5e - Utility worker safety improvement and hazard exposure reduction.
    - 3a - Maintain/Reduce operations and maintenance costs.
    - 4a – Greenhouse Gas emissions reductions (MMTCO2e).
vii. Schedule
    - 3.25 years
viii. EPIC Funds Encumbered
    - $2,098,840
ix. EPIC Funds Spent
    - $4,009,530
x. Partners (if applicable)
    - Department of Energy/National Renewable Energy Laboratory; Edison Electric Institute engaged for elec. utility industry staging events; Portland General Electric closely collaborating for industry-level requirements
xi. Match Funding (if applicable)
    - N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- Pay for performance

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project completed in 2016.
- Beta vehicles demonstrated in the lab and field.
- Four use-cases validated through data collection and testing: (1) Provide power during transformer replacement; (2) temporary power for EV charging stations; (3) establish or support a microgrid (including emergency relief); and (4) electric power plus equipment transport to remote sites.
- Three target power levels achieved: 75, 120, 160 kilovolt-ampere (by vehicle class).
- Project close report finalized and attached to Annual Report.

Project #1.17 Industry Participation to Leverage EPIC Dollars

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Transmission; Distribution

iii.   Objective
- N/A

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #1.18 Appliance-Level Load Disaggregation

i. Investment Plan Period
- 1st Triennial (2012-2014)

ii. Assignment to Value Chain
- Demand-Side Management

iii. Objective
- This project focuses on delivering the cost by major appliances to customers.

iv. Scope
- This project will use the data enabled by the SmartMeter™ platform to provide appliance-level itemization of monthly bill charges to customers, without their completing any audit or subscribing to any new service. This project assumes that minute level meter data is available.

v. Deliverables
- Quantify disaggregation accuracy and compare vendors.
- Based on results, provide recommendations for deployment strategy of appliance-level billing.

vi. Metrics
- 1f - Avoided customer energy use.
- 1h - Customer bill savings (dollars saved).

vii. Schedule
- 3 years

viii. EPIC Funds Encumbered
- $1,399,248

ix. EPIC Funds Spent
- $1,296,842

x. Partners (if applicable)
- N/A

xi. Match Funding (if applicable)
- N/A

xii. Match Funding Split (if applicable)
- N/A

xiii. Funding Mechanism (if applicable)
- Pay for performance

xiv. Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv. 2016 Status Update
- Project completed in 2016.
- Project analyzed results from aggregator vendors and feedback from customer surveys to verify perception and satisfaction with appliance aggregation technology and web portal.
- Project close report finalized and attached to Annual Report.

Project #1.19 Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform

i.   Investment Plan Period
   - 1st Triennial (2012-2014)
ii.   Assignment to Value Chain
   - Distribution; Grid Operation/Market Design; Demand-Side Management
iii.   Objective
   - The project is to explore and discover effective, new data that can be collected and studied for further benefits. Demonstrate the type of additional data that can be collected and/or processed through the SmartMeter™ platform. Evaluate impact of any increased data traffic on the SmartMeter™ network. Focus on new data collection that makes the SmartMeter™ platform more robust for more customers.
iv.   Scope
   - Demonstrate the collection of new data from SmartMeter™ devices. Example use cases include:
     – Power Quality Data (C12.19 format).
     – New Data Channels.
     – Mobile data collection methods.
     – Power theft detection methodology using SmartMeter™ data for revenue assurance purposes.
v.   Deliverables
   - Evaluate new data and analytic methodologies, their associated impact on the SmartMeter™.
   - Recommendation of which data warrants consideration for full-scale deployment.
   - Evaluation should provide key inputs to a business case for general deployment.
vi.   Metrics
   - 1h - Customer bill savings (dollars saved).
   - 1f - Avoided customer energy use (kilowatt-hours saved).
   - 3a - Maintain/Reduce operations and maintenance costs.
   - 3b - Maintain/Reduce capital costs.
   - 5d - Public safety improvement and hazard exposure reduction.
   - 5e - Utility worker safety improvement and hazard exposure reduction.
   - 5f - Reduced flicker and other power quality differences.
   - 5i. Increase in the number of nodes in the power system at monitoring points.
   - 7f - Deployment of cost-effective smart technologies, including real time, automated, interactive technologies that optimize the physical operation of appliance and consumer devices for metering, communications concerning grid operations and status, and distribution automation.
   - 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid.
vii.   Schedule
   - 3.25 years
viii. EPIC Funds Encumbered
   - $1,056,925

ix.　　EPIC Funds Spent
- $1,972,985

x.　　Partners (if applicable)
- N/A

xi.　　Match Funding (if applicable)
- N/A

xii.　　Match Funding Split (if applicable)
- N/A

xiii.　　Funding Mechanism (if applicable)
- Pay for Performance

xiv.　　Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.　　2016 Status Update
- Project completed in 2016.
- Project finalized all four use cases, including:
  1. Proved ability to convert electric meters to the American National Standards Institute (ANSI) C12.19 Standard metering data from the existing Advanced Metering Infrastructure (AMI) vendor proprietary format, which enabled the collection of power quality data (e.g., voltage) that was previously not available in the original format.
  2. Proved ability to add new data channels to the SmartMeter™ feeds and with minor modifications to the AMI network and systems, proved ability to capture 4-channel data (including Received kVarh) from standard kV2c meters.
  3. Proved the ability to transmit SmartMeter™ data from an Access Points (AP) through different types/bandwidths of radios and antennas and into Pacific Gas and Electric Company's back-office with no loss of fidelity and no need for interfaces, which enabled the ability to connect hard-to-reach SmartMeter™ devices for picking up meter reads in remote locations.
  4. Proved that, by collecting and analyzing interval voltage and usage data from Smart Meters™, Line Side Tap energy diversion cases can be detected and the information can be used to remediate safety hazards and prevent electric revenue loss.
- Project close report finalized and attached to Annual Report.

Project #1.20 Demonstrate the Benefits of Providing the Competitive, Open Market With Automated Access to Customer-Authorized SmartMeter™ Data to Drive Innovation.

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Demand-Side Management

iii.   Objective
- N/A

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- N/A

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- N/A

ix.   EPIC Funds Spent
- N/A

x.   Partners (if applicable)
- N/A

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- N/A - No current evidence of Intellectual Property development

xiv.   Treatment of Intellectual Property (if applicable)
- N/A

xv.   2016 Status Update
- Formally notified CPUC on October 31, 2013, project may be terminated as refined scope does not appear to meet safety, reliability, affordability guiding principles for priority Research and Development.

Project #1.21 Automatic Identification of Distributed Photovoltaic (PV) Resources

i.   Investment Plan Period
   - 1st Triennial (2012-2014)

ii. Assignment to Value Chain
   - Distribution; Demand-Side Management

iii. Objective
   - This project aims to validate and integrate a software platform to identify photovoltaic (PV) resources by leveraging Smart Meter™ data. This project focuses on addressing the issue of unauthorized interconnections in an automated fashion by developing and algorithm to identify resources, including integration with Pacific Gas and Electric Company (PG&E) billing and interconnection database, as well as develop an automated outreach system for identified customers.
   - This project addresses California Public Utilities Commission proceeding, R.11-09-011 Rule 21 to support the improved distribution-level interconnection rules and regulations for certain classes of electric generators and electric storage resources.

iv. Scope
   - Identify vendor to develop or pilot software.
   - Develop integration and communication platform for auto-identification of Unauthorized Interconnections (UI).
   - Demonstrate ability to automatically integrate software with billing and interconnection.

v.   Deliverables
   - Successful integration of software with PG&E's Customer Care and Billing (CC&B) system.
   - Successful tracking of all UIs identified.
   - Successful tracking of communication and "conversion" of UIs to interconnection.

vi. Metrics
   - 5d - Public safety improvement and hazard exposure reduction.
   - 5f - Reduced flicker and other power quality differences.
   - 5c - Forecast accuracy improvement.

vii. Schedule
   - 2.5 years

viii. EPIC Funds Encumbered
   - $868,495

ix. EPIC Funds Spent
   - $1,313,767

x.   Partners (if applicable)
   - N/A

xi. Match Funding (if applicable)
   - N/A

xii. Match Funding Split (if applicable)
   - N/A

xiii. Funding Mechanism (if applicable)
- Pay for performance

xiv. Treatment of Intellectual Property (if applicable)
- Provisional patent filed for development of Unauthorized Interconnection Detection Algorithm.

xv. 2016 Status Update
- Project completed in 2016.
- Advanced development and accuracy of PV identification (ID) algorithm to detect solar systems that export.
- Improved the accuracy of the UI identification logic/algorithm and patent submitted.
- Developed methodology to estimate the size of the PV systems and determined the accuracy of the PV system sizing method.
- Supported development of probabilistic algorithm that has the potential to enable identification of other Distributed Energy Resources in addition to PV, such as EV, storage and wind, and implemented algorithm in PG&E systems.
- Identified additional use case that leveraged SmartMeter™ data to determine ability to automatically identify customers with malfunctioning or underperforming PV systems based on the known PV capacity in PG&E's interconnection database.
- Project close report finalized and attached to Annual Report.

Project #1.22 Electric Vehicle Submetering

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Distribution; Grid Operation/Market Design; Demand-Side Management

iii.   Objective
- EV submetering pilot to test subtractive metering process and Electric Vehicle Service Provider (EVSP) business models.
- This project addresses CPUC D.13-11-008, which requires Pacific Gas and Electric Company (PG&E), along with the other two California Investor-Owned Utilities (IOU), to pursue a submetering pilot and eventual protocol.

iv.   Scope
- Electric Vehicle (EV) submetering pilot will entail EV Meter Data Management Agents (MDMA) delivering submeter data to IOU for subtraction from customer's primary meter to create an EV and a house bill. Customer will be responsible for both bills. In Phase 2, an additional business model will be introduced where the MDMA will be responsible for the bill to PG&E.

v.   Deliverables
- Process to receive MDMA sub-metered data.
- Process to subtract EV data from primary meter to create two bills.
- Inclusion of EV portion of bill on customer's monthly bill.
- Process for billing MDMA for participant submeter charges.
- Obtain third-party evaluator for both phases of pilot through a Request for Proposal (RFP).
- Incentive payments to MDMA.

vi.   Metrics
- 4a - GHG emissions reductions (MMTCO2e).
- 1h - Customer bill savings (megawatt-hours saved).

vii.   Schedule
- 4.75 years

viii.   EPIC Funds Encumbered
- $2,149,416

ix.   EPIC Funds Spent
- $1,353,281

x.   Partners (if applicable)
- Phase 1 MDMA Participants:
  - NRG
  - OhmConnect
  - Electric MotorWerks
- Phase 2 MDMA Participants:
  - ChargePoint
  - Kitu
  - Electric MotorWerks
  - Oxygen Initiative

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project is in the Build/Test phase.
- Phase 1 closed in 2016, which included 132 pilot participants and three MDMAs.
- Phase 1 evaluation report released by Nexant and project received CPUC approval for launch of Phase 2, which adds an additional business model where the MDMA will hold contracts with customers be responsible for the EV bill to PG&E.
- Next steps include setting up new MDMAs for participation in Phase 2, enrolling customers and processing payments and MDMA bills.

Project #1.23 Photovoltaic Submetering

i. Investment Plan Period
- 1st Triennial (2012-2014)

ii. Assignment to Value Chain
- Grid Ops and Market Design/Distribution/Demand-Side Management

iii. Objective
- Initiative to obtain additional un-netted Photovoltaic (PV) data to support customer call center bill experience, and provide additional service to its customers. PV generation data will be integrated with existing MyEnergy web portal for customers' benefit.
- This project addresses California Public Utilities Commission proceeding, Net Energy Metering R.12-11-005 and R.11-09-011 Rule 21.

iv. Scope
- Explore four different methods for obtaining PV generation data (Dedicated SmartMeter™, submeter communication via ZigBee radio, third-party estimates, and data exchange with solar companies, and work with vendor to relay data to customer.

v. Deliverables
- Implement pilot program for dedicated smart meters and third-party estimates.
- Explore opportunities for submetering technology and solar company data exchange.
- Modify existing Customer Data Warehouse (CDW)/MyEnergy interface to allow for additional data streams and visualization.
- Evaluate relative merits of various generation measurement/estimation approaches.

vi. Metrics
- 5c - Forecast accuracy improvements.
- 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360).

vii. Schedule
- 2.5 years

viii. EPIC Funds Encumbered
- $950,313

ix. EPIC Funds Spent
- $1,320,410

x. Partners (if applicable)
- N/A

xi. Match Funding (if applicable)
- N/A

xii. Match Funding Split (if applicable)
- N/A

xiii. Funding Mechanism (if applicable)
- Pay for performance

xiv. Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project completed in 2016.
- Evaluated the accuracy of PV generation estimation tools.
- Completed customer surveys regarding usability and value of the project's webpage on Pacific Gas and Electric Company's YourAccount that displayed estimated PV generation and usage data for 10,000 solar customers.
- Determined data gap needs to accurately estimate PV generation for all customers at scale, which includes tilt, azimuth, shading, and degradation information.
- Project close report finalized and attached to Annual Report.

Project #1.24 Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Transmission; Distribution; Grid Operation/Market Design; Demand-Side Management

iii.   Objective
- Assess how to best utilize DSM resources to create a targeted customer- and location-specific approach to assist with distribution capacity constraints.
- This project addresses California Public Utilities Commission proceeding, Distribution Resources Planning R.14-08-013, through improving efficiencies between interconnection and integration.

iv.   Scope
- Improve ability to estimate Heating, Ventilation and Air Conditioning (HVAC) Direct Load Control (DLC) load impacts at the distribution feeder level to aid in better understanding of the localized impact of HVAC DLC devices on meeting distribution feeder level reliability concerns.

v.   Deliverables
- Deploy data logging devices on a scientific sample of existing SmartAC™ Cycling customers, to enable real time monitoring of device performance and load impacts at feeder-level.
- Develop infrastructure to make real-time data available on feeder-level load impacts of SmartAC™ Cycling to distribution operations.
- Produce report describing a case study methodology of targeting and valuing customer side peak load reductions at the feeder level.

vi.   Metrics
- 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360).

vii.   Schedule
- 2 years

viii.   EPIC Funds Encumbered
- $1,196,477

ix.   EPIC Funds Spent
- $1,340,353

x.   Partners (if applicable)
- N/A

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project completed in 2016.
- Information on the project was presented at a number of Demand Response industry events.
- All data loggers will continue to be deployed to provide ongoing real-time feedback Direct Load Control devices to the Demand Response Program Managers.
- Project close report finalized, posted to EPIC, CalMac and Plug Load Management Associated (PLMA) websites, and attached to Annual Report.

Project #1.25 Direct Current (DC) Fast Charging Mapping

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Distribution; Demand-Side Management

iii.   Objective
- Develop, pilot, and validate approaches that help determine the optimal location of DC fast chargers based on traffic patterns and distribution grid infrastructure.

iv.   Scope
- Acquire travel pattern data and grid infrastructure capability data to identify low-cost, high utilization areas in which to integrate DC fast chargers into Pacific Gas and Electric Company's (PG&E) distribution system.

v.   Deliverables
- Develop a process to identify optimal DC fast charging sites.
- Develop a map that presents the locations of optimal DC fast charging sites in a meaningful manner to customers.

vi.   Metrics
- 3a - Maintain/Reduce capital costs.
- 3d - Number of operations of various existing equipment types before and after adoption of a new smart grid component, as an indicator of possible equipment life extensions from reduced wear and tear.
- 4a - Greenhouse Gas emissions reductions (MMTCO2e).
- 5c - Forecast accuracy improvement.
- 5d - Public safety improvement and hazard exposure reduction.
- 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code § 8360).
- 7l - Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.

vii.   Schedule
- 2.5 years

viii.   EPIC Funds Encumbered
- $332,975

ix.   EPIC Funds Spent
- $368,679

x.   Partners (if applicable)
- N/A

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)

- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update

- Project completed in 2016.
- Finalized identification of 300 broad locations within PG&E's territory for DC fast charger installations in 2025.
- Identified over 14,000 individual potential sites to target based on non-exclusive factors such as driving patterns, distribution capacity, Electric Vehicle adoption, and support of disadvantaged communities.
- Developed interactive map released onto PG&E website and developed scoring tool to help on-the-ground planners prioritize these sites.
- Project close report finalized and attached to Annual Report.

Project #1.26 Pilot Measurement and Telemetry Strategies and Technologies That Enable the Cost-Effective Integration of Mass Market Demand Response (DR) Resources Into the CAISO Wholesale Market

i.   Investment Plan Period
- 1st Triennial (2012-2014)

ii.   Assignment to Value Chain
- Grid Operation/Market Design and Demand-side Management.

iii.   Objective
- Develop, pilot and validate approaches and technologies that enable the cost-effective integration (specifically, the measurement and telemetry) of mass market DR resources into the California Independent System Operator (CAISO) wholesale market. While other DR projects focus on integration of DR resources into various utility and future Independent System Operator operational needs, this project intends to test alternative telemetry solutions and technologies to satisfy CAISO operational visibility requirements.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- 0

ix.   EPIC Funds Spent
- 0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #2.01 Evaluate Storage on the Distribution Grid

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Grid Operations/Market Design; Transmission; Distribution; Demand-Side Management

iii.   Objective
- Identify and evaluate whether system needs can be cost-effectively addressed with energy storage, including identifying a range of storage deployment locations and grid interconnection requirements on a granular level.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- 0

ix.   EPIC Funds Spent
- 0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #2.02 Pilot Distributed Energy Management Systems (DERMS)

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Grid Operation/Market Design

iii. Objective
- Demonstrate new technology to monitor and control Distributed Energy Resources (DER) to manage system constraints and evaluate the potential value of DER flexibility to the grid. The DERMS pilot will drive learning about the people, process, and technology needed to operate the high DER penetration grid of 2025.
- Create, test, and iterate on future DERMS requirements (e.g., communication requirements for PG&E and third-party owned DERs).
- Learn about business process change and personnel skills & knowledge needed to implement DERMS.
- Enable informed choice for long-term strategic vendor in 2017+ (pilot is not choosing the long term vendor).
- This project addresses California Public Utilities Commission proceeding, Distribution Resources Plan R.14-08-013 to inform distribution planning by demonstrating DER integration into planning and operations.

iv.   Scope
- Demonstrate minimum viable DERMS operation at Pacific Gas and Electric Company (PG&E) to address key DER management use cases.
- The demonstration will take place in a limited geography with a diverse set of DERs being monitored and controlled by the pilot DERMS.

v.   Deliverables
- The functional integration of a DERMS software minimum viable product and operational demonstration of the identified use cases.
- A report that:
  - Determines the most important characteristics of a full deployment solution including detailed functional and technical requirements.
  - Identifies best practices and required internal capabilities for a full deployment solution.
  - Develops operational processes that can be scaled to a wider system deployment.
  - Defines boundaries and integrations with other PG&E systems (e.g., DRMS, DMS, market systems).
  - Develops a point of view on the utility role in managing DERs for grid and economic benefits.

vi.   Metrics
- 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code (Pub. Util. Code) § 8360).
- 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources (Pub. Util. Code § 8360).

vii. Schedule
- 2.5 years

viii. EPIC Funds Encumbered
- $1,988,613

ix. EPIC Funds Spent
- $3,318,718

x. Partners (if applicable)
- N/A

xi. Match Funding (if applicable)
- $419,000

xii. Match Funding Split (if applicable)
- N/A

xiii. Funding Mechanism (if applicable)
- Pay for performance

xiv. Treatment of Intellectual Property (if applicable)
- TBD

xv. 2016 Status Update
- Project is in the Build/Test phase.

- Developed solution architecture for pilot demonstration, designed integrations to enable DERMS system to communicate with third-party DER aggregators, completed initial Site Acceptance Testing of DERMS software on PG&E systems in preparation for field demonstration of DERMS use cases in 2017.

- Next steps include field demonstration of DERMS use cases, evaluation of effectiveness of DERMS in achieving use case objectives, leveraging of DERMS to participate in wholesale markets and development of recommendations in evaluating DERMS solutions for PG&E, other utilities, DERMS vendors, and DER aggregators.

Project #2.03A Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Distribution; Demand-Side Management

iii.   Objective
- This project will explore the use and impact of aggregated customer-sited smart inverters to help inform emerging industry standards, as well as define the operational and communication requirements to support the advancement and deployment of new inverter technologies.
- This project addresses California Public Utilities Commission proceeding, Distribution Resources Plan R.14-08-013, by informing Distributed Energy Resources modeling by incorporating Smart Inverters.

iv.   Scope
- This project will leverage the results of the lab testing of smart inverter functionalities that is being completed by Pacific Gas and Electric Company's (PG&E) Smart Grid Pilot Volt/Var Optimization (VVO) Project at PG&E's Applied Technologies Lab (as specified by the Smart Inverter Working Group).
- This EPIC project will deploy smart inverters on one or more feeders to evaluate their effectiveness in improving PV integration and mitigation safety risks.

v.   Deliverables
- Identify feeder(s) where Smart Inverters will be installed for demonstration.
- Demonstrate the use of Smart Inverters on one or more feeders to demonstrate the inverters' local voltage control capabilities and impacts related to high penetration of customer-sited solar PV.
- Develop any necessary communications software/hardware/technologies between the utility and third-party aggregator or end devices.
- Evaluate the performance of Smart Inverters.

vi.   Metrics
- 3a - Maintain/Reduce operations and maintenance costs.
- 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources.

vii.   Schedule
- 2.75 years

viii.   EPIC Funds Encumbered
- $1,038,147

ix.   EPIC Funds Spent
- $654,205

x.   Partners (if applicable)
- PG&E Smart Grid VVO Pilot

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A - No current evidence of Intellectual Property development

xv. 2016 Status Update

- Project is in the Build/Test phase.
- Completed lab testing of Smart Inverters, confirming the active and reactive power control settings that can be used in field trial.
- Scoped data analysis and circuit modeling that will be performed by project to evaluate the effectiveness of the field trial of Smart Inverters.
- Executed contract with a Smart Inverter aggregator to drive the installation of Smart Inverters.
- Initiated customer recruitment and installation.
- Next steps include completing customer recruitment and installation of Smart Inverters at customer sites, field trial of Smart Inverter autonomous settings to drive Smart Inverter use cases, perform measurement and verification analysis to evaluate effectiveness of Smart Inverters in creating benefits.

Project #2.03B Test Smart Inverter Enhanced Capabilities - Vehicle to Home

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Distribution; Demand-Side Management

iii. Objective
- As a complement to the smart inverter assessment related to Photovoltaics (PV) in project 2.03A. Smart Inverters for PV, this project will assess the use and impact of EV energy flow capabilities, as required by D.15-04-020.

iv.   Scope
- This EPIC project will enable dispatchable charging and discharging of the Electric Vehicle (EV) in response to demand response or hard islanding events. Multiple test modes will be tested.

v.   Deliverables
- Evaluation of the performance of the EV energy flow capabilities to support residential load during DR and hard islanding events.

vi.   Metrics
- 3a - Maintain/Reduce operations and maintenance costs.
- 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources.

vii. Schedule
- 2.5 years

viii. EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project is in the Plan/Analyze phase.
- Re-designed project implementation plan in alignment with approved scope, after initially planned project partner retracted from participation.
- Next steps include finalize design/engineering testing plan, install equipment and commence testing.

Project #2.04 DG Monitoring & Voltage Tracking

i.   Investment Plan Period
   - 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
   - Grid Operations/Market Design

iii.   Objective
   - This project aims to utilize the voltage measurement capabilities of SmartMeter™ devices to monitor Distributed Generation (DG) output and identify voltage fluctuations caused by the intermittent nature of distributed renewable resources. Project will use data analytics techniques and Advanced Metering Infrastructure (AMI) (and other) data to determine the impact of PV penetration on Rule 2 violations and create a rating for the probability that a Rule 2 violation is caused by DG.

iv.   Scope
   - Create an algorithmic process output rating on the likelihood of a voltage violation (on a given transformer) being caused by DG fluctuations.

v.   Deliverables
   - Develop an analytics process/algorithm to analyze AMI and other data for high penetration DG feeders, as well as some low penetration feeders for baselining.
   - Evaluate impact of DG penetration on voltage.

vi.   Metrics
   - 3a - Maintain/Reduce operations and maintenance costs.
   - 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360).
   - 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources.

vii.   Schedule
   - 1.75 years

viii.   EPIC Funds Encumbered
   - $745,532

ix.   EPIC Funds Spent
   - $1,100,057

x.   Partners (if applicable)
   - TBD

xi.   Match Funding (if applicable)
   - TBD

xii.   Match Funding Split (if applicable)
   - TBD

xiii.   Funding Mechanism (if applicable)
   - Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)
   - N/A - No current evidence of Intellectual Property development

xv.	2016 Status Update

- Project is in the Build/Test phase.
- Executed Request for Proposal to select project vendor.
- Developed an application tool to track and visualize Rule 2 voltage violations.
- Developed an algorithm to calculate likelihood that DG, especially solar interconnections, was the cause of violations, and also help planners identify those locations that might have frequent DG-caused voltage violations in the future.
- Next steps include project completion of stakeholder review and development of close out materials.

Project #2.05 Inertia Response Emulation for DG Impact Improvement

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Grid Operations/Market Design; Transmission

iii.   Objective
- Demonstrate the capability to emulate inertia injection and support primary frequency control using energy storage and smart inverter technologies to potentially mitigate the impacts of large-scale Distributed Generation (DG) to the grid, improve the grid performance and reliability, and advance California energy policy to increase the amounts of renewable and distributed generation on the grid.

iv.   Scope
- Analyze and optimize energy storage inertial response capabilities.

v.   Deliverables
- Test, optimize and assess energy storage inertial response capabilities in a lab, island and grid-tied scenarios.
- Provide inertial response recommendations for future inverter and interconnection requirements.

vi.   Metrics
- TBD

vii.   Schedule
- 1.75 years

viii. EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project is in the Plan/Analyze phase.
- Received internal approval to initiate project and begin development of project plan.
- Next steps include developing project plan, identifying vendors and/or partners and executing project plan.

Project #2.06 Intelligent Universal Transformer (IUT)

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Distribution; Grid Operation/Market Design; Demand-Side Management"

iii.   Objective
- The project objective is to develop and demonstrate a solid-state transformer field prototype Medium Voltage Fast Charger (MVFC) system, as an application use case of solid-state transformers for Direct Current (Direct Current) fast charging of Plug-In Electric Vehicles (PEV), featuring intelligent controls and multiple fast charging of PEVs.

iv.   Scope
- Test demonstration and communication to the same DC solid-state transformer with two protocols.

v.   Deliverables
- Demonstrate a proof of concept that may:
  1. an Intelligent Universal Transformer (IUT) can be used in lieu of other equipment to connect to Direct Current Fast Charge (DCFC) protocols, and
  2. an IUT can communicate back to the utility.

vi.   Metrics
- 3a - Maintain/Reduce operations and maintenance costs.
- 3b - Maintain/Reduce capital costs.
- 5d - Public safety improvement and hazard exposure reduction.
- 7k - Develop standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid.
- 7l - Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.

vii.   Schedule
- N/A

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- N/A

xi.   Match Funding (if applicable)
- N/A

xii.   Match Funding Split (if applicable)
- N/A

xiii.   Funding Mechanism (if applicable)
- N/A

xiv.   Treatment of Intellectual Property (if applicable)
- N/A

xv.   2016 Status Update
- Project put on hold after determining the product (IUT) was not mature enough for a technology demonstration through EPIC.

Project #2.07 Real-Time Loading Data for Distribution Operations and Planning

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Grid Operation/Market Design; Distribution

iii.   Objective
- This demonstration will leverage near real time and interval data to improve feeder modeling, inform load allocation throughout the distribution grid and transformer loading profiles, and identify opportunities to enhance current load forecasting processes for distribution transformers, feeders and substation transformers.

iv.   Scope
- Current technology does not allow for real time line or transformer loading information without full Supervisory Control and Data Acquisition (SCADA) penetration.
- Project will aggregate the meter loading to the transformer level at a higher frequency level.

v.   Deliverables
- Develop a unique loading algorithm and rubrics for determining cost-effective data sources and cadences.

vi.   Metrics
- 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.

vii.   Schedule
- 2.75 years

viii.   EPIC Funds Encumbered
- $768,917

ix.   EPIC Funds Spent
- $1,008,569

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project is in the Build/Test phase.
- Developed both an algorithm to predict real-time loading at the transformer level and a visualization mechanism for users of the model.
- Engaged with vendor and end users to identify a series of enhancements to make data more actionable.
- Next steps include completion of stakeholder review of completed application and integration of this prototype technology with distribution planning tools.

Project #2.08 "Smart" Monitoring and Analysis Tools

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Transmission

iii.   Objective
- Demonstrate strategies and technologies for real time, online monitoring of substation equipment; Demonstrate communication protocols and equipment to support the smart devices; Develop visualization techniques for improved monitoring; and evaluate new vendor technologies that enable data correlation and predictive analysis to better identify and respond to potential safety, reliability and/or operational issues.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #2.09 Distributed Series Impedance (DSI) (Phase 2)

i. Investment Plan Period
- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain
- Transmission

iii. Objective
- Demonstrate congestion mitigation by installing DSIs on parallel transmission facilities to demonstrate the next generation of the Distributed Series Reactor (DSR) devices from the First EPIC Triennial Plan, which may allow for better control of transmission line loading.

iv. Scope
- Project scope being further evaluated - TBD

v. Deliverables
- Project deliverables being further evaluated - TBD

vi. Metrics
- TBD

vii. Schedule
- Project schedule being further evaluated - TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)
- TBD

xv. 2016 Status Update
- Project is currently on-hold.

Project #2.10 Emergency Preparedness Modeling

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Transmission; Distribution

iii.   Objective
- Incorporate natural hazard damage model information into one integrated algorithm/tool, which would provide the ability to quickly estimate the impacts of natural hazards on Pacific Gas and Electric Company facilities to enable faster response and restoration.
- Provide the ability to prepare for these hazards by proactively modeling the impacts of potential hazards, to understand system vulnerabilities and restoration resource requirements.
- Incorporate work efficiency optimization algorithms to more efficient allocate crews.

iv.   Scope
- Develop optimization algorithms and visualization tool that includes asset locations and conditions with multiple potential hazards, which allows for the aggregation of equipment damage estimates (via damage models, outage information systems, and damage assessments), est. hours to repair, and recommended allocation of work resources to efficiently respond to a natural hazard.

v.   Deliverables
- Complete algorithms that aggregate data from multiple sources to feed into application.
- Incorporate multiple algorithms into a proof of concept visualization tool.
- Develop recommendation for deployment strategy.

vi.   Metrics
- 3a - Maintain/Reduce operations and maintenance costs.
- 4a - Greenhouse Gas emissions reductions (MMTCO2e).
- 5a - Outage number, frequency and duration reductions.
- 5d - Public safety improvement and hazard exposure reduction.
- 5e - Utility worker safety improvement and hazard exposure reduction.
- 5c - Forecast accuracy improvement.

vii.   Schedule
- 2.75 years

viii.   EPIC Funds Encumbered
- $1,419,323

ix.   EPIC Funds Spent
- $314,512

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)

- Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)

- PG&E will receive perpetual, transferable sublicenses to all Work Product to use for current and future PG&E business.

xv.   2016 Status Update

- Project is in the Plan/Analyze phase.
- Executed Request for Information (RFI) and Request for Proposal, selected vendor and executed vendor contract.
- Supplied necessary data from key enterprise systems to the vendor for analysis.
- Next steps include development of full system requirements, including architecture, algorithms, and associated documentation, as well as supply and test initial prototype with Emergency Operation Center stakeholders for functionality testing and user input.

Project #2.11 New Mobile Technology & Visualization Applications

i. Investment Plan Period
- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain
- Distribution

iii. Objective
- Demonstrate tailored, advanced mobile applications for Pacific Gas and Electric Company field operations that build upon Grid Operations Situational Intelligence (Project #15) demonstration projects in the EPIC First Triennial Plan as well as existing "baseline" mobile deployments underway.

iv. Scope
- Project scope being further evaluated - TBD

v. Deliverables
- Project deliverables being further evaluated - TBD

vi. Metrics
- TBD

vii. Schedule
- Project schedule being further evaluated - TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)
- TBD

xv. 2016 Status Update
- Project is currently on-hold.

Project #2.12 New Emergency Management Mobile Applications

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Transmission; Distribution

iii.   Objective
- Develop new mobile applications to enhance Pacific Gas and Electric Company's emergency preparedness and response capabilities.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #2.13 Digital Substation/Substation Automation

i.   Investment Plan Period
   • 2nd Triennial (2015-2017)
ii.   Assignment to Value Chain
   • Transmission; Distribution
iii.   Objective
   • Investigate and evaluate sustainable protection and control technologies for future "digital" substations, which may include testing technologies in a lab setting, and performing a pilot implementation to demonstrate technology adoption and integration with legacy substation protection and control technologies.
iv.   Scope
   • Project scope being further evaluated - TBD
v.   Deliverables
   • Project deliverables being further evaluated - TBD
vi.   Metrics
   • TBD
vii.   Schedule
   • Project schedule being further evaluated - TBD
viii.   EPIC Funds Encumbered
   • $0
ix.   EPIC Funds Spent
   • $0
x.   Partners (if applicable)
   • TBD
xi.   Match Funding (if applicable)
   • TBD
xii.   Match Funding Split (if applicable)
   • TBD
xiii.   Funding Mechanism (if applicable)
   • TBD
xiv.   Treatment of Intellectual Property (if applicable)
   • TBD
xv.   2016 Status Update
   • Project is currently on-hold.

Project #2.14 Automatically Map Phasing Information

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Distribution; Demand-Side Management

iii.   Objective
- This project aims to explore a variety of pre-commercial analytics and/or hardware options to automatically map 3-phase electrical power information in order to improve the distribution network models. Use of Advanced Metering Infrastructure (AMI) data; Light Detection and Ranging mapping technology; Micro Phasor Measurement Units (PMU); and hardware at the transformer may provide this automated capability.

iv.   Scope
- Project seeks to improve distribution network models through automatic mapping of 3-phase electrical power information.

v.   Deliverables
- Develop algorithm or novel process to use AMI data and other sources to determine the assignment of Phases to conducting components.
- Complete an analysis on the most cost-effective frequency for running such a mapping process.

vi.   Metrics
- 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.

vii.   Schedule
- 1.75 years

viii.   EPIC Funds Encumbered
- $1,473,618

ix.   EPIC Funds Spent
- $761,743

x.   Partners (if applicable)
- University of California, Riverside testing an alternate algorithm based approach

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- Pay for performance

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project is in the Design/Engineering phase.
- Selected two candidate algorithm approaches for development and demonstration.
- Completed field verification of phasing and meter-to-transformer mapping for the target geography, to act as a training and test set for algorithms.
- Next steps include development of phasing algorithm and meter to transformer algorithm, and explore additional feeder field verification as necessary and possible.

Project #2.15 Synchrophasor Applications for Generator Dynamic Model Validation

i.   Investment Plan Period
   - 2nd Triennial (2015-2017)
ii.   Assignment to Value Chain
   - Transmission
iii.   Objective
   - This project will evaluate new Synchrophasor analysis applications that can perform generator dynamic model parameter estimation and validation using disturbance data recorded by the Synchrophasor system. New Synchrophasor applications could perform mandated generator model validation without requiring time- and labor-intensive on-site tests, and could detect sub-synchronous resonance and other conditions which can cause generator outages. The objective of this project is to determine if this analysis is accurate and cost-effective on Pacific Gas and Electric Company's system.
iv.   Scope
   - Scope is limited to confirming that analysis of Phasor Measurement Unit (PMU) data is equal to costly on-site model validation in the target geography. Scope does not include widespread deployment of PMUs or validation process.
v.   Deliverables
   - Install Synchrophasors (or "PMUs") on generators or generator tie-lines, and test new data analysis software applications.
   - Evaluate the applications' ability to perform generator dynamic model validation by analyzing Synchrophasor data following transient disturbances on the transmission system.
vi.   Metrics
   - 3a - Maintain/Reduce operations and maintenance costs.
   - 5a - Outage number, frequency and duration reductions.
   - 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360).
vii.   Schedule
   - 2.5 years
viii.   EPIC Funds Encumbered
   - $576,157
ix.   EPIC Funds Spent
   - $598,533
x.   Partners (if applicable)
   - TBD
xi.   Match Funding (if applicable)
   - TBD
xii.   Match Funding Split (if applicable)
   - TBD
xiii.   Funding Mechanism (if applicable)
   - Pay for performance

xiv.   Treatment of Intellectual Property (if applicable)

- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update

- Project is in the Build/Test phase.
- Installed Synchrophasor system at the Colusa Generating Station and created models in the Mathworks tool of the CGS facility.
- Next steps include continued testing and validation of generation model.

Project #2.16 Enhanced Synchrophasor Analytics & Applications

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Transmission

iii.   Objective
- Demonstrate new techniques to synthesize Synchrophasor data and utilize the data for advanced real-time system applications, such as wide-area monitoring, protection, and control systems, which could help move Synchrophasor applications beyond planning, forensics, and visualization to enhanced wide-area monitoring, protection, and control applications.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #2.17 Geomagnetic Disturbance (GMD) Evaluation

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Transmission

iii.   Objective
- Evaluate system vulnerability to GMD by modeling GMD that occurs during a geomagnetic storm and evaluating the impact on transmission lines, interconnection lines, substations and system voltages.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #2.18 Optical Instrument Transformers and Sensors for Protection and Control Systems

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Transmission

iii.   Objective
- Demonstrate newer technologies, such as optical sensors, as well as strategies and technologies to configure appropriate protection settings, including the coordination required between both new and conventional instrumentation.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii. EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #2.19 Enable Distributed Demand-Side Strategies & Technologies

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Distribution; Demand-Side Management

iii.   Objective
- Demonstrate distributed demand-side technologies and approaches to address local and flexible resource needs.
- This project addresses California Public Utilities Commission proceeding, Distribution Resources Plan R.14-08-013, by demonstrating Distributed Energy Resource locational benefits and addressing capacity constraints through aggregated behind-the-meter (BTM) customer energy storage.

iv.   Scope
- Deploy an aggregation of BTM customer energy storage resource to reduce peak loading or absorb distributed generation on a utility distribution feeder(s).

v.   Deliverables
- Demonstrate and test field results for effectiveness of the use of aggregated customer-sited BTM energy storage resources to peak load reduction reduce peak loading or absorb distributed generation on a utility distribution feeder(s).
- Potential to demonstrate communications with aggregate resources for visualization and control.
- Evaluate cost-effectiveness and reliability of BTM energy storage for addressing capacity constraints.

vi.   Metrics
- 1c - Avoided procurement and generation costs.
- 1i - Nameplate Capacity of Grid-Connected Storage.
- 3f - Improvements in system operation efficiencies stemming from increased utility dispatchability of customer demand side management.
- 5b - Electric system power flow congestion reduction.
- 5d - Public safety improvement and hazard exposure reduction.
- 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.
- 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources.

vii.   Schedule
- 2.75 years

viii.   EPIC Funds Encumbered
- $1,731,402

ix.   EPIC Funds Spent
- $354,168

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project is in the Build/Test phase.
- Finalized selection of site location.
- Executed Request for Proposal and selected vendors (one commercial scale and one residential scale).
- Initiated customer acquisition efforts with vendors, developed test plan and began integration with the Distributed Energy Resource Management System platform.
- Next steps include completion of customer acquisition and installation of all systems at participating sites, refinement of test plan, completion of commissioning of the systems, commencement of field deployment testing, collection and analysis of system data, collection of lessons learned and completion of final report.

Project #2.20 Real-Time Energy Usage Feedback to Customers

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Grid Operations/Market Design; Distribution; Demand-Side Management

iii.   Objective
- Evaluate innovative feedback technologies to provide near real-time energy usage information to customers and to drive greater customer performance during DR events.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii. EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #2.21 Home Area Network (HAN) for Commercial Customers

i.   Investment Plan Period
   - 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
   - Demand-Side Management

iii.   Objective
   - This project will demonstrate the application of HAN technology to Pacific Gas and Electric Company's commercial customers.

iv.   Scope
   - This project will enable the ZigBee HAN radio on Large Commercial and Industrial (LCI) meters, to facilitate LCI customer access to real time usage data, as well as testing of the integration with existing Energy Management Systems (EMS).

v.   Deliverables
   - Install ZigBee HAN devices with selected LCI customers and connect devices to SmartMeter™ devices.
   - Monitor customer usage and issue/collect customer and vendor surveys.
   - Complete report with identified issues and recommendations for how to integrate with an existing EMS.

vi.   Metrics
   - 1e - Peak load reduction (megawatts) from summer and winter programs.
   - 1f - Avoided customer energy use (kilowatt-hours saved).
   - 1h - Customer bill savings (dollars saved).
   - 3a - Maintain / Reduce operations and maintenance costs.
   - 4a - GHG emissions reductions (MMTCO2e).
   - 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code § 8360).

vii.   Schedule
   - 2 years

viii.   EPIC Funds Encumbered
   - $3,000

ix.   EPIC Funds Spent
   - $137,041

x.   Partners (if applicable)
   - Rainforest Automation providing development of the cloud service application used by the customers

xi.   Match Funding (if applicable)
   - TBD

xii.   Match Funding Split (if applicable)
   - TBD

xiii.   Funding Mechanism (if applicable)
   - Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)

- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update

- Project is in the Build/Test phase.

- Recruited 15 sites for field testing, deployed HAN equipment to key test sites, implemented initial survey on operating sites.

- Next steps include analyzing data for energy consumption impact of deployed devices at field test sites, implementing mid-project and final surveys, compiling survey results and complete final report.

Project #2.22 Demand Reduction Through Targeted Data Analytics

i.   Investment Plan Period
   - 2nd Triennial (2015-2017)
ii.   Assignment to Value Chain
   - Distribution; Demand-Side Management
iii. Objective
   - Identify strategic customers and target demand reduction in local areas by combining and integrating multiple Demand-Side Management technologies (e.g., Energy Efficiency (EE), Demand Response (DR), Distributed Energy Storage, Consumer-oriented Energy Tools).
   - Investigate whether Pacific Gas and Electric Company can achieve a sufficient amount of demand reduction, give visibility into the customer-side resources and improve the reliability of customer-side resources at the local level, in order to reschedule local capacity expansion expenditures.
   - This project addresses California Public Utilities Commission proceeding, Distribution Resources Plan R.14-08-013, by supporting the fair and transparent processes for Distributed Energy Resource (DER) deployment and integration.
iv.   Scope
   - Develop a solution/tool that determines needed customer demand reduction individually and in aggregate at asset level, leveraging interval and Supervisory Control and Data Acquisition (SCADA) data.
   - Develop cross-DER customer targeting to address forecasted capacity challenges at specific assets, for specific days and times of year, leveraging interval data and other customer attributes.
v.   Deliverables
   - Create a data analytics platform capable of combining and analyzing multi-structured data, linking to a variety of data sources.
   - Develop a method for identification, valuation, implementation, and tracking of targeted DERs.
   - Create a quantitative screening/rank order tool.
   - Develop actionable DER recommendations to customer outreach teams for reaching demand reduction goals.
vi.   Metrics
   - 3a - Maintain/Reduce capital costs.
   - 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.
   - 7e - Development and incorporation of cost-effective demand response, demand-side resource, and energy efficient resources.
   - 7h - Deployment and integration of cost-effective advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air-conditioning.
vii. Schedule
   - 2.25 years
viii. EPIC Funds Encumbered
   - $656,887

ix.   EPIC Funds Spent
- $717,547

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)
- Intellectual Property potential being explored

xv.   2016 Status Update
- Project is in the Build/Test phase.
- Issued direct award contract to project vendor.
- Implemented pilot analytical software, integrated various internal datasets to create centralized analytics platform, created initial operational optimization engine (i.e., "screening tool"), assembled analyses across DERs to include within optimization engine and began process to improve foundational analytics where needed (e.g., propensity modeling).
- Next steps include continued refinement of optimization and underlying analytical inputs; improving customer outreach dashboard interface; incorporating value-added output from optimization engine analytics; leveraging metering data to assess energy usage impact from DER deployment; creating methodology and infrastructure for meter-based monitoring and verification; exploring the use of cloud-based platform for project implementation; leveraging project methodology to create improved DER load curve model inputs; applying optimization engine and outreach infrastructure to current field efforts to field test and iteratively improve model and outreach operation.

Project #2.23 Integrate Demand Side Approaches Into Utility Planning

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Distribution; Demand-Side Management

iii.   Objective
- This project will enhance Pacific Gas and Electric Company's ability to incorporate the growing usage of Distributed Energy Resources (DER) into distribution planning tools by developing new customer class load shapes that incorporate DERs and a methodology for modeling DER deployment uncertainty at the circuit level.
- The execution of this project addresses issues as identified in the following proceedings: Distribution Resources Plan R.14-08-013 and Assembly Bill 327 Section 769, which requires transparent and consistent methods to integrate cost-effective DERs into the distribution planning process.

iv.   Scope
- Integrate a broader range of customer-side technologies and DER approaches into grid planning and operations in a least cost framework by enhancing distribution load forecasting tools to include new customer load shapes based on the usage of DERs and to model the uncertainty of DER deployment at the circuit level.

v.   Deliverables
- Develop enhanced Customer and DER Load Shapes Catalog in LoadSEER Planning Tool.
- Incorporate DER Scenario Projections into LoadSEER.
- Develop interface between LoadSEER and CYME for batch processing integration.

vi.   Metrics
- 1c - Avoided procurement and generation costs.
- 3f - Improvements in system operation efficiencies stemming from increased utility dispatchability of customer demand side management.
- 5c - Forecast accuracy improvement.
- 7e - Development and incorporation of cost-effective demand response, demand-side resources, and energy-efficient resources (Public Utilities Code § 8360).

vii.   Schedule
- 2.25 years

viii.   EPIC Funds Encumbered
- $1,615,555

ix.   EPIC Funds Spent
- $2,604,325

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project is in the Build/Test phase.
- Completed enhancements to the planning tools (LoadSEER and CYME) to more readily incorporate Advanced Metering Infrastructure (AMI) data and more transparently incorporate the impacts of the DER deployments at the circuit level, support integration capacity analysis (ICA) and support locational net benefit analysis (LNBA).
- Completed incorporation of DER adjustment portfolios into LoadSEER.
- Completed user acceptance testing of the DER adjustment portfolio administrator functions, the load forecast viewer application, and the load shapes viewer application.
- Developed enhanced interface between LoadSEER and CYME to support integration capacity analysis; completed a number of enhancements to facilitate more efficient data exchange between Teradata, EDGIS, PI and LoadSEER and between LoadSEER and CYME.
- Next steps include demonstrating the enhanced features of LoadSEER and CYME over one distribution planning cycle, completion of final EPIC Project report, and sharing of project learnings with electric industry peers.

Project #2.24 Appliance Level Bill Disaggregation for Non-Residential Customers

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Demand-Side Management

iii.   Objective
- Demonstrate the ability to use sub-minute level usage information to determine appliance load for non-residential customers.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #2.25 Enhanced Smart Grid Communications

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Grid Operations/Market Design; Distribution; Demand-Side Management

iii.   Objective
- Evaluate license spectrum providers that have developed technologies offered on the Federal Communications Commission (FCC) license frequency range/spectrum.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

Project #2.26 Customer & Distribution Automation Open Architecture Devices

i. Investment Plan Period
- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain
- Distribution; Grid Operation/Market Design; Demand-Side Management

iii. Objective
- Demonstrate the means by which new customer and distribution devices could interoperate with Pacific Gas and Electric Company's Advanced Metering Infrastructure (AMI) network (IPv6).

iv. Scope
- Demonstrate the methodology, protocols, and standards for customers and vendors to connect and communicate various new devices and applications (e.g., Home Area Network, Electric Vehicle charging, smart appliances, etc.) with the AMI network (IPv6) in an effective manner.

v. Deliverables
- Conduct lab testing that will certify customer open architecture devices/applications that are AMI compatible, secure and interoperable.
- Provide physical and application interfaces, as a Proof of Concept, which will permit customer and third party devices to connect to our AMI network(s).

vi. Metrics
- 3f - Improvements in system operation efficiencies stemming from increased utility dispatchability of customer demand side management.
- 5i - Increase in the number of nodes in the power system at monitoring points.
- 7j - Provide consumers with timely information and control options.

vii. Schedule
- 2.75 years

viii. EPIC Funds Encumbered
- $190,600

ix. EPIC Funds Spent
- $76,710

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)
- Intellectual Property potential being explored

xv.   2016 Status Update
- Project is in the Design/Engineering phase.
- Completed project business plan, including a detailed use case plan.
- Next steps include conducting a Request for Proposal, selecting vendors, executing contracts, executing proposed use cases and analyzing results and documenting findings.

Project #2.27 Next Generation Integrated Smart Grid Network Management

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Grid Operations/Market Design; Distribution; Demand-Side Management

iii.   Objective
- Evaluate new technologies to holistically monitor, control and evolve the communications network and supporting infrastructure as a platform to enable Smart Grid solutions.

iv.   Scope
- Demonstrate a new Advanced Metering Infrastructure (AMI) Network management system to holistically monitor, control, and evolve the existing AMI network and infrastructure from a billing-centric platform to a fully operational AMI solutions platform that will meet evolving customer and grid needs.

v.   Deliverables
- Demonstrate an integrated, multi-tenant network management system that may include the following features:
  - Integrated network management & control that will monitor and prioritize data traffic.
  - Automate trouble ticketing creation process.
  - Workflow management.
  - Asset management of meter and network equipment regardless of meter or network types.
  - Business continuity planning to streamline maintenance and operations.

vi.   Metrics
- 3a - Maintain/Reduce operations and maintenance costs.
- 5a - Outage number, frequency and duration reductions.
- 5d - Public safety improvement and hazard exposure reduction.
- 5e - Utility worker safety improvement and hazard exposure reduction.

vii.   Schedule
- 2.5 years

viii.   EPIC Funds Encumbered
- $576,433

ix.   EPIC Funds Spent
- $423,393

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)

- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update

- Project is in the Build/Test phase.

- Executed Request for Proposal, selected vendor and issued contract.

- Completed project business plan, finalized requirements, demonstrated and documented system interfaces, and demonstrated data model for inventory/configuration tracking.

- Next steps include generating, demonstrating and documenting custom communication views and custom fault/alert views, finalizing system test plan, conducting data, testing multiple interfaces and completing the project final report.

Project #2.28 Smart Grid Communications Path Monitoring

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Grid Operation/Market Design

iii.   Objective
- Evaluate more efficient communication paths for Advanced Metering Infrastructure (AMI)-related messages, including methods to clear potential interference, congestion, validate proper authorizations, and grant clearances for sending message over a secured communication path.

iv.   Scope
- Determine the ability to identify, analyze, and diagnose radiofrequency (RF) interference that can occur along the communication path from the meter through the data collectors to the AMI vendors' control system.

v.   Deliverables
- Establish the base line noise floor.
- Develop and demonstrate an application with an algorithm, which can automatically and continuously identify, monitor, and confirm RF interferences for multiple spectrums.
- Provide an end-end process for identifying, confirming and mitigating detected interferences with the AMI-network.

vi.   Metrics
- 1h - Customer bill savings (dollars saved).
- 3e - Non-energy economic benefits – reduction operational hours to fix estimated bills due to RF Interference.

vii.   Schedule
- 1.75 years

viii. EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- N/A - No current evidence of Intellectual Property development

xv.   2016 Status Update
- Project is in Plan/Analyze phase
- Received internal approval to initiate project and begin development of project plan
- Next steps include finalizing business plan, finalize use cases, develop functional requirements, conduct Request for Proposal process for developing Radio Frequency Interference (RFI) monitoring application, then build, and test.

Project #2.29 Mobile Meter Applications

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Grid Operations/Market Design; Distribution; Demand-Side Management

iii.   Objective
- Demonstrate the utility's ability to enable dynamic electric mobile metering.

iv.   Scope
- Develop and test a mobile meter prototype on various applications that can be used to capture and monitor real-time energy transactions and usage (e.g. Plug-In Electric Vehicles (PEV), Distributed Generation (DG), mobile storage, etc.).
- Monitor the grid impact of knowing when, where, and what size load will be necessary to support new, flexible location technologies such as: PEVs, mobile distributed generation, and mobile storage.

v.   Deliverables
- Design specification of mobile meter.
- Demonstration of mobile meter hardware prototype.
- End-to-end meter to cash testing using existing AMI or cellular based network.
- Lab testing of use cases on DG applications and PEV metering, including remote and near real-time tracking of vehicle charge locations and energy flow.

vi.   Metrics
- 3a - Maintain/Reduce operations and maintenance costs (Affordability).
- 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Reliability).
- 7j - Provide consumers with timely information and control options (Customer).

vii.   Schedule
- 2.5 years

viii.   EPIC Funds Encumbered
- $867,702

ix.   EPIC Funds Spent
- $898,479

x.   Partners (if applicable)
- Lawrence Livermore National Lab providing technical support for product development

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- Pay for Performance

xiv.   Treatment of Intellectual Property (if applicable)
- Intellectual Property potential being explored

xv.   2016 Status Update

- Project is in the Build/Test phase.
- Executed Request for Proposal, selected vendor and issued contract.
- Developed comprehensive specification for Pacific Gas and Electric Company's Next Generation Mobile Meter (NGM), including multiple test use cases such as behind the meter battery storage devices, Electric Vehicle chargers, etc.
- Finalized hardware/software specifications and mechanical design, and conducted hardware testing.
- Next steps include finalizing prototype, conducting functional testing on Alpha prototypes, complete final integrations and start Quality Assurance products, conduct field trials on Beta prototypes, and complete project final report.

Project #2.30 Leverage EPIC Funds to Participate in Industry-Wide RD&D Programs

i.   Investment Plan Period
- 2nd Triennial (2015-2017)

ii.   Assignment to Value Chain
- Grid Operations/Market Design; Transmission; Distribution; Demand-Side Management

iii.   Objective
- Leverage EPIC dollars by participating and collaborating in multi-utility, industry-wide research, demonstration and deployment initiatives conducted by third-party organizations.

iv.   Scope
- Project scope being further evaluated - TBD

v.   Deliverables
- Project deliverables being further evaluated - TBD

vi.   Metrics
- TBD

vii.   Schedule
- Project schedule being further evaluated - TBD

viii.   EPIC Funds Encumbered
- $0

ix.   EPIC Funds Spent
- $0

x.   Partners (if applicable)
- TBD

xi.   Match Funding (if applicable)
- TBD

xii.   Match Funding Split (if applicable)
- TBD

xiii.   Funding Mechanism (if applicable)
- TBD

xiv.   Treatment of Intellectual Property (if applicable)
- TBD

xv.   2016 Status Update
- Project is currently on-hold.

5 Conclusion

a. Key Results for the Year for PG&E EPIC Programs

Through the course of 2016, PG&E's EPIC 1 and 2 Programs made significant progress and achieved noteworthy successes on many of the projects. Of the 34 active projects across EPIC 1 and EPIC 2, a total of fifteen EPIC 1 projects have completed. Fourteen of these fifteen projects completed in 2016, and PG&E is leveraging the learnings of these projects and applying their results into practice where applicable, including but not limited to:

- Pursuing a production deployment of the technology demonstrated in EPIC 1.08 System Tool for Asset Risk (STAR), which proved the ability to leverage new data analytics techniques to develop and visualize asset risk scores based on severity of risk and probability of occurrence. This may support improvements to distribution system safety and reliability;

- Leveraging the solar irradiance database and web portal that was developed and demonstrated in EPIC 1.05 *Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Outpu*t, which improves the ability to assess current and future grid impacts from PV generation to inform operational decisions with regards to planning and energy procurement;

- Leveraging the technology developed from EPIC 1.21 *Auto Identification of PV Resources* to implement on-going, territory-wide operation by identifying and notifying suspected unauthorized PV interconnected customers to support compliance and customer safety.

The progress and achievements of these projects and others are listed in the Project Status Report found in Appendix A.

Since the inception of the EPIC Program, PG&E has established and maintained strong program management practices to provide oversight of the EPIC Program. In addition to oversight, the Program Management Office provides:

- Communications with interested vendors and suppliers through channels such as referrals and industry events (e.g., Grid Edge Executive Council, Silicon Valley Leadership Group, DistribuTECH, etc.);

- Coordination with the other IOUs and CEC through regular administrator calls and collaboration;

- Collaboration with research entities, such as the Electric Power Research Institute (EPRI);

- Administrator-coordinated execution of industry-wide EPIC workshops and symposiums;

- Other EPIC Program support, such as providing comments and/or Letters of Support to select CEC Program Opportunity Notices (PON).

PG&E's EPIC portfolio of active projects continues to address challenges of the changing grid landscape, including enabling an increase in DER adoption by our customers, the need to modernize the grid to ensure continued safe and reliable operation, and the need to continue improving affordability through advancing how PG&E leverages data. These developments in the marketplace require a focus on more efficient distribution planning tools, enhanced data analytics and forecasting approaches, and extracting value from the growing rate of DERs.

These achievements from the EPIC projects and their future path forward for those technologies that have proven ready to scale help pave the way for the grid of the future, addressing upcoming challenges of a changing grid landscape and, ultimately, improving the safety, reliability and affordability of the electric grid.

b. Next Steps for EPIC Investment Plan

PG&E, in conjunction with the other EPIC Administrators, continue to host bi-annual stakeholder workshops and symposiums with accompanied webinars. The 2016 workshop and symposium took place on June 22, 2016 and December 1st, 2016, respectively. These industry events focused on the sharing of progress, results, and future plans, improving coordination and understanding among the various stakeholders in the EPIC Program while raising awareness and visibility of EPIC investments, and promoting program transparency.

In 2017, PG&E and Administrators will continue to host a workshop and a symposium to achieve the above stated goals, while also preparing for the upcoming 2018-2020 Triennial Investment Plan. The EPIC Administrators will hold scoping workshops, as well as public stakeholder workshops to gain input on the proposed Plans.

PG&E will also continue to promote the EPIC Program through participation in both internal and external public forums, such as industry events and accepting vendor and supplier referrals.

Additionally, PG&E anticipates the closure of one EPIC 1 project and a multitude of EPIC 2 projects in 2017. The findings of these final project results will be shared at industry events, posted to the PG&E EPIC website, and shared directly with relevant industry stakeholders.

c. Issues That May Have Major Impact on Progress in Projects

Inherent to the RD&D nature of the EPIC Program, the market dynamics can change rapidly. Some potential reasons that can impact the projects' progress include:

- Changes in the market place that may have made the project obsolete (or relatively less important to pursue).

- Different technologies have emerged that could produce better insights for the industry and PG&E customers, making some of the original proposed projects no longer the best use of available program funds.

- The technology may prove to not yet be ready for commercialization and/or not yet ready nor capable to support the later stages of the original project objective.

- The vendor interest may drop due to the small-scale pilot size of the project or the vendor may revise their business model such that it is no longer aligned with the projects' objectives.

Furthermore, while the more obvious goal of technology demonstration is to help advance the pre-commercial technologies, there are related goals, which include determining feasibility of future investments in clean technology. In some cases, success may be defined by determining that a project should not proceed to full scale until additional development takes place.

PG&E is mitigating some of this risk by managing the EPIC projects proactively. PG&E continually coordinates both internally and externally to stay aware of the latest technology demonstration needs, and practices enablement focused governance over the project portfolio to help ensure successful and cost-effective technology demonstrations that emphasize continuous learning.

PACIFIC GAS AND ELECTRIC COMPANY

ATTACHMENT B

PG&E'S APPENDIX A TO EPIC REPORT

(PROJECT STATUS REPORT)

PACIFIC GAS AND ELECTRIC COMPANY

APPENDIX A

PROJECT STATUS REPORT

(SEE ATTACHED SPREADSHEET)

Row #	Investment Program Period	Program	Project Name	Project Type	Brief Description of the Project - Objective	Brief Description of the Project - Scope	Brief Description of the Project - Deliverables
	A	B	C	D	E1	E2	E3
For Report DOC	i. Investment Plan Period		Project Name		iii. Objective	iv. Scope	v. Deliverables
1	1st Triennial (2012-2014)	PG&E	1.01 Energy Storage for Market Operations	Renewables/DER Resource Integration	• Develop technologies and strategies for efficient and optimized bidding and scheduling of Energy Storage Technologies (EST) in California Independent System Operator (CAISO) markets and demonstrate those strategies using Pacific Gas and Electric Company's existing Sodium Sulfur Battery Energy Storage Systems (NaS BESS). • This project addresses the following CPUC proceedings: - This project will count towards the Investor Owned Utility energy procurement targets as set forth in D.10 03 040, the Energy Storage Procurement Framework. - As applicable, operational experiences gained from this project can inform outstanding policy and implementation issues as identified in Energy Storage Order Instituting Rulemaking 15 03 011.	• Develop and deploy technology to enable fully automated resource response to CAISO market awards. • Quantify the values that battery resources can capture in CAISO markets. • Establish financial performance of battery resource participation in CAISO markets.	• Demonstrate automated and remote control application for generic energy storage resources to interface with existing SCADA systems. • Report financial performance from participation in CAISO markets. • Report comparison of actual performance vs. hypothetical performance quoted in industry reports. • Comply with regulatory requirements and establish a framework/recommendations for accounting standards applicable to energy storage.
2	1st Triennial (2012-2014)	PG&E	1.02 Energy Storage for Distribution Operations	Renewables/DER Resource Integration	• Demonstrate the ability of a utility operated energy storage asset to address capacity overloads on the distribution system and improve reliability. • This project addresses the following California Public Utilities Commission (CPUC) proceedings: - This project will count towards the Investor Owned Utility energy procurement targets as set forth in D.10 03 040, the Energy Storage Procurement Framework. - As applicable, operational experiences gained from this project can inform outstanding policy and implementation issues as identified in Energy Storage OIR R.15 03 011.	• Deploy utility operated energy storage asset at a single site. • Demonstrate peak shaving use case along with other site-specific use cases as suggested by distribution operators.	• Identify energy storage site based on project objectives. • Identify an economic modeling tool to compare the planned traditional utility with alternatives using distributed resources or demand-side investments. • Construct and integrate energy storage system. • Test system and analyze results to prove project objectives.
3	1st Triennial (2012-2014)	PG&E	1.03 Mobile and Stationary Energy Storage Synergies	Renewables/DER Resource Integration	• The project aims to reduce existing barriers to deployment of battery energy storage systems by demonstrating whether post-electric vehicle (EV) "second life" batteries can cost-effectively perform electric distribution services. The project will demonstrate the potential for reduced energy storage system costs via a) the development of an integration platform for deploying such batteries (Phase 1) and b) the use of lower cost "second life" batteries in the integrated platform (Phase 2).	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
4	1st Triennial (2012-2014)	PG&E	1.04 Expand Test Lab and Pilot Facilities for New Energy Storage Systems. Formally Withdrawn. CPUC A.12-11-003, 10/15/2013.	Renewables/DER Resource Integration	N/A	N/A	N/A
5	1st Triennial (2012-2014)	PG&E	1.05 New Forecast Methods for Improved Storm Damage Modeling	Renewables/DER Resource Integration	• Demonstration of emerging capabilities in mesoscale modeling to provide more granular and accurate weather forecasting input to Pacific Gas and Electric Company's (PG&E) storm damage prediction model, and to other PG&E forecasting applications, like catastrophic wildfire risk and Photovoltaic (PV) generation. The main goal is more effective and granular damage prediction, and therefore more efficient response to storm events.	• Project focus is on development, deployment, and implementation of an operational version of the Weather Research and Forecasting (WRF) mesoscale model to support PG&E's forecasting program related to fire, storms and solar production. • Not in scope for this project are enhancements to PG&E's Restoration Work Plan other than improved forecast damage numbers.	• Fully functional mesoscale modeling system known as POMMS (PG&E Operational Mesoscale Modeling System) that will provide the following: - Detailed weather input into PG&E's damage prediction modeling system (SOPP). - Next generation wildfire threat awareness system. - Historical and forecast solar irradiance data to internal PG&E stakeholders.
6	1st Triennial (2012-2014)	PG&E	1.06 Demonstrate Communication Systems Allowing the CAISO to Utilize Available Renewable Generation Flexibility	Renewables/DER Resource Integration	• This project would demonstrate the use of accepted communications protocols to allow the California Independent System Operator (CAISO) to send an operating signal to reduce output under specified conditions, as allowed by contracts.	Project scope being further evaluated - TBD	Project deliverables being further evaluated - TBD

Row #	Investment Program Period	Program	Project Name	Project Type	Brief Description of the Project - Objective	Brief Description of the Project - Scope	Brief Description of the Project - Deliverables
	A	B	C	D	E1	E2	E3
For Report DOC	i. Investment Plan Period		Project Name		iii. Objective	iv. Scope	v. Deliverables
7	1st Triennial (2012-2014)	PG&E	1.07 Demonstrate Systems to Ramp Existing Gas-Fired Generation More Quickly to Adapt to Changes in Variable Energy Resources Output	N/A	N/A	N/A	N/A
8	1st Triennial (2012-2014)	PG&E	1.08 Distribution System Safety and Reliability Through New Data Analytics Techniques	Grid Modernization and Optimization	• Develop and demonstrate a new data analytics technique to improve distribution system safety and reliability. The project specifically developed and tested a System Tool for Asset Risk (STAR), which is an enterprise software application that Electric Operations will use to calculate and display (graphically and geospatially) risk scores for electric transmission, substation and distribution assets. The STAR will enable an automated, system-wide application to improve risk identification, prioritization, and investment decisions to support electric system safety.	• Demonstrate whether the ever-increasing amounts of data can be mined and combined for targeted, cost-effective use for improved asset management. • Potential scenarios include risk-based asset management, safety hazard mitigation and proactive outage prediction using self-serve and virtual integration environments.	• Overview of existing applications and data sources. • Assessment of existing data source quality. • High-level future business processes by functional area. • Inventory of asset risk algorithms (formulas or complexity) for "In Scope" asset classes. • High-level Change Management Approach. • Prioritized and phased implementation plan. • Cost estimate for full implementation of the STAR project. • Proof of concept prototype.
9	1st Triennial (2012-2014)	PG&E	1.09A Close Proximity Switching	Grid Modernization and Optimization	• This project explores and seeks to discover effective, new tools to safely operate "Solid Blade in Oil Rotatory Switches."	• Test new tools and techniques for safe operation of Solid Blade in Oil Rotatory Switches. • Evaluate alternatives to decrease probability of injury to workers and public. • Help design a robotic tool to allow remote operation. • Develop the necessary parts/adaptors to be used on various types (manufacturer, brand, age, etc.) of Solid Blade in Oil Rotatory Switches.	• A working prototype for the various Solid Blade in Oil Rotatory Switch tools.
10	1st Triennial (2012-2014)	PG&E	1.09B and 1.10B - Network Conditioned-Based Maintenance	Grid Modernization and Optimization	• The project focus is on development, testing, deployment, and implementation of new technologies, construction methods and techniques, and cost reduction techniques in support of the Supervisory Control and Data Acquisition (SCADA) monitoring systems used on the Distribution Networks. The monitoring system consists of a complex and extensive set of components used to assess the health and condition of the network transformers on a continuous basis. This research is looking at potential failure points on the monitoring system components and what technologies and improvements can be applied to increase life expectancy of these components and reduce production and maintenance costs for this system and similar systems.	• Assess new technologies and feasibility of application on the Distribution Networks. • Primary focus on technologies, components and work methods to extend the life expectancy of monitoring systems equipment and reduce long term maintenance costs.	• Modified or improved components identified for use on Distribution Network Monitoring System. • Improved installation and construction work methods. • Economic model for maintenance variables based on life expectancy testing of components. • Changes to components.
11	1st Triennial (2012-2014)	PG&E	1.09C Discrete Series Reactors (DSRs)	Grid Modernization and Optimization	• Gain operating experience with Discrete Series Reactors (DSR) to determine whether such devices would be cost effective and operate reliably and safely on Pacific Gas and Electric Company's (PG&E) transmission system.	• Install and test 90 DSR units on the Las Positas-Newark 230 kV line. • Install and test Server at PG&E's San Francisco General Office (SFGO) headquarters, complete with Smart Wire System Manager Software. • Communication links between the DSRs and server to support the DSR monitoring and control.	• Installation, testing and analysis of DSR and server communication links. • Job Estimate to engineer, procure, construct and test the DSRs. • White paper describing project including go/no go recommendation. • Final report describing overall project, including finding from the operations and testing of DSR units and a recommendation as to whether or not to install the DSRs elsewhere in the PG&E system.
12	1st Triennial (2012-2014)	PG&E	1.10A Dissolved Gas Analysis	Grid Modernization and Optimization	• Develop tools and algorithms that analyze data from monitoring equipment installed on substation equipment (distribution and transmission) that tests for dissolved gasses or other precursor data that would assist in understanding the condition of the equipment.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
13	1st Triennial (2012-2014)	PG&E	1.10C Underground Cable Analysis	Grid Modernization and Optimization	• Develop tools and algorithms that analyze load and operating characteristic data from underground cables in order to develop an understanding of potential failure points, cable maintenance needs, and cable life expectancy.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD

Row #	Investment Program Period	Program	Project Name	Project Type	Brief Description of the Project - Objective	Brief Description of the Project - Scope	Brief Description of the Project - Deliverables
	A	B	C	D	E1	E2	E3
For Report DOC	i. Investment Plan Period		Project Name		iii. Objective	iv. Scope	v. Deliverables
14	1st Triennial (2012-2014)	PG&E	1.11 Demonstrate Self-Correcting Tools to Improve System Records and Operations	Grid Modernization and Optimization	• Demonstrate tools that identify and "register" existing assets to improve the integration between utility planning and operations. As part of the demonstration, implement "self-correcting" technologies that identifies plan vs. actual discrepancies and updates system records automatically. High priority use cases include: (1) Mapping of transformers to primary phase; (2) Mapping of customers to transformers; and (3) Precision mapping of Pacific Gas and Electric Company's overhead and underground network.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
15	1st Triennial (2012-2014)	PG&E	1.12 Demonstrate New Technologies That Improve Wildlife Safety and Protect Assets From Weather-Related Degradation	Grid Modernization and Optimization	• Demonstrate new strategies and technologies to improve animal and bird protection, reduce outages caused by animals and birds, and protect assets from expensive weather related degradation such as fog related corrosion.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
16	1st Triennial (2012-2014)	PG&E	1.13 Demonstrate New Communication Systems to Improve Substation Automation and Interoperability	Grid Modernization and Optimization	• Demonstrate new strategies and technologies to convert and integrate multiple existing proprietary technologies within the substation environment for more effective operations. Substation are key operational hubs and represent significant investments, which must be further leveraged by engaging with vendors to create the next generation of interoperable substation services and products.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
17	1st Triennial (2012-2014)	PG&E	1.14 Next Generation SmartMeter™ Telecom Network Functionalities	Grid Modernization and Optimization	• This project explores and discovers effective new network applications and devices to leverage and improve the SmartMeter™ communications network.	• Leverage the existing SmartMeter™ network to support additional applications. Inform future uses of the SmartMeter™ network as to message capability, security, latency, and engineering constraints. Specifically focus on: - Test new devices to support network functions and capabilities not previously envisioned (e.g., new data streams, faster data collection). - Evaluate alternatives to decrease future upgrade, maintenance and/or operational costs. - Demonstrate different network applications, each focused on separate use cases.	• Evaluate new applications and devices, their associated data traffic impact on the SmartMeter™ network, and recommend which items warrant consideration for full scale deployment. • Develop business case based on findings for full deployment consideration.
18	1st Triennial (2012-2014)	PG&E	1.15 Grid Operations Situational Intelligence	Grid Modernization and Optimization	• The objective of this pilot is to develop and pilot a real-time data visualization software platform for use by Electric Distribution Operations end users. Data will be integrated from various data sources and displayed on Distribution Control Center video walls and individual desktop computers, with potential for future scalability to handheld devices.	• Scope includes the integration of data (network model, loading, SmartMeter™ devices, outages, fire, weather, etc.) and a real-time data visualization platform for Distribution Operations. • The Distribution Management System (DMS) platform and predictive analytics are not included in the scope.	• Demonstrate Real-time Data Visualization Platform, including data integration from a variety of data sources and a visual interface that includes geospatial, list, and trending layers.

Row #	Investment Program Period	Program	Project Name	Project Type	Brief Description of the Project - Objective	Brief Description of the Project - Scope	Brief Description of the Project - Deliverables
	A	B	C	D	E1	E2	E3
For Report DOC	i. Investment Plan Period		Project Name		iii. Objective	iv. Scope	v. Deliverables
19	1st Triennial (2012-2014)	PG&E	1.16 Vehicle-to-Grid Operational Integration	Grid Modernization and Optimization	• Leverage plug-in hybrid vehicle technology emerging in Pacific Gas and Electric Company (PG&E) fleet to generate utility-grade power, supporting distribution circuits during planned or unplanned outage events.	• Develop nominally 120 kilowatt exportable power capabilities from a plug in hybrid electric truck. Seek to create the protocols necessary to safely connect the truck to the appropriate grid connection points. The portfolio of fleet vehicles (higher and lower weight classes) may broaden the range of available power ratings demonstrated by the project.	• Develop operating requirements for the vehicle. • Understand engineering challenges with high power export with collaborative supplier development to solve. • Develop safety and interconnection protocols to connect the vehicle to the grid leveraging existing protocols for temporary local generator set connection. • Define and document power requirements for different outage/usage scenarios. • Develop operating protocols (when and how the vehicles will be used). • Develop unplanned outage protocols. • Develop the hardware and software (if required) to connect the vehicle to PG&E's system. • Build vehicles for field testing.
20	1st Triennial (2012-2014)	PG&E	1.17 Industry Participation to Leverage EPIC Dollars	N/A	N/A	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
21	1st Triennial (2012-2014)	PG&E	1.18 Appliance-Level Load Disaggregation	Customer Service and Enablement	• This project focuses on delivering the cost by major appliances to customers.	• This project will use the data enabled by the SmartMeter™ platform to provide appliance level itemization of monthly bill charges to customers, without their completing any audit or subscribing to any new service. This project assumes that minute level meter data is available.	• Quantify disaggregation accuracy and compare vendors. • Based on results, provide recommendations for deployment strategy of appliance level billing.
22	1st Triennial (2012-2014)	PG&E	1.19 Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	Customer Service and Enablement	• The project is to explore and discover effective, new data that can be collected and studied for further benefits. Demonstrate the type of additional data that can be collected and/or processed through the SmartMeter™ platform. Evaluate impact of any increased data traffic on the SmartMeter™ network. Focus on new data collection that makes the SmartMeter™ platform more robust for more customers.	• Demonstrate the collection of new data from SmartMeter™ devices. Example use cases include: - Power Quality Data (C12.19 format). - New Data Channels. - Mobile data collection methods. - Power theft detection methodology using SmartMeter™ data for revenue assurance purposes.	• Evaluate new data and analytic methodologies, their associated impact on the SmartMeter™. • Recommendation of which data warrants consideration for full-scale deployment. • Evaluation should provide key inputs to a business case for general deployment.
23	1st Triennial (2012-2014)	PG&E	1.20 Demonstrate the Benefits of Providing the Competitive, Open Market With Automated Access to Customer-Authorized SmartMeter™ Data to Drive Innovation.	Customer Service and Enablement	N/A	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD

Row #	Investment Program Period	Program	Project Name	Project Type	Brief Description of the Project - Objective	Brief Description of the Project - Scope	Brief Description of the Project - Deliverables
	A	B	C	D	E1	E2	E3
For Report DOC	i. Investment Plan Period		Project Name		iii. Objective	iv. Scope	v. Deliverables
24	1st Triennial (2012-2014)	PG&E	1.21 Automatic Identification of Distributed Photovoltaic (PV) Resources	Customer Service and Enablement	• This project aims to validate and integrate a software platform to identify photovoltaic (PV) resources by leveraging Smart Meter™ data. This project focuses on addressing the issue of unauthorized interconnections in an automated fashion by developing and algorithm to identify resources, including integration with Pacific Gas and Electric Company (PG&E) billing and interconnection database, as well as develop an automated outreach system for identified customers. • This project addresses California Public Utilities Commission proceeding, R.11 09 011 Rule 21 to support the improved distribution level interconnection rules and regulations for certain classes of electric generators and electric storage resources.	• Identify vendor to develop or pilot software. • Develop integration and communication platform for auto identification of Unauthorized Interconnections (UI). • Demonstrate ability to automatically integrate software with billing and interconnection.	• Successful integration of software with PG&E's Customer Care and Billing (CC&B) system. • Successful tracking of all UIs identified. • Successful tracking of communication and "conversion" of UIs to interconnection.
25	1st Triennial (2012-2014)	PG&E	1.22 Electric Vehicle Submetering	Customer Service and Enablement	• EV submetering pilot to test subtractive metering process and Electric Vehicle Service Provider (EVSP) business models. • This project addresses California Public Utilities Commission proceeding, which requires Pacific Gas and Electric Company (PG&E), along with the other two California Investor Owned Utilities (IOU), to pursue a submetering pilot and eventual protocol.	• Electric Vehicle (EV) submetering pilot will entail EV Meter Data Management Agents (MDMA) delivering submeter data to IOU for subtraction from customer's primary meter to create an EV and a house bill. Customer will be responsible for both bills. In Phase 2, an additional business model will be introduced where the MDMA will be responsible for the bill to PG&E.	• Process to receive MDMA submetered data. • Process to subtract EV data from primary meter to create two bills. • Inclusion of EV portion of bill on customer's monthly bill. • Process for billing MDMA for participant submeter charges. • Obtain third party evaluator for both phases of pilot through a Request for Proposal (RFP). • Incentive payments to MDMA.
26	1st Triennial (2012-2014)	PG&E	1.23 Photovoltaic (PV) Submetering	Customer Service and Enablement	• Initiative to obtain additional un-netted Photovoltaic (PV) data to support customer call center bill experience, and provide additional service to its customers. PV generation data will be integrated with existing MyEnergy web portal for customers' benefit. • This project addresses California Public Utilities Commission proceeding, Net Energy Metering R.12-11-005 and R.11 09 011 Rule 21.	• Explore four different methods for obtaining PV generation data (Dedicated SmartMeter™, submeter communication via ZigBee radio, third party estimates, and data exchange with solar companies, and work with vendor to relay data to customer.	• Implement pilot program for dedicated smart meters and third party estimates. • Explore opportunities for submetering technology and solar company data exchange. • Modify existing Customer Data Warehouse (CDW)/MyEnergy interface to allow for additional data streams and visualization. • Evaluate relative merits of various generation measurement/estimation approaches.
27	1st Triennial (2012-2014)	PG&E	1.24 Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	Customer Service and Enablement	• Assess how to best utilize DSM resources to create a targeted customer- and location-specific approach to assist with distribution capacity constraints. • This project addresses California Public Utilities Commission proceeding, Distribution Resources Planning R.14 08 013, through improving efficiencies between interconnection and integration.	• Improve ability to estimate Heating, Ventilation and Air Conditioning (HVAC) Direct Load Control (DLC) load impacts at the distribution feeder level to aid in better understanding of the localized impact of HVAC DLC devices on meeting distribution feeder level reliability concerns.	• Deploy data logging devices on a scientific sample of existing SmartAC™ Cycling customers, to enable real time monitoring of device performance and load impacts at feeder level. • Develop infrastructure to make real-time data available on feeder-level load impacts of SmartAC™ Cycling to distribution operations. • Produce report describing a case study methodology of targeting and valuing customer side peak load reductions at the feeder level.
28	1st Triennial (2012-2014)	PG&E	1.25 Direct Current (DC) Fast Charging Mapping	Customer Service and Enablement	• Develop, pilot, and validate approaches that help determine the optimal location of DC fast chargers based on traffic patterns and distribution grid infrastructure.	• Acquire travel pattern data and grid infrastructure capability data to identify low cost, high utilization areas in which to integrate DC fast chargers into Pacific Gas and Electric Company's (PG&E) distribution system.	• Develop a process to identify optimal DC fast charging sites. • Develop a map that presents the locations of optimal DC fast charging sites in a meaningful manner to customers.

Row #	Investment Program Period	Program	Project Name	Project Type	Brief Description of the Project - Objective	Brief Description of the Project - Scope	Brief Description of the Project - Deliverables
	A	B	C	D	E1	E2	E3
For Report DOC	i. Investment Plan Period		Project Name		iii. Objective	iv. Scope	v. Deliverables
29	1st Triennial (2012-2014)	PG&E	1.26 Pilot Measurement and Telemetry Strategies and Technologies That Enable the Cost-Effective Integration of Mass Market Demand Response (DR) Resources Into the CAISO Wholesale Market	Customer Service and Enablement	• Develop, pilot and validate approaches and technologies that enable the cost effective integration (specifically, the measurement and telemetry) of mass market DR resources into the California Independent System Operator (CAISO) wholesale market. While other DR projects focus on integration of DR resources into various utility and future Independent System Operator operational needs, this project intends to test alternative telemetry solutions and technologies to satisfy CAISO operational visibility requirements.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
30	2nd Triennial (2015-2017)	PG&E	2.01 Evaluate Storage on the Distribution Grid	Renewables/DER Resource Integration	• Identify and evaluate whether system needs can be cost-effectively addressed with energy storage, including identifying a range of storage deployment locations and grid interconnection requirements on a granular level.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
31	2nd Triennial (2015-2017)	PG&E	2.02 Pilot Distributed Energy Management Systems (DERMS)	Renewables/DER Resource Integration	• Demonstrate new technology to monitor and control Distributed Energy Resources (DER) to manage system constraints and evaluate the potential value of DER flexibility to the grid. The DERMS pilot will drive learning about the people, process, and technology needed to operate the high DER penetration grid of 2025. • Create, test, and iterate on future DERMS requirements (e.g., communication requirements for PG&E and third party owned DERs). • Learn about business process change and personnel skills & knowledge needed to implement DERMS. • Enable informed choice for long-term strategic vendor in 2017+ (pilot is not choosing the long term vendor). • This project addresses California Public Utilities Commission proceeding, Distribution Resources Plan R.14 08 013 to inform distribution planning by demonstrating DER integration into planning and operations.	• Demonstrate minimum viable DERMS operation at Pacific Gas and Electric Company (PG&E) to address key DER management use cases. • The demonstration will take place in a limited geography with a diverse set of DERs being monitored and controlled by the pilot DERMS.	• The functional integration of a DERMS software minimum viable product and operational demonstration of the identified use cases. • A report that: - Determines the most important characteristics of a full deployment solution including detailed functional and technical requirements. - Identifies best practices and required internal capabilities for a full deployment solution. - Develops operational processes that can be scaled to a wider system deployment. - Defines boundaries and integrations with other PG&E systems (e.g., DRMS, DMS, market systems). - Develops a point of view on the utility role in managing DERs for grid and economic benefits.
32	2nd Triennial (2015-2017)	PG&E	2.03A Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	Renewables/DER Resource Integration	• This project will explore the use and impact of aggregated customer-sited smart inverters to help inform emerging industry standards, as well as define the operational and communication requirements to support the advancement and deployment of new inverter technologies. • This project addresses California Public Utilities Commission proceeding, Distribution Resources Plan R.14 08 013, by informing Distributed Energy Resources modeling by incorporating Smart Inverters.	• This project will leverage the results of the lab testing of smart inverter functionalities that is being completed by Pacific Gas and Electric Company's (PG&E) Smart Grid Pilot Volt/Var Optimization (VVO) Project at PG&E's Applied Technologies Lab (as specified by the Smart Inverter Working Group). • This EPIC project will deploy smart inverters on one or more feeders to evaluate their effectiveness in improving PV integration and mitigation safety risks.	• Identify feeder(s) where Smart Inverters will be installed for demonstration. • Demonstrate the use of Smart Inverters on one or more feeders to demonstrate the inverters' local voltage control capabilities and impacts related to high penetration of customer sited solar PV. • Develop any necessary communications software/hardware/technologies between the utility and third party aggregator or end devices. • Evaluate the performance of Smart Inverters.
33	2nd Triennial (2015-2017)	PG&E	2.03B Test Smart Inverter Enhanced Capabilities - Vehicle to Home	Renewables/DER Resource Integration	• As a complement to the smart inverter assessment related to Photovoltaics (PV) in project 2.03A. Smart Inverters for PV, this project will assess the use and impact of EV energy flow capabilities, as required by D.15-04-020.	• This EPIC project will enable dispatchable charging and discharging of the Electric Vehicle (EV) in response to demand response or hard islanding events. Multiple test modes will be tested.	• Evaluation of the performance of the EV energy flow capabilities to support residential load during DR and hard islanding events.
34	2nd Triennial (2015-2017)	PG&E	2.04 DG Monitoring & Voltage Tracking	Renewables/DER Resource Integration	• This project aims to utilize the voltage measurement capabilities of SmartMeter™ devices to monitor Distributed Generation (DG) output and identify voltage fluctuations caused by the intermittent nature of distributed renewable resources. Project will use data analytics techniques and Advanced Metering Infrastructure (AMI) (and other) data to determine the impact of PV penetration on Rule 2 violations and create a rating for the probability that a Rule 2 violation is caused by DG.	• Create an algorithmic process output rating on the likelihood of a voltage violation (on a given transformer) being caused by DG fluctuations.	• Develop an analytics process/algorithm to analyze AMI and other data for high penetration DG feeders, as well as some low penetration feeders for baselining. • Evaluate impact of DG penetration on voltage.

Row #	Investment Program Period	Program	Project Name	Project Type	Brief Description of the Project - Objective	Brief Description of the Project - Scope	Brief Description of the Project - Deliverables
	A	B	C	D	E1	E2	E3
For Report DOC	i. Investment Plan Period		Project Name		iii. Objective	iv. Scope	v. Deliverables
35	2nd Triennial (2015-2017)	PG&E	2.05 Inertia Response Emulation for DG Impact Improvement	Renewables/DER Resource Integration	• Demonstrate the capability to emulate inertia injection and support primary frequency control using energy storage and smart inverter technologies to potentially mitigate the impacts of large-scale Distributed Generation (DG) to the grid, improve the grid performance and reliability, and advance California energy policy to increase the amounts of renewable and distributed generation on the grid.	• Analyze and optimize energy storage inertial response capabilities.	• Test, optimize and assess energy storage inertial response capabilities in a lab, island and grid-tied scenarios. • Provide inertial response recommendations for future inverter and interconnection requirements.
36	2nd Triennial (2015-2017)	PG&E	2.06 Intelligent Universal Transformer (IUT)	Renewables/DER Resource Integration	• The project objective is to develop and demonstrate a solid-state transformer field prototype Medium Voltage Fast Charger (MVFC) system, as an application use case of solid-state transformers for Direct Current (Direct Current) fast charging of Plug In Electric Vehicles (PEV), featuring intelligent controls and multiple fast charging of PEVs.	• Test demonstration and communication to the same DC solid-state transformer with two protocols.	• Demonstrate a proof of concept that may: 1. an Intelligent Universal Transformer (IUT) can be used in lieu of other equipment to connect to Direct Current Fast Charge (DCFC) protocols, and 2. an IUT can communicate back to the utility.
37	2nd Triennial (2015-2017)	PG&E	2.07 Real-Time Loading Data for Distribution Operations and Planning	Grid Modernization and Optimization	• This demonstration will leverage near real time and interval data to improve feeder modeling, inform load allocation throughout the distribution grid and transformer loading profiles, and identify opportunities to enhance current load forecasting processes for distribution transformers, feeders and substation transformers.	• Current technology does not allow for real time line or transformer loading information without full Supervisory Control and Data Acquisition (SCADA) penetration. • Project will aggregate the meter loading to the transformer level at a higher frequency level.	• Develop a unique loading algorithm and rubrics for determining cost effective data sources and cadences.
38	2nd Triennial (2015-2017)	PG&E	2.08 "Smart" Monitoring and Analysis Tools	Grid Modernization and Optimization	• Demonstrate strategies and technologies for real time, online monitoring of substation equipment; Demonstrate communication protocols and equipment to support the smart devices; Develop visualization techniques for improved monitoring; and evaluate new vendor technologies that enable data correlation and predictive analysis to better identify and respond to potential safety, reliability and/or operational issues.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
39	2nd Triennial (2015-2017)	PG&E	2.09 Distributed Series Impedance (DSI) (Phase 2)	Grid Modernization and Optimization	• Demonstrate congestion mitigation by installing DSIs on parallel transmission facilities to demonstrate the next generation of the Distributed Series Reactor (DSR) devices from the First EPIC Triennial Plan, which may allow for better control of transmission line loading.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
40	2nd Triennial (2015-2017)	PG&E	2.10 Emergency Preparedness Modeling	Grid Modernization and Optimization	• Incorporate natural hazard damage model information into one integrated algorithm/tool, which would provide the ability to quickly estimate the impacts of natural hazards on Pacific Gas and Electric Company facilities to enable faster response and restoration. • Provide the ability to prepare for these hazards by proactively modeling the impacts of potential hazards, to understand system vulnerabilities and restoration resource requirements. • Incorporate work efficiency optimization algorithms to more efficient allocate crews.	• Develop optimization algorithms and visualization tool that includes asset locations and conditions with multiple potential hazards, which allows for the aggregation of equipment damage estimates (via damage models, outage information systems, and damage assessments), est. hours to repair, and recommended allocation of work resources to efficiently respond to a natural hazard.	• Complete algorithms that aggregate data from multiple sources to feed into application. • Incorporate multiple algorithms into a proof of concept visualization tool. • Develop recommendation for deployment strategy.
41	2nd Triennial (2015-2017)	PG&E	2.11 New Mobile Technology & Visualization Applications	Grid Modernization and Optimization	• Demonstrate tailored, advanced mobile applications for Pacific Gas and Electric Company field operations that build upon Grid Operations Situational Intelligence (Project #15) demonstration projects in the EPIC First Triennial Plan as well as existing "baseline" mobile deployments underway.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
42	2nd Triennial (2015-2017)	PG&E	2.12 New Emergency Management Mobile Applications	Grid Modernization and Optimization	• Develop new mobile applications to enhance Pacific Gas and Electric Company's emergency preparedness and response capabilities.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
43	2nd Triennial (2015-2017)	PG&E	2.13 Digital Substation/Substation Automation	Grid Modernization and Optimization	• Investigate and evaluate sustainable protection and control technologies for future "digital" substations, which may include testing technologies in a lab setting, and performing a pilot implementation to demonstrate technology adoption and integration with legacy substation protection and control technologies.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD

Row #	Investment Program Period	Program	Project Name	Project Type	Brief Description of the Project - Objective	Brief Description of the Project - Scope	Brief Description of the Project - Deliverables
	A	B	C	D	E1	E2	E3
For Report DOC	i. Investment Plan Period		Project Name		iii. Objective	iv. Scope	v. Deliverables
44	2nd Triennial (2015-2017)	PG&E	2.14 Automatically Map Phasing Information	Grid Modernization and Optimization	• This project aims to explore a variety of pre-commercial analytics and/or hardware options to automatically map 3-phase electrical power information in order to improve the distribution network models. Use of Advanced Metering Infrastructure (AMI) data; Light Detection and Ranging mapping technology; Micro Phasor Measurement Units (PMU); and hardware at the transformer may provide this automated capability.	• Project seeks to improve distribution network models through automatic mapping of 3 phase electrical power information.	• Develop algorithm or novel process to use AMI data and other sources to determine the assignment of Phases to conducting components. • Complete an analysis on the most cost-effective frequency for running such a mapping process.
45	2nd Triennial (2015-2017)	PG&E	2.15 Synchrophasor Applications for Generator Dynamic Model Validation	Grid Modernization and Optimization	• This project will evaluate new Synchrophasor analysis applications that can perform generator dynamic model parameter estimation and validation using disturbance data recorded by the Synchrophasor system. New Synchrophasor applications could perform mandated generator model validation without requiring time and labor intensive on-site tests, and could detect subsynchronous resonance and other conditions which can cause generator outages. The objective of this project is to determine if this analysis is accurate and cost-effective on Pacific Gas and Electric Company's system.	• Scope is limited to confirming that analysis of Phasor Measurement Unit (PMU) data is equal to costly on-site model validation in the target geography. Scope does not include widespread deployment of PMUs or validation process.	• Install Synchrophasors (or "PMUs") on generators or generator tie-lines, and test new data analysis software applications. • Evaluate the applications' ability to perform generator dynamic model validation by analyzing Synchrophasor data following transient disturbances on the transmission system.
46	2nd Triennial (2015-2017)	PG&E	2.16 Enhanced Synchrophasor Analytics & Applications	Grid Modernization and Optimization	• Demonstrate new techniques to synthesize Synchrophasor data and utilize the data for advanced real-time system applications, such as wide-area monitoring, protection, and control systems, which could help move Synchrophasor applications beyond planning, forensics, and visualization to enhanced wide-area monitoring, protection, and control applications.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
47	2nd Triennial (2015-2017)	PG&E	2.17 Geomagnetic Disturbance (GMD) Evaluation	Grid Modernization and Optimization	• Evaluate system vulnerability to GMD by modeling GMD that occurs during a geomagnetic storm and evaluating the impact on transmission lines, interconnection lines, substations and system voltages.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
48	2nd Triennial (2015-2017)	PG&E	2.18 Optical Instrument Transformers and Sensors for Protection and Control Systems	Grid Modernization and Optimization	• Demonstrate newer technologies, such as optical sensors, as well as strategies and technologies to configure appropriate protection settings, including the coordination required between both new and conventional instrumentation.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
49	2nd Triennial (2015-2017)	PG&E	2.19 Enable Distributed Demand-Side Strategies & Technologies	Customer Service and Enablement	• Demonstrate distributed demand-side technologies and approaches to address local and flexible resource needs. • This project addresses California Public Utilities Commission proceeding, Distribution Resources Plan R.14 08 013, by demonstrating Distributed Energy Resource locational benefits and addressing capacity constraints through aggregated behind the meter (BTM) customer energy storage.	• Deploy an aggregation of BTM customer energy storage resource to reduce peak loading or absorb distributed generation on a utility distribution feeder(s).	• Demonstrate and test field results for effectiveness of the use of aggregated customer-sited BTM energy storage resources to peak load reduction reduce peak loading or absorb distributed generation on a utility distribution feeder(s). • Potential to demonstrate communications with aggregate resources for visualization and control. • Evaluate cost-effectiveness and reliability of BTM energy storage for addressing capacity constraints.
50	2nd Triennial (2015-2017)	PG&E	2.20 Real-Time Energy Usage Feedback to Customers	Customer Service and Enablement	• Evaluate innovative feedback technologies to provide near real-time energy usage information to customers and to drive greater customer performance during DR events.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
51	2nd Triennial (2015-2017)	PG&E	2.21 Home Area Network (HAN) for Commercial Customers	Customer Service and Enablement	• This project will demonstrate the application of HAN technology to Pacific Gas and Electric Company's commercial customers.	• This project will enable the ZigBee HAN radio on Large Commercial and Industrial (LCI) meters, to facilitate LCI customer access to real time usage data, as well as testing of the integration with existing Energy Management Systems (EMS).	• Install ZigBee HAN devices with selected LCI customers and connect devices to SmartMeter™ devices. • Monitor customer usage and issue/collect customer and vendor surveys. • Complete report with identified issues and recommendations for how to integrate with an existing EMS.

Row #	Investment Program Period	Program	Project Name	Project Type	Brief Description of the Project - Objective	Brief Description of the Project - Scope	Brief Description of the Project - Deliverables
	A	B	C	D	E1	E2	E3
For Report DOC	i. Investment Plan Period		Project Name		iii. Objective	iv. Scope	v. Deliverables
52	2nd Triennial (2015-2017)	PG&E	2.22 Demand Reduction Through Targeted Data Analytics	Customer Service and Enablement	• Identify strategic customers and target demand reduction in local areas by combining and integrating multiple Demand Side Management technologies (e.g., Energy Efficiency (EE), Demand Response (DR), Distributed Energy Storage, Consumer oriented Energy Tools). • Investigate whether Pacific Gas and Electric Company can achieve a sufficient amount of demand reduction, give visibility into the customer-side resources and improve the reliability of customer-side resources at the local level, in order to reschedule local capacity expansion expenditures. • This project addresses California Public Utilities Commission proceeding, Distribution Resources Plan R.14 08 013, by supporting the fair and transparent processes for Distributed Energy Resource (DER) deployment and integration.	• Develop a solution/tool that determines needed customer demand reduction individually and in aggregate at asset level, leveraging interval and Supervisory Control and Data Acquisition (SCADA) data. • Develop cross DER customer targeting to address forecasted capacity challenges at specific assets, for specific days and times of year, leveraging interval data and other customer attributes.	• Create a data analytics platform capable of combining and analyzing multi structured data, linking to a variety of data sources. • Develop a method for identification, valuation, implementation, and tracking of targeted DERs. • Create a quantitative screening/rank order tool. • Develop actionable DER recommendations to customer outreach teams for reaching demand reduction goals.
53	2nd Triennial (2015-2017)	PG&E	2.23 Integrate Demand Side Approaches Into Utility Planning	Customer Service and Enablement	• This project will enhance Pacific Gas and Electric Company's ability to incorporate the growing usage of Distributed Energy Resources (DER) into distribution planning tools by developing new customer class load shapes that incorporate DERs and a methodology for modeling DER deployment uncertainty at the circuit level. • The execution of this project addresses issues as identified in the following proceedings: Distribution Resources Plan R.14-08-013 and Assembly Bill 327 Section 769, which requires transparent and consistent methods to integrate cost effective DERs into the distribution planning process.	• Integrate a broader range of customer-side technologies and DER approaches into grid planning and operations in a least cost framework by enhancing distribution load forecasting tools to include new customer load shapes based on the usage of DERs and to model the uncertainty of DER deployment at the circuit level.	• Develop enhanced Customer and DER Load Shapes Catalog in LoadSEER Planning Tool. • Incorporate DER Scenario Projections into LoadSEER. • Develop interface between LoadSEER and CYME for batch processing integration.
54	2nd Triennial (2015-2017)	PG&E	2.24 Appliance Level Bill Disaggregation for Non-Residential Customers	Customer Service and Enablement	• Demonstrate the ability to use sub-minute level usage information to determine appliance load for non-residential customers.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
55	2nd Triennial (2015-2017)	PG&E	2.25 Enhanced Smart Grid Communications	Cross-Cutting/Foundational	• Evaluate license spectrum providers that have developed technologies offered on the Federal Communications Commission (FCC) license frequency range/spectrum.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD
56	2nd Triennial (2015-2017)	PG&E	2.26 Customer & Distribution Automation Open Architecture Devices	Cross-Cutting/Foundational	• Demonstrate the means by which new customer and distribution devices could interoperate with Pacific Gas and Electric Company's Advanced Metering Infrastructure (AMI) network (IPv6).	• Demonstrate the methodology, protocols, and standards for customers and vendors to connect and communicate various new devices and applications (e.g., Home Area Network, Electric Vehicle charging, smart appliances, etc.) with the AMI network (IPv6) in an effective manner.	• Conduct lab testing that will certify customer open architecture devices/applications that are AMI compatible, secure and interoperable. • Provide physical and application interfaces, as a Proof of Concept, which will permit customer and third party devices to connect to our AMI network(s).

Row #	Investment Program Period	Program	Project Name	Project Type	Brief Description of the Project - Objective	Brief Description of the Project - Scope	Brief Description of the Project - Deliverables
	A	B	C	D	E1	E2	E3
For Report DOC	i. Investment Plan Period		Project Name		iii. Objective	iv. Scope	v. Deliverables
57	2nd Triennial (2015-2017)	PG&E	2.27 Next Generation Integrated Smart Grid Network Management	Cross-Cutting/Foundational	• Evaluate new technologies to holistically monitor, control and evolve the communications network and supporting infrastructure as a platform to enable Smart Grid solutions.	• Demonstrate a new Advanced Metering Infrastructure (AMI) Network management system to holistically monitor, control, and evolve the existing AMI network and infrastructure from a billing-centric platform to a fully operational AMI solutions platform that will meet evolving customer and grid needs.	• Demonstrate an integrated, multi-tenant network management system that may include the following features: - Integrated network management & control that will monitor and prioritize data traffic. - Automate trouble ticketing creation process. - Workflow management. - Asset management of meter and network equipment regardless of meter or network types. - Business continuity planning to streamline maintenance and operations.
58	2nd Triennial (2015-2017)	PG&E	2.28 Smart Grid Communications Path Monitoring	Cross-Cutting/Foundational	• Evaluate more efficient communication paths for Advanced Metering Infrastructure (AMI) related messages, including methods to clear potential interference, congestion, validate proper authorizations, and grant clearances for sending message over a secured communication path.	• Determine the ability to identify, analyze, and diagnose radiofrequency (RF) interference that can occur along the communication path from the meter through the data collectors to the AMI vendors' control system.	• Establish the base line noise floor. • Develop and demonstrate an application with an algorithm, which can automatically and continuously identify, monitor, and confirm RF interferences for multiple spectrums. • Provide an end-end process for identifying, confirming and mitigating detected interferences with the AMI-network.
59	2nd Triennial (2015-2017)	PG&E	2.29 Mobile Meter Applications	Cross-Cutting/Foundational	• Demonstrate the utility's ability to enable dynamic electric mobile metering.	• Develop and test a mobile meter prototype on various applications that can be used to capture and monitor real-time energy transactions and usage (e.g. Plug-In Electric Vehicles (PEV), Distributed Generation (DG), mobile storage, etc.). • Monitor the grid impact of knowing when, where, and what size load will be necessary to support new, flexible location technologies such as: PEVs, mobile distributed generation, and mobile storage.	• Design specification of mobile meter. • Demonstration of mobile meter hardware prototype. • End-to-end meter to cash testing using existing AMI or cellular based network. • Lab testing of use cases on DG applications and PEV metering, including remote and near real-time tracking of vehicle charge locations and energy flow.
60	2nd Triennial (2015-2017)	PG&E	2.30 Leverage EPIC funds to Participate in Industry-Wide RD&D Programs	Grid Modernization and Optimization	• Leverage EPIC dollars by participating and collaborating in multi-utility, industry wide research, demonstration and deployment initiatives conducted by third party organizations.	• Project scope being further evaluated - TBD	• Project deliverables being further evaluated - TBD

*Date of award corrected from previous annual report

Row #	Investment Program Period	Program	Project Name	Brief Description	Date of the	Was This Project	Assignment to	Encumbered	Committed Funding	Funds Expended	Funds Expended	Funds Expended	Administrative	Leveraged Funds
	A	B	C	E4	F	G	H	I	J	K	L	M	N	O
For Report DOC	i. Investment Plan Period		Project Name	vii. Schedule			ii. Assignment to Value Chain	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent		
1	1st Triennial (2012-2014)	PG&E	1.01 Energy Storage for Market Operations	3 years	9/19/2013	No	Grid Operation/Market Design	$ 616,857	$1,660,000 - $2,030,000	$ 778,040	$ 1,055,071	$ 1,833,110	All project costs are related to project activities. Admin costs are tracked separately.	Leveraged battery assets that was funded by Energy Regulators Regional Association (ERRA). Leveraged $163K, as well as software and expertise from PG&E's hydro generation group.
2	1st Triennial (2012-2014)	PG&E	1.02 Energy Storage for Distribution Operations	2.75 years	7/25/2014	Yes	Distribution; Grid Operation/Market Design	$ 2,548,062	$4,590,000 - $5,610,000	$ 1,137,835	$ 1,090,923	$ 2,228,758	All project costs are related to project activities. Admin costs are tracked separately.	No
3	1st Triennial (2012-2014)	PG&E	1.03 Mobile and Stationary Energy Storage Synergies	Project schedule being further evaluated - TBD	NA	No	Grid Operation/Market Design	$ 0	$ 0	$ 0	$ 0	$ 0	All project costs are related to project activities. Admin costs are tracked separately.	TBD
4	1st Triennial (2012-2014)	PG&E	1.04 Expand Test Lab and Pilot Facilities for New Energy Storage Systems. Formally Withdrawn. CPUC A.12-11-003, 10/15/2013.	N/A	NA	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	1st Triennial (2012-2014)	PG&E	1.05 New Forecast Methods for Improved Storm Damage Modeling	3.25 years	9/19/2013	No	Distribution	$ 535,055	$720,000 - $880,000	$ 496,606	$ 324,544	$ 821,150	All project costs are related to project activities. Admin costs are tracked separately.	N/A
6	1st Triennial (2012-2014)	PG&E	1.06 Demonstrate Communication Systems Allowing the CAISO to Utilize Available Renewable Generation Flexibility	Project schedule being further evaluated - TBD	NA	No	Grid Operation/Market Design	$ 0	N/A	N/A	N/A	N/A	N/A	N/A

Row #	Investment Program Period	Program	Project Name	Brief Description	Date of the	Was This Project	Assignment to	Encumbered	Committed Funding	Funds Expended	Funds Expended	Funds Expended	Administrative	Leveraged Funds
	A	B	C	E4	F	G	H	I	J	K	L	M	N	O
For Report DOC	i. Investment Plan Period		Project Name	vii. Schedule			ii. Assignment to Value Chain	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent		
7	1st Triennial (2012-2014)	PG&E	1.07 Demonstrate Systems to Ramp Existing Gas-Fired Generation More Quickly to Adapt to Changes in Variable Energy Resources Output	N/A	NA	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	1st Triennial (2012-2014)	PG&E	1.08 Distribution System Safety and Reliability Through New Data Analytics Techniques	2.25 years	9/19/2013	No	Transmission; Distribution	$ 1,249,505	$2,200,000 - $2,690,000	$ 1,791,805	$ 320,835	$ 2,112,640	All project costs are related to project activities. Admin costs are tracked separately.	N/A
9	1st Triennial (2012-2014)	PG&E	1.09A Close Proximity Switching	2.5 years	9/19/2013	No	Transmission; Distribution	$ 301,808	$900,000 - $1,100,000	$ 382,094	$ 133,174	$ 515,268	All project costs are related to project activities. Admin costs are tracked separately.	N/A
10	1st Triennial (2012-2014)	PG&E	1.09B and 1.10B - Network Conditioned-Based Maintenance	3.25 years	9/19/2013	No	Transmission; Distribution	$ 484,250	$450,000 - $550,000	$ 524,791	$ 22,962	$ 547,753	All project costs are related to project activities. Admin costs are tracked separately.	N/A
11	1st Triennial (2012-2014)	PG&E	1.09C Discrete Series Reactors (DSRs)	3.25 years	9/19/2013	No	Transmission	$ 1,449,835	$2,490,000 - $3,050,000	$ 1,517,147	$ 923,783	$ 2,440,930	All project costs are related to project activities. Admin costs are tracked separately.	N/A
12	1st Triennial (2012-2014)	PG&E	1.10A Dissolved Gas Analysis	Project schedule being further evaluated - TBD	NA	No	Transmission; Distribution	$ 0	N/A		$ 0	$ 0	TBD	TBD
13	1st Triennial (2012-2014)	PG&E	1.10C Underground Cable Analysis	Project schedule being further evaluated - TBD	NA	No	Distribution	$ 0	N/A		$ 0	$ 0	TBD	TBD

Row #	Investment Program Period	Program	Project Name	Brief Description	Date of the	Was This Project	Assignment to	Encumbered	Committed Funding	Funds Expended	Funds Expended	Funds Expended	Administrative	Leveraged Funds
	A	B	C	E4	F	G	H	I	J	K	L	M	N	O
For Report DOC	i. Investment Plan Period		Project Name	vii. Schedule			ii. Assignment to Value Chain	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent		
14	1st Triennial (2012-2014)	PG&E	1.11 Demonstrate Self-Correcting Tools to Improve System Records and Operations	Project schedule being further evaluated - TBD	NA	No	Transmission; Distribution	$ 0	N/A		$ 0	$ 0	TBD	TBD
15	1st Triennial (2012-2014)	PG&E	1.12 Demonstrate New Technologies That Improve Wildlife Safety and Protect Assets From Weather-Related Degradation	Project schedule being further evaluated - TBD	NA	No	Transmission; Distribution	$ 0	N/A		$ 0	$ 0	TBD	TBD
16	1st Triennial (2012-2014)	PG&E	1.13 Demonstrate New Communication Systems to Improve Substation Automation and Interoperability	Project schedule being further evaluated - TBD	NA	No	Transmission; Distribution	$ 0	N/A		$ 0	$ 0	TBD	TBD
17	1st Triennial (2012-2014)	PG&E	1.14 Next Generation SmartMeter™ Telecom Network Functionalities	3 years	9/19/2013	No	Distribution; Grid Operation/Market Design; Demand-Side Management	$ 3,986,281	$3,520,000 - $4,300,000	$ 3,303,570	$ 811,151	$ 4,114,721	All project costs are related to project activities. Admin costs are tracked separately.	No
18	1st Triennial (2012-2014)	PG&E	1.15 Grid Operations Situational Intelligence	3.25 years	9/19/2013	No	Distribution; Grid Operation/Market Design; Demand-Side Management	$ 1,334,030	$3,780,000 - $4,620,000	$ 1,587,143	$ 2,545,598	$ 4,132,741	0	N/A

Row #	Investment Program Period	Program	Project Name	Brief Description	Date of the	Was This Project	Assignment to	Encumbered	Committed Funding	Funds Expended	Funds Expended	Funds Expended	Administrative	Leveraged Funds
	A	B	C	E4	F	G	H	I	J	K	L	M	N	O
For Report DOC	i. Investment Plan Period		Project Name	vii. Schedule			ii. Assignment to Value Chain	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent		
19	1st Triennial (2012-2014)	PG&E	1.16 Vehicle-to-Grid Operational Integration	3.25 years	9/19/2013	No	Distribution	$ 2,098,840	$3,600,000 - $4,400,000	$ 2,439,962	$ 1,569,568	$ 4,009,530	All project costs are related to project activities. Admin costs are tracked separately.	Department of Energy (DOE) provided test services using National Renewable Energy Lab (NREL) facilities. Approximate cost share to date: $120,000.
20	1st Triennial (2012-2014)	PG&E	1.17 Industry Participation to Leverage EPIC Dollars	Project schedule being further evaluated - TBD	NA	No	Transmission; Distribution	$ 0	N/A	$ 0	$ 0	$ 0	All project costs are related to project activities. Admin costs are tracked separately.	TBD
21	1st Triennial (2012-2014)	PG&E	1.18 Appliance-Level Load Disaggregation	3 years	9/19/2013	No	Demand-Side Management	$ 1,399,248	$1,080,000 - $1,320,000	$ 1,231,131	$ 65,711	$ 1,296,842	All project costs are related to project activities. Admin costs are tracked separately.	N/A
22	1st Triennial (2012-2014)	PG&E	1.19 Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	3.25 years	9/19/2013	No	Distribution; Grid Operation/Market Design; Demand-Side Management	$ 1,056,925	$2,600,000 - $3,180,000	$ 825,373	$ 1,147,612	$ 1,972,985	All project costs are related to project activities. Admin costs are tracked separately.	Leveraging existing AMI network investments.
23	1st Triennial (2012-2014)	PG&E	1.20 Demonstrate the Benefits of Providing the Competitive, Open Market With Automated Access to Customer-Authorized SmartMeter™ Data to Drive Innovation.	Project schedule being further evaluated - TBD	NA	N/A	Demand-Side Management	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Row #	Investment Program Period	Program	Project Name	Brief Description	Date of the	Was This Project	Assignment to	Encumbered	Committed Funding	Funds Expended	Funds Expended	Funds Expended	Administrative	Leveraged Funds
	A	B	C	E4	F	G	H	I	J	K	L	M	N	O
For Report DOC	i. Investment Plan Period		Project Name	vii. Schedule			ii. Assignment to Value Chain	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent		
24	1st Triennial (2012-2014)	PG&E	1.21 Automatic Identification of Distributed Photovoltaic (PV) Resources	2.5 years	5/1/2014	Yes	Distribution; Demand-Side Management	$ 868,495	$1,350,000 - $1,650,000	$ 876,409	$ 437,358	$ 1,313,767	All project costs are related to project activities. Admin costs are tracked separately.	N/A
25	1st Triennial (2012-2014)	PG&E	1.22 Electric Vehicle Submetering	4.75 years	11/14/2013	No	Distribution; Grid Operation/Market Design; Demand-Side Management	$ 2,149,416	$2,860,000 - $3,500,000	$ 1,131,770	$ 221,510	$ 1,353,281	All project costs are related to project activities. Admin costs are tracked separately.	N/A
26	1st Triennial (2012-2014)	PG&E	1.23 Photovoltaic (PV) Submetering	2.5 years	5/1/2014	Yes	Grid Ops and Mkt. Design / Distribution / DSM	$ 950,313	$1,350,000 - $1,650,000	$ 860,199	$ 460,210	$ 1,320,410	All project costs are related to project activities. Admin costs are tracked separately.	N/A
27	1st Triennial (2012-2014)	PG&E	1.24 Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	2 years	5/1/2014	Yes	Transmission; Distribution; Grid Operation/Market Design; Demand-Side Management	$ 1,196,477	$1,330,000 - $1,620,000	$ 1,262,770	$ 77,583	$ 1,340,353	All project costs are related to project activities. Admin costs are tracked separately.	N/A
28	1st Triennial (2012-2014)	PG&E	1.25 Direct Current (DC) Fast Charging Mapping	2.5 years	5/1/2014	Yes	Distribution; Demand-Side Management	$ 332,975	$450,000 - $550,000	$ 236,225	$ 132,454	$ 368,679	All project costs are related to project activities. Admin costs are tracked separately.	N/A

Row #	Investment Program Period	Program	Project Name	Brief Description	Date of the	Was This Project	Assignment to	Encumbered	Committed Funding	Funds Expended	Funds Expended	Funds Expended	Administrative	Leveraged Funds
	A	B	C	E4	F	G	H	I	J	K	L	M	N	O
For Report DOC	i. Investment Plan Period		Project Name	vii. Schedule			ii. Assignment to Value Chain	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent		
29	1st Triennial (2012-2014)	PG&E	1.26 Pilot Measurement and Telemetry Strategies and Technologies That Enable the Cost-Effective Integration of Mass Market Demand Response (DR) Resources Into the CAISO Wholesale Market	Project schedule being further evaluated - TBD	NA	No	Grid Operation/Market Design and Demand-side Management.	$ 0	N/A		$ 0	$ 0	TBD	TBD
30	2nd Triennial (2015-2017)	PG&E	2.01 Evaluate Storage on the Distribution Grid	Project schedule being further evaluated - TBD	NA	No	Grid Operations/Market Design; Transmission; Distribution; DSM	$ 0	N/A		$ 0	$ 0	TBD	TBD
31	2nd Triennial (2015-2017)	PG&E	2.02 Pilot Distributed Energy Management Systems (DERMS)	2.5 years	9/15/2015*	No	Grid Operation/Market Design	$ 1,988,613	$ 5,850,000 - $7,150,000 (updated in 2016)	$ 1,769,284	$ 1,549,434	$ 3,318,718	$ 2,326	N/A
32	2nd Triennial (2015-2017)	PG&E	2.03A Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	2.75 years	4/10/2015	No	Distribution; Demand-Side Management	$1,038,147	$1,890,000 - $2,310,000	$378,186	$276,019	$ 654,205	$1,140	This project is leveraging funds from the PG&E Smart Grid Volt/Var Optimization (VVO) pilot given they are completing the testing of the functionality of the smart inverter technologies. The results of the testing will impact this project's opportunity to launch.
33	2nd Triennial (2015-2017)	PG&E	2.03B Test Smart Inverter Enhanced Capabilities - Vehicle to Home	2.5 years	1/8/2016	Yes	Distribution; Demand-Side Management	$ 0	$500,000 - $1,500,000	$ 0	$ 0	$ 0	$ 11,224	TBD
34	2nd Triennial (2015-2017)	PG&E	2.04 DG Monitoring & Voltage Tracking	1.75 years	4/10/2015	No	Grid Operations/Market Design	$ 745,532	$1,700,000 - $2,070,000	$ 473,347	$ 626,710	$ 1,100,057	$ 6,140	TBD

Row #	Investment Program Period	Program	Project Name	Brief Description	Date of the	Was This Project	Assignment to	Encumbered	Committed Funding	Funds Expended	Funds Expended	Funds Expended	Administrative	Leveraged Funds
A	A	B	C	E4	F	G	H	I	J	K	L	M	N	O
For Report DOC	i. Investment Plan Period		Project Name	vii. Schedule			ii. Assignment to Value Chain	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent		
35	2nd Triennial (2015-2017)	PG&E	2.05 Inertia Response Emulation for DG Impact Improvement	1.75 years	1/6/2017*	Yes	Grid Operations/ Market Design; Transmission	$ 0	$630,000 - $770,000	$ 0	$ 0	$ 0	TBD	TBD
36	2nd Triennial (2015-2017)	PG&E	2.06 Intelligent Universal Transformer (IUT)	N/A	9/15/2015	No	Distribution; Grid Operation/Market Design; Demand-Side Management	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	N/A
37	2nd Triennial (2015-2017)	PG&E	2.07 Real-Time Loading Data for Distribution Operations and Planning	2.75 years	4/10/2015*	No	Grid Operation/Market Design; Distribution	$ 768,917	$2,790,000 - $3,410,000 (updated in 2016)	$ 625,085	$ 383,484	$ 1,008,569	$ 5,458	TBD
38	2nd Triennial (2015-2017)	PG&E	2.08 "Smart" Monitoring and Analysis Tools	Project schedule being further evaluated - TBD	NA	No	Transmission	$ 0	N/A		$ 0	$ 0	TBD	TBD
39	2nd Triennial (2015-2017)	PG&E	2.09 Distributed Series Impedance (DSI) (Phase 2)	Project schedule being further evaluated - TBD	NA	No	Transmission	$ 0	N/A		$ 0	$ 0	TBD	TBD
40	2nd Triennial (2015-2017)	PG&E	2.10 Emergency Preparedness Modeling	2.75 years	4/10/2015*	No	Transmission; Distribution	$ 1,419,323	$1,980,000 - $2,420,000 (updated in 2016)	$ 222,599	$ 91,913	$ 314,512	$ 1,538	TBD
41	2nd Triennial (2015-2017)	PG&E	2.11 New Mobile Technology & Visualization Applications	Project schedule being further evaluated - TBD	NA	No	Distribution	$ 0	N/A		$ 0	$ 0	TBD	TBD
42	2nd Triennial (2015-2017)	PG&E	2.12 New Emergency Management Mobile Applications	Project schedule being further evaluated - TBD	NA	No	Transmission; Distribution	$ 0	N/A		$ 0	$ 0	TBD	TBD
43	2nd Triennial (2015-2017)	PG&E	2.13 Digital Substation/Substation Automation	Project schedule being further evaluated - TBD	NA	No	Transmission; Distribution	$ 0	N/A		$ 0	$ 0	TBD	TBD

Row #	Investment Program Period	Program	Project Name	Brief Description	Date of the	Was This Project	Assignment to	Encumbered	Committed Funding	Funds Expended	Funds Expended	Funds Expended	Administrative	Leveraged Funds
	A	B	C	E4	F	G	H	I	J	K	L	M	N	O
For Report DOC	i. Investment Plan Period		Project Name	vii. Schedule			ii. Assignment to Value Chain	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent		
44	2nd Triennial (2015-2017)	PG&E	2.14 Automatically Map Phasing Information	1.75 years	9/15/2015	No	Distribution; Demand-Side Management	$ 1,473,618	$1,400,000 - $1,720,000	$ 629,667	$ 132,076	$ 761,743	$ 4,922	TBD
45	2nd Triennial (2015-2017)	PG&E	2.15 Synchrophasor Applications for Generator Dynamic Model Validation	2.5 years	4/10/2015*	No	Transmission	$ 576,157	$1,090,000 - $1,340,000	$ 471,779	$ 126,754	$ 598,533	$ 800	TBD
46	2nd Triennial (2015-2017)	PG&E	2.16 Enhanced Synchrophasor Analytics & Applications	Project schedule being further evaluated - TBD	NA	No	Transmission	$ 0	N/A	$ 0	$ 0		TBD	TBD
47	2nd Triennial (2015-2017)	PG&E	2.17 Geomagnetic Disturbance (GMD) Evaluation	Project schedule being further evaluated - TBD	NA	No	Transmission	$ 0	N/A	$ 0	$ 0		TBD	TBD
48	2nd Triennial (2015-2017)	PG&E	2.18 Optical Instrument Transformers and Sensors for Protection and Control Systems	Project schedule being further evaluated - TBD	NA	No	Transmission	$ 0	N/A	$ 0	$ 0		TBD	TBD
49	2nd Triennial (2015-2017)	PG&E	2.19 Enable Distributed Demand-Side Strategies & Technologies	2.75 years	4/10/2015*	No	Distribution; Demand-Side Management	$ 1,731,402	$2,620,000 - $3,200,000	$ 161,985	$ 192,183	$ 354,168	$ 11,516	TBD
50	2nd Triennial (2015-2017)	PG&E	2.20 Real-Time Energy Usage Feedback to Customers	Project schedule being further evaluated - TBD	NA	No	Grid Operations/ Market Design; Distribution; Demand-Side Management	$ 0	N/A	$ 0	$ 0		TBD	TBD
51	2nd Triennial (2015-2017)	PG&E	2.21 Home Area Network (HAN) for Commercial Customers	2 years	9/15/2015	No	Demand-Side Management	$ 3,000	$180,000 - $220,000	$ 1,960	$ 135,081	$ 137,041	$ 2,387	TBD

Row #	Investment Program Period	Program	Project Name	Brief Description	Date of the	Was This Project	Assignment to	Encumbered	Committed Funding	Funds Expended	Funds Expended	Funds Expended	Administrative	Leveraged Funds
	A	B	C	E4	F	G	H	I	J	K	L	M	N	O
For Report DOC	i. Investment Plan Period		Project Name	vii. Schedule			ii. Assignment to Value Chain	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent		
52	2nd Triennial (2015-2017)	PG&E	2.22 Demand Reduction Through Targeted Data Analytics	2.25 years	9/15/2015	No	Distribution; Demand-Side Management	$ 656,887	$1,560,000 - $1,900,000	$ 419,944	$ 297,603	$ 717,547	$ 2,789	TBD
53	2nd Triennial (2015-2017)	PG&E	2.23 Integrate Demand Side Approaches Into Utility Planning	2.25 years	4/10/2015*	No	Distribution; Demand-Side Management	$ 1,615,555	$2,560,000 - $3,130,000	$ 1,511,977	$ 1,092,349	$ 2,604,325	$ 799	TBD
54	2nd Triennial (2015-2017)	PG&E	2.24 Appliance Level Bill Disaggregation for Non-Residential Customers	Project schedule being further evaluated - TBD	NA	No	Demand-Side Management	$ 0	N/A		$ 0	$ 0	TBD	TBD
55	2nd Triennial (2015-2017)	PG&E	2.25 Enhanced Smart Grid Communications	Project schedule being further evaluated - TBD	NA	No	Grid Operations/ Market Design; Distribution; Demand-Side Management	$ 0	N/A		$ 0	$ 0	TBD	TBD
56	2nd Triennial (2015-2017)	PG&E	2.26 Customer & Distribution Automation Open Architecture Devices	2.75 years	9/15/2015	No	Distribution; Grid Operation/Market Design; Demand-Side Management	$ 190,600	$1,760,000 - $2,150,000	$ 750	$ 75,960	$ 76,710	$ 454	TBD

Row #	Investment Program Period	Program	Project Name	Brief Description	Date of the	Was This Project	Assignment to	Encumbered	Committed Funding	Funds Expended	Funds Expended	Funds Expended	Administrative	Leveraged Funds
	A	B	C	E4	F	G	H	I	J	K	L	M	N	O
For Report DOC	i. Investment Plan Period		Project Name	vii. Schedule			ii. Assignment to Value Chain	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent		
57	2nd Triennial (2015-2017)	PG&E	2.27 Next Generation Integrated Smart Grid Network Management	2.5 years	4/10/2015*	No	Grid Operations/Market Design; Distribution; Demand-Side Management	$ 576,433	$1,010,000 - $1,240,000	$ 221,931	$ 201,462	$ 423,393	$ 306	TBD
58	2nd Triennial (2015-2017)	PG&E	2.28 Smart Grid Communications Path Monitoring	1.75 years	1/6/2017*	Yes	Grid Operation/Market Design	$ 0	$810,000 - $990,000	$ -	$ -	$ 0	TBD	TBD
59	2nd Triennial (2015-2017)	PG&E	2.29 Mobile Meter Applications	2.5 years	4/10/2015*	No	Grid Operations/Market Design; Distribution; Demand-Side Management	$ 867,702	$1,730,000 - $2,120,000	$ 699,566	$ 198,913	$ 898,479	$ 459	In-kind services for resource time from Lawrence Livermore National Lab (LLNL) on technical specification calls
60	2nd Triennial (2015-2017)	PG&E	2.30 Leverage EPIC funds to Participate in Industry-Wide RD&D Programs	Project schedule being further evaluated - TBD	NA	No	Grid Operations/ Market Design; Transmission; Distribution; Demand-Side Management	$ 0	N/A		$ 0	$ 0	TBD	TBD

*Date of award corrected from previous annual report

Row #	Investment Program Period	Program	Project Name	Partners	Match Funding	Match Funding	Funding	Intellectual Property	Identification of the Method Used to Grant	If Competitively	If Competitively Selected,
	A	B	C	P	Q	R	S	T	U	V	W
For Report DOC	i. Investment Plan Period		Project Name	x. Partners (if applicable)	xi. Match Funding (if applicable)	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
1	1st Triennial (2012-2014)	PG&E	1.01 Energy Storage for Market Operations	N/A	N/A	N/A	Pay for performance	N/A - No current evidence of Intellectual Property development	Sole Source: •Power Settlements Consulting (sole vendor that could provide solution without modification or required hardware). • Trimark Associates (enhancements were made to their equipment for this EPIC project, as they were the original vendor under the capital project for the Yerba Buena and Vaca batteries).	N/A	N/A
2	1st Triennial (2012-2014)	PG&E	1.02 Energy Storage for Distribution Operations	N/A	No	N/A	Pay for Performance	N/A - No current evidence of Intellectual Property development	Competitive Bid	11	Cupertino Electric
3	1st Triennial (2012-2014)	PG&E	1.03 Mobile and Stationary Energy Storage Synergies	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
4	1st Triennial (2012-2014)	PG&E	1.04 Expand Test Lab and Pilot Facilities for New Energy Storage Systems. Formally Withdrawn. CPUC A.12-11-003, 10/15/2013.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	1st Triennial (2012-2014)	PG&E	1.05 New Forecast Methods for Improved Storm Damage Modeling	N/A	N/A	N/A	Pay for performance	Intellectual Property potential being explored	Competitive Bid & Sole Source • 1st award to create raw, gridded weather forecast data: competitive. • 2nd award to develop map of variables from data: completive. • 3rd award: Sole source to Clean Power Research due to obtain PV estimation for inclusion in solar irradiance use case.	• 1st award: 6 • 2nd award: 6	• 1st award: Weather Decision Technologies • 2nd award: Vertum Partners
6	1st Triennial (2012-2014)	PG&E	1.06 Demonstrate Communication Systems Allowing the CAISO to Utilize Available Renewable Generation Flexibility	N/A	N/A	N/A	N/A	N/A - No current evidence of Intellectual Property development	N/A	N/A	N/A

Row #	Investment Program Period	Program	Project Name	Partners	Match Funding	Match Funding	Funding	Intellectual Property	Identification of the Method Used to Grant	If Competitively	If Competitively Selected,
	A	B	C	P	Q	R	S	T	U	V	W
For Report DOC	i. Investment Plan Period		Project Name	x. Partners (if applicable)	xi. Match Funding (if applicable)	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
7	1st Triennial (2012-2014)	PG&E	1.07 Demonstrate Systems to Ramp Existing Gas-Fired Generation More Quickly to Adapt to Changes in Variable Energy Resources Output	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	1st Triennial (2012-2014)	PG&E	1.08 Distribution System Safety and Reliability Through New Data Analytics Techniques	N/A	N/A	N/A	Pay for performance	N/A - No current evidence of Intellectual Property development	Competitive Bid	• 11 total bidders • 7 passed initial screen	Space Time Insight
9	1st Triennial (2012-2014)	PG&E	1.09A Close Proximity Switching	N/A	N/A	N/A	Pay for Performance	N/A - No current evidence of Intellectual Property development	Competitive Bid	4	Two vendors chosen from RFP: • Inertia Switch • Trayer — Issued Direct Award for Remote Solutions. They not respond to RFP, but shortly after competitive bid process completed, they announced independent creation of similar product.
10	1st Triennial (2012-2014)	PG&E	1.09B and 1.10B - Network Conditioned-Based Maintenance	N/A	N/A	N/A	Pay for performance	N/A - No current evidence of Intellectual Property development	Competitive Bid	Phase I: 5 bids Phase 2: 8 bids	Phase 1: Black and Veach Phase 2: Exponent
11	1st Triennial (2012-2014)	PG&E	1.09C Discrete Series Reactors (DSRs)	N/A	N/A	N/A	Pay for Performance	N/A - No current evidence of Intellectual Property development	Sole Source - Smart Wires, Inc. selected as they are the developer and sole supplier of DSR devices.	N/A	N/A
12	1st Triennial (2012-2014)	PG&E	1.10A Dissolved Gas Analysis	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
13	1st Triennial (2012-2014)	PG&E	1.10C Underground Cable Analysis	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Row #	Investment Program Period	Program	Project Name	Partners	Match Funding	Match Funding	Funding	Intellectual Property	Identification of the Method Used to Grant	If Competitively	If Competitively Selected,
	A	B	C	P	Q	R	S	T	U	V	W
For Report DOC	i. Investment Plan Period		Project Name	x. Partners (if applicable)	xi. Match Funding (if applicable)	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
14	1st Triennial (2012-2014)	PG&E	1.11 Demonstrate Self-Correcting Tools to Improve System Records and Operations	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
15	1st Triennial (2012-2014)	PG&E	1.12 Demonstrate New Technologies That Improve Wildlife Safety and Protect Assets From Weather-Related Degradation	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
16	1st Triennial (2012-2014)	PG&E	1.13 Demonstrate New Communication Systems to Improve Substation Automation and Interoperability	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
17	1st Triennial (2012-2014)	PG&E	1.14 Next Generation SmartMeter™ Telecom Network Functionalities	N/A	N/A	N/A	Pay for Performance	Provisional patent filed for Smart Pole Meter and Meter Socket, and for development of Wire Down Algorithm.	Sole Source - Silver Springs Network selected as they solutions provider for PG&E's AMI electric network. It is necessary to work with SSN to ensure that devices and applications can communicate across the AMI network.	N/A	N/A
18	1st Triennial (2012-2014)	PG&E	1.15 Grid Operations Situational Intelligence	N/A	N/A	N/A	Pay For Performance	New Intellectual Property (IP) has been created through co-development with the vendor. PG&E retains ownership rights to the IP and will provide free unlimited use rights to CA IOUs per the CPUC decision	Competitive Bid	3	BitStew

Row #	Investment Program Period	Program	Project Name	Partners	Match Funding	Match Funding	Funding	Intellectual Property	Identification of the Method Used to Grant	If Competitively	If Competitively Selected,
	A	B	C	P	Q	R	S	T	U	V	W
For Report DOC	i. Investment Plan Period		Project Name	x. Partners (if applicable)	xi. Match Funding (if applicable)	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
19	1st Triennial (2012-2014)	PG&E	1.16 Vehicle-to-Grid Operational Integration	DOE/NREL; Edison Electric Institute engaged for elec. utility industry staging events; Portland General Electric closely collaborating for industry-level requirements	N/A	N/A	Pay for performance	N/A - No current evidence of Intellectual Property development	• Phase 1 (Mule Phase): 2 Direct Awards - Efficient Drivetrains, Inc. (EDI) and Electric Vehicle International (EVI) selected due to short-term availability of prototype driveline and capability of generating utility-grade export power on F550 - diesel/gasoline configuration • Phase 2 (Alpha Phase): Based on results of Mule phase, moved forward with EDI, which was designed to help formulate specs for Phase 3 • Phase 3 (Beta Phase): Competitive solicitation. 10 potential bidders. Received 2 final bids.	2 (Phase 3 - Beta Phase)	Efficient Drivetrains, Inc. (EDI) (Phase 3 - Beta Phase)
20	1st Triennial (2012-2014)	PG&E	1.17 Industry Participation to Leverage EPIC Dollars	TBD	N/A	N/A	TBD	TBD	TBD	TBD	TBD
21	1st Triennial (2012-2014)	PG&E	1.18 Appliance-Level Load Disaggregation	N/A	N/A	N/A	Pay for performance	N/A - No current evidence of Intellectual Property development	Sole Source - Silver Springs Network, as they are the solutions provider for PG&E's AMI electric network. It is necessary to work with SSN to ensure that devices and applications can communicate across the AMI network.	N/A	N/A
22	1st Triennial (2012-2014)	PG&E	1.19 Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	N/A	N/A	N/A	Pay for Performance	N/A - No current evidence of Intellectual Property development	Competitive Bid	3	BitStew & Primestone
23	1st Triennial (2012-2014)	PG&E	1.20 Demonstrate the Benefits of Providing the Competitive, Open Market With Automated Access to Customer-Authorized SmartMeter™ Data to Drive Innovation.	N/A	N/A	N/A	N/A - No current evidence of Intellectual Property development	N/A	N/A	N/A	N/A

Row #	Investment Program Period	Program	Project Name	Partners	Match Funding	Match Funding	Funding	Intellectual Property	Identification of the Method Used to Grant	If Competitively	If Competitively Selected,
	A	B	C	P	Q	R	S	T	U	V	W
For Report DOC	i. Investment Plan Period		Project Name	x. Partners (if applicable)	xi. Match Funding (if applicable)	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
24	1st Triennial (2012-2014)	PG&E	1.21 Automatic Identification of Distributed Photovoltaic (PV) Resources	N/A	N/A	N/A	Pay for performance	Provisional patent filed for development of Unauthorized Interconnection Detection Algorithm.	Sole Source - Nexant selected due to expertise in PG&E's CC&B database, PV generation data analysis and AMI network.	N/A	N/A
25	1st Triennial (2012-2014)	PG&E	1.22 Electric Vehicle Submetering	• Phase 1 MDMA Participants: -NRG -OhmConnect -Electric MotorWerks • Phase 2 MDMA Participants: -ChargePoint -Kitu -Electric MotorWerks -Oxygen Initiative	N/A	N/A	Pay for Performance	N/A - No current evidence of Intellectual Property development	Competitive Bid	15	Nexant, Inc.
26	1st Triennial (2012-2014)	PG&E	1.23 Photovoltaic (PV) Submetering	N/A	N/A	N/A	Pay for performance	N/A - No current evidence of Intellectual Property development	• Sole Source - - Opower - PG&E's customer facing web portal, My Energy. Given the project is integrated PV generation interval data into My Energy, it was necessary to work with them. - Clean Power Research - Purchased subscription to estimated generation data.	N/A	N/A
27	1st Triennial (2012-2014)	PG&E	1.24 Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	N/A	N/A	N/A	Pay for performance	N/A - No current evidence of Intellectual Property development	Sole sourced - Enetics is a consulting firm that performed a study that assessed the available technologies that would best address the need of the project and determined Enetics provides that solution. They were also willing to make enhancements to their device to further meet the need of PG&E and were the lowest cost and immediately available.	N/A	N/A
28	1st Triennial (2012-2014)	PG&E	1.25 Direct Current (DC) Fast Charging Mapping	N/A	N/A	N/A	Pay for Performance	N/A - No current evidence of Intellectual Property development	Competitive Bid	4	Energy and Environmental Economics, Inc. (E3)

Row #	Investment Program Period	Program	Project Name	Partners	Match Funding	Match Funding	Funding	Intellectual Property	Identification of the Method Used to Grant	If Competitively	If Competitively Selected,
	A	B	C	P	Q	R	S	T	U	V	W
For Report DOC	i. Investment Plan Period		Project Name	x. Partners (if applicable)	xi. Match Funding (if applicable)	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
29	1st Triennial (2012-2014)	PG&E	1.26 Pilot Measurement and Telemetry Strategies and Technologies That Enable the Cost-Effective Integration of Mass Market Demand Response (DR) Resources Into the CAISO Wholesale Market	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
30	2nd Triennial (2015-2017)	PG&E	2.01 Evaluate Storage on the Distribution Grid	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
31	2nd Triennial (2015-2017)	PG&E	2.02 Pilot Distributed Energy Management Systems (DERMS)	N/A	$419,000	N/A	Pay for performance	TBD	Competitive Bid	5	GE Alstom
32	2nd Triennial (2015-2017)	PG&E	2.03A Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	PG&E Smart Grid VVO Pilot	TBD	TBD	Pay for Performance	N/A - No current evidence of Intellectual Property development	Sole Source - SolarCity selected due to their large residential market share and large amount of customers on impacted distribution circuits that is most relevant to test their technologies.	TBD	TBD
33	2nd Triennial (2015-2017)	PG&E	2.03B Test Smart Inverter Enhanced Capabilities - Vehicle to Home	TBD	TBD	TBD	Pay for Performance	N/A - No current evidence of Intellectual Property development	TBD	TBD	TBD
34	2nd Triennial (2015-2017)	PG&E	2.04 DG Monitoring & Voltage Tracking	TBD	TBD	TBD	Pay for Performance	N/A - No current evidence of Intellectual Property development	Competitive Bid	12	Nexant, Inc.

Row #	Investment Program Period	Program	Project Name	Partners	Match Funding	Match Funding	Funding	Intellectual Property	Identification of the Method Used to Grant	If Competitively	If Competitively Selected,
	A	B	C	P	Q	R	S	T	U	V	W
For Report DOC	i. Investment Plan Period		Project Name	x. Partners (if applicable)	xi. Match Funding (if applicable)	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
35	2nd Triennial (2015-2017)	PG&E	2.05 Inertia Response Emulation for DG Impact Improvement	TBD	TBD	TBD	TBD	N/A - No current evidence of Intellectual Property development	TBD	TBD	TBD
36	2nd Triennial (2015-2017)	PG&E	2.06 Intelligent Universal Transformer (IUT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
37	2nd Triennial (2015-2017)	PG&E	2.07 Real-Time Loading Data for Distribution Operations and Planning	TBD	TBD	TBD	Pay for Performance	N/A - No current evidence of Intellectual Property development	Competitive Bid	12	Trove Predictive Data
38	2nd Triennial (2015-2017)	PG&E	2.08 "Smart" Monitoring and Analysis Tools	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
39	2nd Triennial (2015-2017)	PG&E	2.09 Distributed Series Impedance (DSI) (Phase 2)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
40	2nd Triennial (2015-2017)	PG&E	2.10 Emergency Preparedness Modeling	TBD	TBD	TBD	Pay for Performance	PG&E will receive perpetual, transferable sublicenses to all Work Product to use for current and future PG&E business.	Competitive Bid	3	IBM
41	2nd Triennial (2015-2017)	PG&E	2.11 New Mobile Technology & Visualization Applications	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
42	2nd Triennial (2015-2017)	PG&E	2.12 New Emergency Management Mobile Applications	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
43	2nd Triennial (2015-2017)	PG&E	2.13 Digital Substation/Substation Automation	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Row #	Investment Program Period	Program	Project Name	Partners	Match Funding	Match Funding	Funding	Intellectual Property	Identification of the Method Used to Grant	If Competitively	If Competitively Selected,
	A	B	C	P	Q	R	S	T	U	V	W
For Report DOC	i. Investment Plan Period		Project Name	x. Partners (if applicable)	xi. Match Funding (if applicable)	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
44	2nd Triennial (2015-2017)	PG&E	2.14 Automatically Map Phasing Information	UC Riverside testing an alternate algorithm based approach	TBD	TBD	Pay for performance	N/A - No current evidence of Intellectual Property development	• Sole Source - - Silver Springs Network selected as they are the solutions provider for PG&E's AMI electric network. It is necessary to work with SSN to ensure that devices and applications can communicate across the AMI network. - Navigant selected due to industry expertise and familiarity with PG&E-specific systems - Consulting branch of UC Riverside selected per industry expertise	TBD	TBD
45	2nd Triennial (2015-2017)	PG&E	2.15 Synchrophasor Applications for Generator Dynamic Model Validation	TBD	TBD	TBD	Pay for performance	N/A - No current evidence of Intellectual Property development	• Sole Source - - MathWorks was selected as the software tool because they are the only commercial vendor of this type of parameter estimation tool required for the project. - Schweitzer Engineering Labs was selected as the PMU vendor because they are the only vendor to offer a module to measure generator rotor angle which was necessary for the modeling effort.	N/A	N/A
46	2nd Triennial (2015-2017)	PG&E	2.16 Enhanced Synchrophasor Analytics & Applications	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
47	2nd Triennial (2015-2017)	PG&E	2.17 Geomagnetic Disturbance (GMD) Evaluation	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
48	2nd Triennial (2015-2017)	PG&E	2.18 Optical Instrument Transformers and Sensors for Protection and Control Systems	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
49	2nd Triennial (2015-2017)	PG&E	2.19 Enable Distributed Demand-Side Strategies & Technologies	TBD	TBD	TBD	Pay for Performance	N/A - No current evidence of Intellectual Property development	Competitive Bid	10	Solar City (for residential customers); Green Charge Networks (for commercial customers)
50	2nd Triennial (2015-2017)	PG&E	2.20 Real-Time Energy Usage Feedback to Customers	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
51	2nd Triennial (2015-2017)	PG&E	2.21 Home Area Network (HAN) for Commercial Customers	Rainforest Automation providing development of the cloud service application used by the customers	TBD	TBD	Pay for Performance	N/A - No current evidence of Intellectual Property development	Sole Source to Rainforest Automation for purchase of energy monitoring devices that connect to the SmartMeter™.	TBD	TBD

Row #	Investment Program Period	Program	Project Name	Partners	Match Funding	Match Funding	Funding	Intellectual Property	Identification of the Method Used to Grant	If Competitively	If Competitively Selected,
	A	B	C	P	Q	R	S	T	U	V	W
For Report DOC	i. Investment Plan Period		Project Name	x. Partners (if applicable)	xi. Match Funding (if applicable)	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
52	2nd Triennial (2015-2017)	PG&E	2.22 Demand Reduction Through Targeted Data Analytics	TBD	TBD	TBD	Pay for Performance	Intellectual Property potential being explored	Sole Source to Teradata to reduce unnecessary IT redundancy by leveraging existing data platform and data connections rather than re-create them.	TBD	TBD
53	2nd Triennial (2015-2017)	PG&E	2.23 Integrate Demand Side Approaches Into Utility Planning	TBD	TBD	TBD	Pay for Performance	N/A - No current evidence of Intellectual Property development	Sole Source to Integral Analytics (IA) given they are the developer/vendor for LoadSEER, which is the tool that is being modified to achieve the goals of this project.	N/A	N/A
54	2nd Triennial (2015-2017)	PG&E	2.24 Appliance Level Bill Disaggregation for Non-Residential Customers	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
55	2nd Triennial (2015-2017)	PG&E	2.25 Enhanced Smart Grid Communications	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
56	2nd Triennial (2015-2017)	PG&E	2.26 Customer & Distribution Automation Open Architecture Devices	TBD	TBD	TBD	TBD	Intellectual Property potential being explored	TBD	TBD	TBD

Row #	Investment Program Period	Program	Project Name	Partners	Match Funding	Match Funding	Funding	Intellectual Property	Identification of the Method Used to Grant	If Competitively	If Competitively Selected,
	A	B	C	P	Q	R	S	T	U	V	W
For Report DOC	i. Investment Plan Period		Project Name	x. Partners (if applicable)	xi. Match Funding (if applicable)	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
57	2nd Triennial (2015-2017)	PG&E	2.27 Next Generation Integrated Smart Grid Network Management	TBD	TBD	TBD	Pay for Performance	N/A - No current evidence of Intellectual Property development	Competitive Bid	8	Errigal Inc.
58	2nd Triennial (2015-2017)	PG&E	2.28 Smart Grid Communications Path Monitoring	TBD	TBD	TBD	TBD	N/A - No current evidence of Intellectual Property development	TBD	TBD	TBD
59	2nd Triennial (2015-2017)	PG&E	2.29 Mobile Meter Applications	Lawrence Livermore National Lab providing technical support for product development	TBD	TBD	Pay for Performance	Intellectual Property potential being explored	Competitive Bid	8	Ofer Communications
60	2nd Triennial (2015-2017)	PG&E	2.30 Leverage EPIC funds to Participate in Industry-Wide RD&D Programs	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

*Date of award corrected from previous annual report

Row #	Investment Program Period	Program	Project Name	If Competitively Selected,	If Competitively Selected,	If Interagency or Sole Source	Does Award Recipient Identify as	How the Project Leads to
	A	B	C	X	Y	Z	AA	AB
For Report DOC	i. Investment Plan Period		Project Name					
1	1st Triennial (2012-2014)	PG&E	1.01 Energy Storage for Market Operations	N/A	N/A	Column applicable to CEC only	Yes. •Power Settlements Consulting - California-based • Trimark Associates - California-based	Column applicable to CEC only
2	1st Triennial (2012-2014)	PG&E	1.02 Energy Storage for Distribution Operations	1	N/A	Column applicable to CEC only	Yes - California-based.	Column applicable to CEC only
3	1st Triennial (2012-2014)	PG&E	1.03 Mobile and Stationary Energy Storage Synergies	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
4	1st Triennial (2012-2014)	PG&E	1.04 Expand Test Lab and Pilot Facilities for New Energy Storage Systems. Formally Withdrawn. CPUC A.12-11-003, 10/15/2013.	N/A	N/A	Column applicable to CEC only	N/A	Column applicable to CEC only
5	1st Triennial (2012-2014)	PG&E	1.05 New Forecast Methods for Improved Storm Damage Modeling	• 1st award: 1 • 2nd award: 1	N/A	N/A	• Weather Decision Technologies: No • Vertum Partners: Yes - California-based • Clean Power Research: Yes - California-based	Column applicable to CEC only
6	1st Triennial (2012-2014)	PG&E	1.06 Demonstrate Communication Systems Allowing the CAISO to Utilize Available Renewable Generation Flexibility	N/A	N/A	Column applicable to CEC only	N/A	Column applicable to CEC only

Row #	Investment Program Period	Program	Project Name	If Competitively Selected,	If Competitively Selected,	If Interagency or Sole Source	Does Award Recipient Identify as	How the Project Leads to
	A	B	C	X	Y	Z	AA	AB
For Report DOC	i. Investment Plan Period		Project Name					
7	1st Triennial (2012-2014)	PG&E	1.07 Demonstrate Systems to Ramp Existing Gas-Fired Generation More Quickly to Adapt to Changes in Variable Energy Resources Output	N/A	N/A	Column applicable to CEC only	N/A	Column applicable to CEC only
8	1st Triennial (2012-2014)	PG&E	1.08 Distribution System Safety and Reliability Through New Data Analytics Techniques	1	N/A	Column applicable to CEC only	Yes - California-based	Column applicable to CEC only
9	1st Triennial (2012-2014)	PG&E	1.09A Close Proximity Switching	The two RFP vendors tied for first.	N/A	Column applicable to CEC only	No	Column applicable to CEC only
10	1st Triennial (2012-2014)	PG&E	1.09B and 1.10B - Network Conditioned-Based Maintenance	Phase 1: 1 Phase 2: 1	N/A	Column applicable to CEC only	No	Column applicable to CEC only
11	1st Triennial (2012-2014)	PG&E	1.09C Discrete Series Reactors (DSRs)	N/A	N/A	Column applicable to CEC only	No	Column applicable to CEC only
12	1st Triennial (2012-2014)	PG&E	1.10A Dissolved Gas Analysis	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
13	1st Triennial (2012-2014)	PG&E	1.10C Underground Cable Analysis	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only

Row #	Investment Program Period	Program	Project Name	If Competitively Selected,	If Competitively Selected,	If Interagency or Sole Source	Does Award Recipient Identify as	How the Project Leads to
	A	B	C	X	Y	Z	AA	AB
For Report DOC	i. Investment Plan Period		Project Name					
14	1st Triennial (2012-2014)	PG&E	1.11 Demonstrate Self-Correcting Tools to Improve System Records and Operations	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
15	1st Triennial (2012-2014)	PG&E	1.12 Demonstrate New Technologies That Improve Wildlife Safety and Protect Assets From Weather-Related Degradation	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
16	1st Triennial (2012-2014)	PG&E	1.13 Demonstrate New Communication Systems to Improve Substation Automation and Interoperability	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
17	1st Triennial (2012-2014)	PG&E	1.14 Next Generation SmartMeter™ Telecom Network Functionalities	N/A	N/A	Column applicable to CEC only	No	Column applicable to CEC only
18	1st Triennial (2012-2014)	PG&E	1.15 Grid Operations Situational Intelligence	1	N/A	Column applicable to CEC only	No	Column applicable to CEC only

Row #	Investment Program Period	Program	Project Name	If Competitively Selected,	If Competitively Selected,	If Interagency or Sole Source	Does Award Recipient Identify as	How the Project Leads to
	A	B	C	X	Y	Z	AA	AB
For Report DOC	i. Investment Plan Period		Project Name					
19	1st Triennial (2012-2014)	PG&E	1.16 Vehicle-to-Grid Operational Integration	1 (Phase 3 - Beta Phase)	N/A	Column applicable to CEC only	N/A	Column applicable to CEC only
20	1st Triennial (2012-2014)	PG&E	1.17 Industry Participation to Leverage EPIC Dollars	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
21	1st Triennial (2012-2014)	PG&E	1.18 Appliance-Level Load Disaggregation	N/A	N/A	Column applicable to CEC only	No	Column applicable to CEC only
22	1st Triennial (2012-2014)	PG&E	1.19 Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	Tie for first	N/A	Column applicable to CEC only	No	Column applicable to CEC only
23	1st Triennial (2012-2014)	PG&E	1.20 Demonstrate the Benefits of Providing the Competitive, Open Market With Automated Access to Customer-Authorized SmartMeter™ Data to Drive Innovation.	N/A	N/A	N/A	N/A	N/A

Row #	Investment Program Period	Program	Project Name	If Competitively Selected,	If Competitively Selected,	If Interagency or Sole Source	Does Award Recipient Identify as	How the Project Leads to
	A	B	C	X	Y	Z	AA	AB
For Report DOC	i. Investment Plan Period		Project Name					
24	1st Triennial (2012-2014)	PG&E	1.21 Automatic Identification of Distributed Photovoltaic (PV) Resources	N/A	N/A	Column applicable to CEC only	No	Column applicable to CEC only
25	1st Triennial (2012-2014)	PG&E	1.22 Electric Vehicle Submetering	1	N/A	Column applicable to CEC only	No	Column applicable to CEC only
26	1st Triennial (2012-2014)	PG&E	1.23 Photovoltaic (PV) Submetering	N/A	N/A	Column applicable to CEC only	Opower - No Clean Power Research - Yes: California-based	Column applicable to CEC only
27	1st Triennial (2012-2014)	PG&E	1.24 Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	N/A	N/A	Column applicable to CEC only	No	Column applicable to CEC only
28	1st Triennial (2012-2014)	PG&E	1.25 Direct Current (DC) Fast Charging Mapping	1	N/A - E3 was the highest scoring vendor.	N/A	Yes - California-based, small business, and Minority Based Enterprise (MBE).	Column applicable to CEC only

Row #	Investment Program Period	Program	Project Name	If Competitively Selected,	If Competitively Selected,	If Interagency or Sole Source	Does Award Recipient Identify as	How the Project Leads to
	A	B	C	X	Y	Z	AA	AB
For Report DOC	i. Investment Plan Period		Project Name					
29	1st Triennial (2012-2014)	PG&E	1.26 Pilot Measurement and Telemetry Strategies and Technologies That Enable the Cost-Effective Integration of Mass Market Demand Response (DR) Resources Into the CAISO Wholesale Market	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
30	2nd Triennial (2015-2017)	PG&E	2.01 Evaluate Storage on the Distribution Grid	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
31	2nd Triennial (2015-2017)	PG&E	2.02 Pilot Distributed Energy Management Systems (DERMS)	1	N/A	N/A	No	Column applicable to CEC only
32	2nd Triennial (2015-2017)	PG&E	2.03A Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
33	2nd Triennial (2015-2017)	PG&E	2.03B Test Smart Inverter Enhanced Capabilities - Vehicle to Home	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
34	2nd Triennial (2015-2017)	PG&E	2.04 DG Monitoring & Voltage Tracking	1	N/A	N/A	No	Column applicable to CEC only

Row #	Investment Program Period	Program	Project Name	If Competitively Selected,	If Competitively Selected,	If Interagency or Sole Source	Does Award Recipient Identify as	How the Project Leads to
	A	B	C	X	Y	Z	AA	AB
For Report DOC	i. Investment Plan Period		Project Name					
35	2nd Triennial (2015-2017)	PG&E	2.05 Inertia Response Emulation for DG Impact Improvement	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
36	2nd Triennial (2015-2017)	PG&E	2.06 Intelligent Universal Transformer (IUT)	TBD	TBD	N/A	N/A	N/A
37	2nd Triennial (2015-2017)	PG&E	2.07 Real-Time Loading Data for Distribution Operations and Planning	1	N/A	N/A	No	Column applicable to CEC only
38	2nd Triennial (2015-2017)	PG&E	2.08 "Smart" Monitoring and Analysis Tools	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
39	2nd Triennial (2015-2017)	PG&E	2.09 Distributed Series Impedance (DSI) (Phase 2)	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
40	2nd Triennial (2015-2017)	PG&E	2.10 Emergency Preparedness Modeling	1	N/A	N/A	No	Column applicable to CEC only
41	2nd Triennial (2015-2017)	PG&E	2.11 New Mobile Technology & Visualization Applications	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
42	2nd Triennial (2015-2017)	PG&E	2.12 New Emergency Management Mobile Applications	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
43	2nd Triennial (2015-2017)	PG&E	2.13 Digital Substation/Substation Automation	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only

Row #	Investment Program Period	Program	Project Name	If Competitively Selected,	If Competitively Selected,	If Interagency or Sole Source	Does Award Recipient Identify as	How the Project Leads to
	A	B	C	X	Y	Z	AA	AB
For Report DOC	i. Investment Plan Period		Project Name					
44	2nd Triennial (2015-2017)	PG&E	2.14 Automatically Map Phasing Information	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
45	2nd Triennial (2015-2017)	PG&E	2.15 Synchrophasor Applications for Generator Dynamic Model Validation	N/A	N/A	Column applicable to CEC only	No	Column applicable to CEC only
46	2nd Triennial (2015-2017)	PG&E	2.16 Enhanced Synchrophasor Analytics & Applications	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
47	2nd Triennial (2015-2017)	PG&E	2.17 Geomagnetic Disturbance (GMD) Evaluation	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
48	2nd Triennial (2015-2017)	PG&E	2.18 Optical Instrument Transformers and Sensors for Protection and Control Systems	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
49	2nd Triennial (2015-2017)	PG&E	2.19 Enable Distributed Demand-Side Strategies & Technologies	1	N/A	N/A	No	Column applicable to CEC only
50	2nd Triennial (2015-2017)	PG&E	2.20 Real-Time Energy Usage Feedback to Customers	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
51	2nd Triennial (2015-2017)	PG&E	2.21 Home Area Network (HAN) for Commercial Customers	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only

Row #	Investment Program Period	Program	Project Name	If Competitively Selected,	If Competitively Selected,	If Interagency or Sole Source	Does Award Recipient Identify as	How the Project Leads to
	A	B	C	X	Y	Z	AA	AB
For Report DOC	i. Investment Plan Period		Project Name					
52	2nd Triennial (2015-2017)	PG&E	2.22 Demand Reduction Through Targeted Data Analytics	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
53	2nd Triennial (2015-2017)	PG&E	2.23 Integrate Demand Side Approaches Into Utility Planning	N/A	N/A	Column applicable to CEC only	No	Column applicable to CEC only
54	2nd Triennial (2015-2017)	PG&E	2.24 Appliance Level Bill Disaggregation for Non-Residential Customers	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
55	2nd Triennial (2015-2017)	PG&E	2.25 Enhanced Smart Grid Communications	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
56	2nd Triennial (2015-2017)	PG&E	2.26 Customer & Distribution Automation Open Architecture Devices	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only

Row #	Investment Program Period	Program	Project Name	If Competitively Selected,	If Competitively Selected,	If Interagency or Sole Source	Does Award Recipient Identify as	How the Project Leads to
	A	B	C	X	Y	Z	AA	AB
For Report DOC	i. Investment Plan Period		Project Name					
57	2nd Triennial (2015-2017)	PG&E	2.27 Next Generation Integrated Smart Grid Network Management	1	N/A	N/A	Yes	Column applicable to CEC only
58	2nd Triennial (2015-2017)	PG&E	2.28 Smart Grid Communications Path Monitoring	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only
59	2nd Triennial (2015-2017)	PG&E	2.29 Mobile Meter Applications	1	N/A	N/A	No	Column applicable to CEC only
60	2nd Triennial (2015-2017)	PG&E	2.30 Leverage EPIC funds to Participate in Industry-Wide RD&D Programs	TBD	TBD	Column applicable to CEC only	TBD	Column applicable to CEC only

*Date of award corrected from previous annual report

Row #	Investment Program Period	Program	Project Name	Applicable Metrics	2016 Update
	A	B	C	AC	AD
For Report DOC	i. Investment Plan Period		Project Name	vi. Metrics	xv. 2016 Status Update
1	1st Triennial (2012-2014)	PG&E	1.01 Energy Storage for Market Operations	• 1i - Nameplate capacity (megawatts) of grid-connected energy storage. • 3a - Maintain/Reduce operations and maintenance costs. • 6a - CAISO NGR financial settlements. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code (Pub. Util. Code) § 8360). • 7c - Dynamic optimization of grid operations and resources, including appropriate consideration for asset management and utilization of related grid operations and resources, with cost-effective full cyber security (Pub. Util. Code § 8360). • 7l - Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services (Pub. Util. Code § 8360). • 9c - EPIC project results referenced in regulatory proceedings and policy reports (Business Plan references: CPUC R.10-12-007).	• Project completed in 2016. • Engaged with CAISO to identify and resolve implementation issues with the CAISO Non-Generator Resource (NGR) model for Limited Energy Storage Resources based on operational experience, quantified financial revenues of the CAISO Day Ahead (DA) and Real-Time (RT) energy markets, and achieved NGR model design improvements through the Energy Storage and Distributed Energy Resources (DER) initiative, such as including state of charge in the day-ahead market bid parameters • Project close report finalized and attached to Annual Report.
2	1st Triennial (2012-2014)	PG&E	1.02 Energy Storage for Distribution Operations	• 1c - Avoided procurement and generation costs. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code (Pub. Util. Code) § 8360). • 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources (Pub. Util. Code § 8360). • 9c - EPIC project results referenced in regulatory proceedings and policy reports (Business Plan references: Deferring a capacity upgrade has been identified as a key potential value of Energy Storage Technologies (ESTs) and noted in filings with the CPUC/Assembly Bill 2514.	• Project is in the Build/Test phase. • Completed project design and procured all equipment. • Completed all civil and electrical construction on site. • Proved Distributed Network Protocol 3 (DNP3) communications and bank load management Supervisory Control and Data Acquisition (SCADA) control scheme for energy storage controller in lab setting. • Next steps are to energize facility, complete performance testing, test and confirm via data analysis bank load management SCADA control scheme in real world operations, collect data and issue final report.
3	1st Triennial (2012-2014)	PG&E	1.03 Mobile and Stationary Energy Storage Synergies	TBD	• Project is currently on-hold.
4	1st Triennial (2012-2014)	PG&E	1.04 Expand Test Lab and Pilot Facilities for New Energy Storage Systems. Formally Withdrawn. CPUC A.12-11-003, 10/15/2013.	N/A	• Formally Withdrawn.
5	1st Triennial (2012-2014)	PG&E	1.05 New Forecast Methods for Improved Storm Damage Modeling	• 3a - Maintain/Reduce operations and maintenance costs. • 4a - GHG emissions reductions (MMTCO2e). • 5c - Forecast accuracy improvement. • 5e - Utility worker safety improvement and hazard exposure reduction.	• Project completed in 2016. • The project provided improved storm damage modeling guidance for numerous storm events during the year. • The fire danger model development was completed and placed into operations during the 2016 fire season given its improved guidance over the existing fire danger rating system, and was shared with broader fire science community. • The solar irradiance database and web portal was developed and demonstrated, including the function to compute PV power output (KW). This data can improve the ability to assess current and future grid impacts from PV generation to inform operational decisions with regards to planning and energy procurement. • Project close report finalized and attached to Annual Report.
6	1st Triennial (2012-2014)	PG&E	1.06 Demonstrate Communication Systems Allowing the CAISO to Utilize Available Renewable Generation Flexibility	N/A	• Project is currently on-hold.

Row #	Investment Program Period	Program	Project Name	Applicable Metrics	2016 Update
	A	B	C	AC	AD
For Report DOC	i. Investment Plan Period		Project Name	vi. Metrics	xv. 2016 Status Update
7	1st Triennial (2012-2014)	PG&E	1.07 Demonstrate Systems to Ramp Existing Gas-Fired Generation More Quickly to Adapt to Changes in Variable Energy Resources Output	N/A	• Formally Withdrawn CPUC A.12-11-003.
8	1st Triennial (2012-2014)	PG&E	1.08 Distribution System Safety and Reliability Through New Data Analytics Techniques	• 7c - Dynamic optimization of grid operations and resources; including appropriate consideration for asset management and utilization of related grid operations and resource, with cost-effective full cyber security (Public Utilities Code §8360). • 3a - Maintain/Reduce operations and maintenance costs: With the improved understanding of risk, there could be a better tool for evaluating projects such as asset replacement.	• Project completed in 2015. • Final report included in previous 2015 EPIC Annual Report.
9	1st Triennial (2012-2014)	PG&E	1.09A Close Proximity Switching	• 5a - Outage number, frequency and duration reductions. • 5e - Utility worker safety improvement and hazard exposure reduction.	• Project completed in 2016. • Project completed close out phase, including the comparison of three vendors and the EPIC close report. • Project close report finalized and attached to Annual Report.
10	1st Triennial (2012-2014)	PG&E	1.09B and 1.10B - Network Conditioned-Based Maintenance	• 3a - Maintain/Reduce operations and maintenance costs. • 3b - Maintain/Reduce capital costs. • 5d - Public safety improvement and hazard exposure reduction. • 5e - Utility worker safety improvement and hazard exposure reduction.	• Project completed in 2016. • Project completed accelerated lifecycle testing to establish a baseline for the robustness of SCADA condition monitoring equipment exposed to underground vault environmental conditions over an elongated period of time, and evaluated potential failure points within the components. • Project demonstrated life extension approaches by identifying and demonstrating improvements to increase life expectancy of components and reduce life cycle costs. • Project evaluated data integrity by identifying opportunities to enhance the efficacy of maintenance and replacement programs by determining methods to enhance the data integrity of the condition monitoring information being collected by the SCADA system. • Project close report finalized and attached to Annual Report.
11	1st Triennial (2012-2014)	PG&E	1.09C Discrete Series Reactors (DSRs)	• 3a - Maintain/Reduce operations and maintenance costs. • 3b - Maintain/Reduce capital costs. • 5a - Outage number, frequency and duration reductions. • 5b - Electric system power flow congestion reduction.	• Project completed in 2016. • Performed Power Line Carrier Testing to confirm that line protection is acceptable with the DSR units in the inject mode. • Performed operational testing to demonstrate the performance of the DSRs, including firmware and software improvements to achieve high availability. • Project close report finalized and attached to Annual Report.
12	1st Triennial (2012-2014)	PG&E	1.10A Dissolved Gas Analysis	TBD	• Project is currently on-hold.
13	1st Triennial (2012-2014)	PG&E	1.10C Underground Cable Analysis	TBD	• Project is currently on-hold.

Row #	Investment Program Period	Program	Project Name	Applicable Metrics	2016 Update
	A	B	C	AC	AD
For Report DOC	i. Investment Plan Period		Project Name	vi. Metrics	xv. 2016 Status Update
14	1st Triennial (2012-2014)	PG&E	1.11 Demonstrate Self-Correcting Tools to Improve System Records and Operations	TBD	• Project is currently on-hold.
15	1st Triennial (2012-2014)	PG&E	1.12 Demonstrate New Technologies That Improve Wildlife Safety and Protect Assets From Weather-Related Degradation	TBD	• Project is currently on-hold.
16	1st Triennial (2012-2014)	PG&E	1.13 Demonstrate New Communication Systems to Improve Substation Automation and Interoperability	TBD	• Project is currently on-hold.
17	1st Triennial (2012-2014)	PG&E	1.14 Next Generation SmartMeter™ Telecom Network Functionalities	• 7f - Deployment of cost-effective smart technologies, including real time, automated, interactive technologies that optimize the physical operation of appliance and consumer devices for metering, communications concerning grid operations and status, and distribution automation (Public Utilities Code (Pub. Util. Code) §8360). • 7k - Develop standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid (Pub. Util. Code §8360). • Note: Each technology demonstrated may have additional specific benefits to name. For instance, the following could apply: improved communication for power restoration, improved control of streetlights, etc.	• Project completed in 2016. • Completed remaining 4 of 17 use cases, which included demonstrating the use of the SmartMeter™ Network as a communications channel for various smart grid devices and processes, including Distribution Automation, low-profile meters for wireless cellular clients, and devices to monitor transformers in small spaces. • Low Profile Meter (LPM) developed and installed in Smart Poles and deployed 50 LPMs in San Jose. Low profile meter specification and marketing documentation prepared and patent submitted. • Developed methodology for quantifying available bandwidth on the SmartMeter™ Radio Mesh Network, and determined that, on average, there was significant available bandwidth. • Enhanced existing outage notification capabilities of SmartMeter™ devices and developed an Outage "Restoration Dashboard" visualization tool. • Developed algorithm for detecting wires down using SmartMeter™ messages and analytics and patent submitted. • Project close report finalized and attached to Annual Report.
18	1st Triennial (2012-2014)	PG&E	1.15 Grid Operations Situational Intelligence	• 5a - Outage number, frequency and duration reductions. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360). • 3a - Maintain/Reduce operations and maintenance costs.	• Project completed in 2016. • Demonstrated a technology platform to visualize grid operations data to improve both real time and short-term operational decisions, such as outage anticipation, construction planning, circuit loading research, and emergency operations. • The project developed key data, system, and user experience learnings through integrating more than 20 data sources into a single visualization tool allowing users to view complex data sources in ways that were not possible through current solutions. • Used agile methodology to incorporate user feedback from operators to support function development. • Project close report finalized and attached to Annual Report.

Row #	Investment Program Period	Program	Project Name	Applicable Metrics	2016 Update
	A	B	C	AC	AD
For Report DOC	i. Investment Plan Period		Project Name	vi. Metrics	xv. 2016 Status Update
19	1st Triennial (2012-2014)	PG&E	1.16 Vehicle-to-Grid Operational Integration	• 5a - Outage number, frequency and duration reductions. • 5e - Utility worker safety improvement and hazard exposure reduction. • 3a - Maintain/Reduce operations and maintenance costs. • 4a – Greenhouse Gas emissions reductions (MMTCO2e).	• Project completed in 2016. • Beta vehicles demonstrated in the lab and field. • Four use-cases validated through data collection and testing: (1) Provide power during transformer replacement; (2) temporary power for EV charging stations; (3) establish or support a microgrid (including emergency relief); and (4) electric power plus equipment transport to remote sites. • Three target power levels achieved: 75, 120, 160 kilovolt ampere (by vehicle class). • Project close report finalized and attached to Annual Report.
20	1st Triennial (2012-2014)	PG&E	1.17 Industry Participation to Leverage EPIC Dollars	TBD	• Project is currently on-hold.
21	1st Triennial (2012-2014)	PG&E	1.18 Appliance-Level Load Disaggregation	• 1f - Avoided customer energy use. • 1h - Customer bill savings (dollars saved).	• Project completed in 2016. • Project analyzed results from aggregator vendors and feedback from customer surveys to verify perception and satisfaction with appliance aggregation technology and web portal. • Project close report finalized and attached to Annual Report.
22	1st Triennial (2012-2014)	PG&E	1.19 Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	• 1h - Customer bill savings (dollars saved). • 1f - Avoided customer energy use (kilowatt-hours saved). • 3a - Maintain/Reduce operations and maintenance costs. • 3b - Maintain/Reduce capital costs. • 5d - Public safety improvement and hazard exposure reduction. • 5e - Utility worker safety improvement and hazard exposure reduction. • 5f - Reduced flicker and other power quality differences. • 5i. Increase in the number of nodes in the power system at monitoring points. • 7f - Deployment of cost-effective smart technologies, including real time, automated, interactive technologies that optimize the physical operation of appliance and consumer devices for metering, communications concerning grid operations and status, and distribution automation. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid.	• Project completed in 2016. • Project finalized all four use cases, including: 1. Proved ability to convert electric meters to the American National Standards Institute (ANSI) C12.19 Standard metering data from the existing Advanced Metering Infrastructure (AMI) vendor proprietary format, which enabled the collection of power quality data (e.g., voltage) that was previously not available in the original format. 2. Proved ability to add new data channels to the SmartMeter™ feeds and with minor modifications to the AMI network and systems, proved ability to capture 4 channel data (including Received kVarh) from standard kV2c meters. 3. Proved the ability to transmit SmartMeter™ data from an Access Points (AP) through different types/bandwidths of radios and antennas and into Pacific Gas and Electric Company's back office with no loss of fidelity and no need for interfaces, which enabled the ability to connect hard-to-reach SmartMeter™ devices for picking up meter reads in remote locations. 4. Proved that, by collecting and analyzing interval voltage and usage data from Smart Meters™, Line Side Tap energy diversion cases can be detected and the information can be used to remediate safety hazards and prevent electric revenue loss. • Project close report finalized and attached to Annual Report.
23	1st Triennial (2012-2014)	PG&E	1.20 Demonstrate the Benefits of Providing the Competitive, Open Market With Automated Access to Customer-Authorized SmartMeter™ Data to Drive Innovation.	N/A	• Formally notified CPUC on 10-31-13, project may be terminated as refined scope does not appear to meet safety, reliability, affordability guiding principles for priority Research and Development.

Row #	Investment Program Period	Program	Project Name	Applicable Metrics	2016 Update
	A	B	C	AC	AD
For Report DOC	i. Investment Plan Period		Project Name	vi. Metrics	xv. 2016 Status Update
24	1st Triennial (2012-2014)	PG&E	1.21 Automatic Identification of Distributed Photovoltaic (PV) Resources	• 5d - Public safety improvement and hazard exposure reduction. • 5f - Reduced flicker and other power quality differences. • 5c - Forecast accuracy improvement.	• Project completed in 2016. • Advanced development and accuracy of PV identification (ID) algorithm to detect solar systems that export. • Improved the accuracy of the UI identification logic/algorithm and patent submitted. • Developed methodology to estimate the size of the PV systems and determined the accuracy of the PV system sizing method. • Supported development of probabilistic algorithm that has the potential to enable identification of other Distributed Energy Resources in addition to PV, such as EV, storage and wind, and implemented algorithm in PG&E systems. • Identified additional use case that leveraged SmartMeter™ data to determine ability to automatically identify customers with malfunctioning or underperforming PV systems based on the known PV capacity in PG&E's interconnection database. • Project close report finalized and attached to Annual Report.
25	1st Triennial (2012-2014)	PG&E	1.22 Electric Vehicle Submetering	• 4a - GHG emissions reductions (MMTCO2e). • 1h - Customer bill savings (megawatt hours saved).	• Project is in the Build/Test phase. • Phase 1 closed in 2016, which included 132 pilot participants and three MDMAs. • Phase 1 evaluation report released by Nexant and project received CPUC approval for launch of Phase 2, which adds an additional business model where the MDMA will hold contracts with customers be responsible for the EV bill to PG&E. • Next steps include setting up new MDMAs for participation in Phase 2, enrolling customers and processing payments and MDMA bills.
26	1st Triennial (2012-2014)	PG&E	1.23 Photovoltaic (PV) Submetering	• 5c - Forecast accuracy improvements. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360).	• Project completed in 2016. • Evaluated the accuracy of PV generation estimation tools. • Completed customer surveys regarding usability and value of the project's webpage on Pacific Gas and Electric Company's YourAccount that displayed estimated PV generation and usage data for 10,000 solar customers. • Determined data gap needs to accurately estimate PV generation for all customers at scale, which includes tilt, azimuth, shading, and degradation information. • Project close report finalized and attached to Annual Report.
27	1st Triennial (2012-2014)	PG&E	1.24 Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	• 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360).	• Project completed in 2016. • Information on the project was presented at a number of Demand Response industry events. • All data loggers will continue to be deployed to provide ongoing real time feedback Direct Load Control devices to the Demand Response Program Managers. • Project close report finalized, posted to EPIC, CalMac and Plug Load Management Associated (PLMA) websites, and attached to Annual Report.
28	1st Triennial (2012-2014)	PG&E	1.25 Direct Current (DC) Fast Charging Mapping	• 3a - Maintain/Reduce capital costs. • 3d - Number of operations of various existing equipment types before and after adoption of a new smart grid component, as an indicator of possible equipment life extensions from reduced wear and tear. • 4a - Greenhouse Gas emissions reductions (MMTCO2e). • 5c - Forecast accuracy improvement. • 5d - Public safety improvement and hazard exposure reduction. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code § 8360). • 7l - Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.	• Project completed in 2016. • Finalized identification of 300 broad locations within PG&E's territory for DC fast charger installations in 2025. • Identified over 14,000 individual potential sites to target based on non exclusive factors such as driving patterns, distribution capacity, Electric Vehicle adoption, and support of disadvantaged communities. • Developed interactive map released onto PG&E website and developed scoring tool to help on-the-ground planners prioritize these sites. • Project close report finalized and attached to Annual Report.

Row #	Investment Program Period	Program	Project Name	Applicable Metrics	2016 Update
	A	B	C	AC	AD
For Report DOC	i. Investment Plan Period		Project Name	vi. Metrics	xv. 2016 Status Update
29	1st Triennial (2012-2014)	PG&E	1.26 Pilot Measurement and Telemetry Strategies and Technologies That Enable the Cost-Effective Integration of Mass Market Demand Response (DR) Resources Into the CAISO Wholesale Market	TBD	• Project is currently on-hold.
30	2nd Triennial (2015-2017)	PG&E	2.01 Evaluate Storage on the Distribution Grid	TBD	• Project is currently on-hold.
31	2nd Triennial (2015-2017)	PG&E	2.02 Pilot Distributed Energy Management Systems (DERMS)	• 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code (Pub. Util. Code) § 8360). • 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources (Pub. Util. Code § 8360).	• Project is in the Build/Test phase. • Developed solution architecture for pilot demonstration, designed integrations to enable DERMS system to communicate with third party DER aggregators, completed initial Site Acceptance Testing of DERMS software on PG&E systems in preparation for field demonstration of DERMS use cases in 2017. • Next steps include field demonstration of DERMS use cases, evaluation of effectiveness of DERMS in achieving use case objectives, leveraging of DERMS to participate in wholesale markets and development of recommendations in evaluating DERMS solutions for PG&E, other utilities, DERMS vendors, and DER aggregators.
32	2nd Triennial (2015-2017)	PG&E	2.03A Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	• 3a - Maintain/Reduce operations and maintenance costs. • 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources.	• Project is in the Build/Test phase. • Completed lab testing of Smart Inverters, confirming the active and reactive power control settings that can be used in field trial. • Scoped data analysis and circuit modeling that will be performed by project to evaluate the effectiveness of the field trial of Smart Inverters. • Executed contract with a Smart Inverter aggregator to drive the installation of Smart Inverters. • Initiated customer recruitment and installation. • Next steps include completing customer recruitment and installation of Smart Inverters at customer sites, field trial of Smart Inverter autonomous settings to drive Smart Inverter use cases, perform measurement and verification analysis to evaluate effectiveness of Smart Inverters in creating benefits.
33	2nd Triennial (2015-2017)	PG&E	2.03B Test Smart Inverter Enhanced Capabilities - Vehicle to Home	• 3a - Maintain/Reduce operations and maintenance costs. • 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources.	• Project is in the Plan/Analyze phase. • Re-designed project implementation plan in alignment with approved scope, after initially planned project partner retracted from participation. • Next steps include finalize design/engineering testing plan, install equipment and commence testing.
34	2nd Triennial (2015-2017)	PG&E	2.04 DG Monitoring & Voltage Tracking	• 3a - Maintain/Reduce operations and maintenance costs. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360). • 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources.	• Project is in the Build/Test phase. • Executed Request for Proposal to select project vendor. • Developed an application tool to track and visualize Rule 2 voltage violations. • Developed an algorithm to calculate likelihood that DG, especially solar interconnections, was the cause of violations, and also help planners identify those locations that might have frequent DG-caused voltage violations in the future. • Next steps include project completion of stakeholder review and development of close out materials.

Row #	Investment Program Period	Program	Project Name	Applicable Metrics	2016 Update
	A	B	C	AC	AD
For Report DOC	i. Investment Plan Period		Project Name	vi. Metrics	xv. 2016 Status Update
35	2nd Triennial (2015-2017)	PG&E	2.05 Inertia Response Emulation for DG Impact Improvement	TBD	• Project is in the Plan/Analyze phase. • Received internal approval to initiate project and begin development of project plan. • Next steps include developing project plan, identifying vendors and/or partners and executing project plan.
36	2nd Triennial (2015-2017)	PG&E	2.06 Intelligent Universal Transformer (IUT)	• 3a - Maintain/Reduce operations and maintenance costs. • 3b - Maintain/Reduce capital costs. • 5d - Public safety improvement and hazard exposure reduction. • 7k - Develop standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid. • 7l - Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.	• Project put on hold after determining the product (IUT) was not mature enough for a technology demonstration through EPIC.
37	2nd Triennial (2015-2017)	PG&E	2.07 Real-Time Loading Data for Distribution Operations and Planning	• 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.	• Project is in the Build/Test phase. • Developed both an algorithm to predict real-time loading at the transformer level and a visualization mechanism for users of the model. • Engaged with vendor and end users to identify a series of enhancements to make data more actionable. • Next steps include completion of stakeholder review of completed application and integration of this prototype technology with distribution planning tools.
38	2nd Triennial (2015-2017)	PG&E	2.08 "Smart" Monitoring and Analysis Tools	TBD	• Project is currently on-hold.
39	2nd Triennial (2015-2017)	PG&E	2.09 Distributed Series Impedance (DSI) (Phase 2)	TBD	• Project is currently on-hold.
40	2nd Triennial (2015-2017)	PG&E	2.10 Emergency Preparedness Modeling	• 3a - Maintain/Reduce operations and maintenance costs. • 4a - Greenhouse Gas emissions reductions (MMTCO2e). • 5a - Outage number, frequency and duration reductions. • 5d - Public safety improvement and hazard exposure reduction. • 5e - Utility worker safety improvement and hazard exposure reduction. • 5c - Forecast accuracy improvement.	• Project is in the Plan/Analyze phase. • Executed Request for Information (RFI) and Request for Proposal, selected vendor and executed vendor contract. • Supplied necessary data from key enterprise systems to the vendor for analysis. • Next steps include development of full system requirements, including architecture, algorithms, and associated documentation, as well as supply and test initial prototype with Emergency Operation Center stakeholders for functionality testing and user input.
41	2nd Triennial (2015-2017)	PG&E	2.11 New Mobile Technology & Visualization Applications	TBD	• Project is currently on-hold.
42	2nd Triennial (2015-2017)	PG&E	2.12 New Emergency Management Mobile Applications	TBD	• Project is currently on-hold.
43	2nd Triennial (2015-2017)	PG&E	2.13 Digital Substation/Substation Automation	TBD	• Project is currently on-hold.

Row #	Investment Program Period	Program	Project Name	Applicable Metrics	2016 Update
	A	B	C	AC	AD
For Report DOC	i. Investment Plan Period		Project Name	vi. Metrics	xv. 2016 Status Update
44	2nd Triennial (2015-2017)	PG&E	2.14 Automatically Map Phasing Information	• 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.	• Project is in the Design/Engineering phase. • Selected two candidate algorithm approaches for development and demonstration. • Completed field verification of phasing and meter-to-transformer mapping for the target geography, to act as a training and test set for algorithms. • Next steps include development of phasing algorithm and meter to transformer algorithm, and explore additional feeder field verification as necessary and possible.
45	2nd Triennial (2015-2017)	PG&E	2.15 Synchrophasor Applications for Generator Dynamic Model Validation	• 3a - Maintain/Reduce operations and maintenance costs. • 5a - Outage number, frequency and duration reductions. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360).	• Project is in the Build/Test phase. • Installed Synchrophasor system at the Colusa Generating Station and created models in the Mathworks tool of the CGS facility. • Next steps include continued testing and validation of generation model.
46	2nd Triennial (2015-2017)	PG&E	2.16 Enhanced Synchrophasor Analytics & Applications	TBD	• Project is currently on-hold.
47	2nd Triennial (2015-2017)	PG&E	2.17 Geomagnetic Disturbance (GMD) Evaluation	TBD	• Project is currently on-hold.
48	2nd Triennial (2015-2017)	PG&E	2.18 Optical Instrument Transformers and Sensors for Protection and Control Systems	TBD	• Project is currently on-hold.
49	2nd Triennial (2015-2017)	PG&E	2.19 Enable Distributed Demand-Side Strategies & Technologies	• 1c - Avoided procurement and generation costs. • 1i - Nameplate Capacity of Grid-Connected Storage. • 3f - Improvements in system operation efficiencies stemming from increased utility dispatchability of customer demand side management. • 5b - Electric system power flow congestion reduction. • 5d - Public safety improvement and hazard exposure reduction. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid. • 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources.	• Project is in the Build/Test phase. • Finalized selection of site location. • Executed Request for Proposal and selected vendors (one commercial scale and one residential scale). • Initiated customer acquisition efforts with vendors, developed test plan and began integration with the Distributed Energy Resource Management System platform. • Next steps include completion of customer acquisition and installation of all systems at participating sites, refinement of test plan, completion of commissioning of the systems, commencement of field deployment testing, collection and analysis of system data, collection of lessons learned and completion of final report.
50	2nd Triennial (2015-2017)	PG&E	2.20 Real-Time Energy Usage Feedback to Customers	TBD	• Project is currently on-hold.
51	2nd Triennial (2015-2017)	PG&E	2.21 Home Area Network (HAN) for Commercial Customers	• 1e - Peak load reduction (megawatts) from summer and winter programs. • 1f - Avoided customer energy use (kilowatt hours saved). • 1h - Customer bill savings (dollars saved). • 3a - Maintain / Reduce operations and maintenance costs. • 4a - GHG emissions reductions (MMTCO2e). • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code § 8360).	• Project is in the Build/Test phase. • Recruited 15 sites for field testing, deployed HAN equipment to key test sites, implemented initial survey on operating sites. • Next steps include analyzing data for energy consumption impact of deployed devices at field test sites, implementing mid-project and final surveys, compiling survey results and complete final report.

Row #	Investment Program Period	Program	Project Name	Applicable Metrics	2016 Update
	A	B	C	AC	AD
For Report DOC	i. Investment Plan Period		Project Name	vi. Metrics	xv. 2016 Status Update
52	2nd Triennial (2015-2017)	PG&E	2.22 Demand Reduction Through Targeted Data Analytics	• 3a - Maintain/Reduce capital costs. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid. • 7e - Development and incorporation of cost-effective demand response, demand side resource, and energy efficient resources. • 7h - Deployment and integration of cost-effective advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air-conditioning.	• Project is in the Build/Test phase. • Issued direct award contract to project vendor. • Implemented pilot analytical software, integrated various internal datasets to create centralized analytics platform, created initial operational optimization engine (i.e., "screening tool"), assembled analyses across DERs to include within optimization engine and began process to improve foundational analytics where needed (e.g., propensity modeling). • Next steps include continued refinement of optimization and underlying analytical inputs; improving customer outreach dashboard interface; incorporating value added output from optimization engine analytics; leveraging metering data to assess energy usage impact from DER deployment; creating methodology and infrastructure for meter based monitoring and verification; exploring the use of cloud-based platform for project implementation; leveraging project methodology to create improved DER load curve model inputs; applying optimization engine and outreach infrastructure to current field efforts to field test and iteratively improve model and outreach operation.
53	2nd Triennial (2015-2017)	PG&E	2.23 Integrate Demand Side Approaches Into Utility Planning	• 1c - Avoided procurement and generation costs. • 3f - Improvements in system operation efficiencies stemming from increased utility dispatchability of customer demand side management. • 5c - Forecast accuracy improvement. • 7e - Development and incorporation of cost-effective demand response, demand side resources, and energy-efficient resources (Public Utilities Code § 8360).	• Project is in the Build/Test phase. • Completed enhancements to the planning tools (LoadSEER and CYME) to more readily incorporate Advanced Metering Infrastructure (AMI) data and more transparently incorporate the impacts of the DER deployments at the circuit level, support integration capacity analysis (ICA) and support locational net benefit analysis (LNBA). • Completed incorporation of DER adjustment portfolios into LoadSEER. • Completed user acceptance testing of the DER adjustment portfolio administrator functions, the load forecast viewer application, and the load shapes viewer application. • Developed enhanced interface between LoadSEER and CYME to support integration capacity analysis; completed a number of enhancements to facilitate more efficient data exchange between Teradata, EDGIS, PI and LoadSEER and between LoadSEER and CYME. • Next steps include demonstrating the enhanced features of LoadSEER and CYME over one distribution planning cycle, completion of final EPIC Project report, and sharing of project learnings with electric industry peers.
54	2nd Triennial (2015-2017)	PG&E	2.24 Appliance Level Bill Disaggregation for Non-Residential Customers	TBD	• Project is currently on-hold.
55	2nd Triennial (2015-2017)	PG&E	2.25 Enhanced Smart Grid Communications	TBD	• Project is currently on-hold.
56	2nd Triennial (2015-2017)	PG&E	2.26 Customer & Distribution Automation Open Architecture Devices	• 3f - Improvements in system operation efficiencies stemming from increased utility dispatchability of customer demand side management. • 5i - Increase in the number of nodes in the power system at monitoring points. • 7j - Provide consumers with timely information and control options.	• Project is in the Design/Engineering phase. • Completed project business plan, including a detailed use case plan. • Next steps include conducting a Request for Proposal, selecting vendors, executing contracts, executing proposed use cases and analyzing results and documenting findings.

Row #	Investment Program Period	Program	Project Name	Applicable Metrics	2016 Update
	A	B	C	AC	AD
For Report DOC	i. Investment Plan Period		Project Name	vi. Metrics	xv. 2016 Status Update
57	2nd Triennial (2015-2017)	PG&E	2.27 Next Generation Integrated Smart Grid Network Management	• 3a - Maintain/Reduce operations and maintenance costs. • 5a - Outage number, frequency and duration reductions. • 5d – Public safety improvement and hazard exposure reduction. • 5e - Utility worker safety improvement and hazard exposure reduction.	• Project is in the Build/Test phase. • Executed Request for Proposal, selected vendor and issued contract. • Completed project business plan, finalized requirements, demonstrated and documented system interfaces, and demonstrated data model for inventory/configuration tracking. • Next steps include generating, demonstrating and documenting custom communication views and custom fault/alert views, finalizing system test plan, conducting data, testing multiple interfaces and completing the project final report.
58	2nd Triennial (2015-2017)	PG&E	2.28 Smart Grid Communications Path Monitoring	• 1h - Customer bill savings (dollars saved). • 3e - Non-energy economic benefits – reduction operational hours to fix estimated bills due to RF Interference.	• Project is in Plan/Analyze phase • Received internal approval to initiate project and begin development of project plan • Next steps include finalizing business plan, finalize use cases, develop functional requirements, conduct Request for Proposal process for developing Radio Frequency Interference (RFI) monitoring application, then build, and test.
59	2nd Triennial (2015-2017)	PG&E	2.29 Mobile Meter Applications	• 3a - Maintain/Reduce operations and maintenance costs (Affordability). • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Reliability). • 7j - Provide consumers with timely information and control options (Customer).	• Project is in the Build/Test phase. • Executed Request for Proposal, selected vendor and issued contract. • Developed comprehensive specification for Pacific Gas and Electric Company's Next Generation Mobile Meter (NGM), including multiple test use cases such as behind the meter battery storage devices, Electric Vehicle chargers, etc. • Finalized hardware/software specifications and mechanical design, and conducted hardware testing. • Next steps include finalizing prototype, conducting functional testing on Alpha prototypes, complete final integrations and start Quality Assurance products, conduct field trials on Beta prototypes, and complete project final report.
60	2nd Triennial (2015-2017)	PG&E	2.30 Leverage EPIC funds to Participate in Industry-Wide RD&D Programs	TBD	• Project is currently on-hold.

*Date of award corrected from previous annual report

PACIFIC GAS AND ELECTRIC COMPANY

ATTACHMENT C

PG&E'S FINAL REPORTS (APPENDICES B – O)
(Attachment C is being provided within PG&E's
Notice of Availability in lieu of electronic files due
to its large file size. The content of Attachment C
has been provided to the Commission's Docket
Office for filing.)

**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA**

Application of the California Energy Commission for Approval of Electric Program Investment Charge Proposed 2015 through 2017 Triennial Investment Plan. And Related Matters.	A.14-04-034 (Filed April 29, 2014) A.14-05-003 A.14-05-004 A.14-05-005

**NOTICE OF AVAILABILITY (IN LIEU) OF
ATTACHMENT C OF THE 2016 ANNUAL ELECTRIC
PROGRAM INVESTMENT CHARGE REPORT OF
PACIFIC GAS AND ELECTRIC COMPANY (U 39 E)**

CHRISTOPHER J. WARNER

Pacific Gas and Electric Company
77 Beale Street, B30A
San Francisco, CA 94105
Telephone: (415) 973-6695
Facsimile: (415) 973-0516
E-Mail: CJW5@pge.com

Attorneys for
Dated: February 28, 2017   PACIFIC GAS AND ELECTRIC COMPANY

Application of the California Energy Commission for Approval of Electric Program Investment Charge Proposed 2015 through 2017 Triennial Investment Plan.	A.14-04-034 (Filed April 29, 2014)
And Related Matters.	A.14-05-003 A.14-05-004 A.14-05-005

NOTICE OF AVAILABILITY (IN LIEU) OF ATTACHMENT C OF THE 2016 ANNUAL ELECTRIC PROGRAM INVESTMENT CHARGE REPORT OF PACIFIC GAS AND ELECTRIC COMPANY (U 39 E)

TO ALL PARTIES IN A.14-04-034, et al.

PLEASE TAKE NOTICE THAT on February 28, 2017, Pacific Gas and Electric Company (PG&E) served its 2016 Annual Electric Program Investment Charge Report. The reports consists of the Pleading, Attachment A- EPIC Annual Report, Attachment B- PG&E's Appendix A to EPIC Report (Project Status Report) and Attachment C- PG&E's Final Reports (Appendices B-O). Due to the exceeding large file size of Attachment C, PG&E hereby provides this Notice of Availability.[1] Attachment C- PG&E's Final Reports (Appendices B-O) are available on PG&E's website at the link provided:

https://www.pge.com/en_US/about-pge/environment/what-we-are-doing/electric-program-investment-charge/closeout-reports.page

Appendix	Title of Document	Date Posted
B	EPIC 1.01 - Energy Storage End Uses	1/4/2017
C	EPIC 1.05 - Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output	1/30/2017
D	EPIC 1.09A - Test New Remote Monitoring and Control Systems for Existing Transmission & Distribution Assets: Close Proximity Switching	8/16/2016
E	EPIC 1.09B/1.10B - Test New Remote Monitoring and Control Systems for T&D Assets / Demonstrate New Strategies and Technologies to Improve the Efficacy of Existing Maintenance	2/3/2017

---

[1] Attachments A and B to the report will be electronically filed using the Commission's e-file system. Attachment C has been uploaded onto an archival grade DVD and will be provided to the Commission's Docket Office for handling.

Appendix	Title of Document	Date Posted
	and Replacement Programs	
F	EPIC 1.09C - Test New Remote Monitoring and Control Systems for T&D Assets	1/30/2017
G	EPIC 1.14 - Next Generation SmartMeter™ Telecom Network Functionalities	2/21/2017
H	EPIC 1.15 - Grid Operations Situational Intelligence (GOSI)	1/30/2017
I	EPIC 1.16 - Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages	2/3/2017
J	EPIC 1.18 - Demonstrate SmartMeter™-Enabled Data Analytics to Provide Customers with Appliance-Level Energy Use Information	2/17/2017
K	EPIC 1.19 - Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	1/30/2017
L	EPIC 1.21 - Auto Identification of Photovoltaic (PV) Resources	2/6/2017
M	EPIC 1.23 - Photovoltaic (PV) Submetering	1/30/17
N	EPIC 1.24 - Demonstrate Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	6/20/17
O	EPIC 1.25 - Direct Current Fast Charging (DCFC) Mapping	2/17/17

PG&E will, upon request, provide a hard copy of the above-described report. PG&E asks that

requests be submitted in writing by e-mail or facsimile transmission to:

Annabel Striplin
PG&E's Law Department
77 Beale Street, Mail Code B30A
San Francisco, CA 94105
Telephone: 415.973.7374
Facsimile: 415.973.5520
E-mail: a1sv@pge.com

Respectfully Submitted,

CHRISTOPHER J. WARNER

By: */s/ Christopher J. Warner*
    CHRISTOPHER J. WARNER

Pacific Gas and Electric Company
77 Beale Street, B30A
San Francisco, CA 94105
Telephone: (415) 973-6695
Facsimile: (415) 973-5520
E-Mail: CJW5@pge.com

Attorney for
Dated: February 28, 2017   PACIFIC GAS AND ELECTRIC COMPANY