
PACIFIC GAS AND ELECTRIC COMPANY
ELECTRIC PROGRAM INVESTMENT CHARGE (EPIC)
2017 ANNUAL REPORT

IN COMPLIANCE WITH CPUC DECISION 12-05-037

SUBMITTED FEBRUARY 28, 2018

VOLUME 1

ATTACHMENT A:
2017 Annual Report

ATTACHMENT B:
2017 Annual Report Appendix A



**PACIFIC GAS AND ELECTRIC COMPANY
ATTACHMENT A
2017 EPIC ANNUAL REPORT**

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ELECTRIC PROGRAM INVESTMENT CHARGE (EPIC)
2017 ANNUAL REPORT
FEBRUARY 28, 2018



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 Company (PG&E) hereby files the 2017 Annual Report for the Electric Program Investment Charge Program.

In compliance with Ordering Paragraph 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 -

EPIC 2012-2014: A.12-11-001, A.12-11-002, A.12-11-003, A.12-11-004,

EPIC 2015-2017: A.14-05-003, A.14-05-004, A.14-05-005, A.14-04-034

EPIC 2018-2020: A.17-04-028, A.17-05-003, A.17-05-005, 17-05-009

PG&E recently filed GRC: A.15-09-001,

SCE recently filed GRC: A.16-09-001,

SDG&E recently filed GRC: A.17-10-007

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1. Executive Summary

a. Overview of Program and 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 sixth annual report, documenting project activities since project inception through December 31, 2017.

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). On August 10, 2017, the CPUC issued Resolution E-4863, which approved two of the six new EPIC projects proposed by PG&E via a Tier 3 Advice Letter (AL) 5015-E filed on February 07, 2017, between triennial EPIC Applications as permitted by D.15-09-005. On April 28, 2017, PG&E filed its Application (A.) 17-04-028 for the third triennial investment plan period of 2018-2020 (referred to as EPIC 3). PG&E is currently waiting for CPUC decision and approval of this third triennial investment plan.

This report summarizes PG&E's projects' progress and status for the 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 PG&E's customers that enable greater customer choice; integrate Demand-Side Management (DSM) for grid optimization.

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.

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 the customers, as it offers the opportunity to cost-effectively develop and demonstrate innovative technologies which can advance the company’s core values of Safety, Reliability, and Affordability. 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 PG&E’s 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 PG&E 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 2017 TD&D Program Highlights

PG&E is pleased to report the significant achievement of completing one EPIC 1 project and six EPIC 2 projects in 2017 and/or before filing the 2017 EPIC Annual Report, which brings the total number of completed EPIC 1 and 2 projects to date to twenty-two out of a total of thirty-six funded projects.

Below are the seven EPIC projects that have closed in 2017 and/or before filing the 2017 EPIC Annual Report:

1. *EPIC 1.02 – Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction*
2. *EPIC 2.03B – Smart Inverter Enhanced Capabilities - Vehicle to Home*
3. *EPIC 2.04 – Distributed Generation (DG) Monitoring and Voltage Tracking*
4. *EPIC 2.19 – Enable Distributed Demand-Side Strategies & Technologies*
5. *EPIC 2.21 – Home Area Network (HAN) for Commercial Customers*
6. *EPIC 2.23 – Integrate demand side approaches into Utility Planning*
7. *EPIC 2.28 – Smart Grid Communications Path Monitoring*

Each project’s purpose, methods, findings, results, and industry-relevant learnings are further documented in their individual final reports (attached in Appendices B through H).³

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

Upon completion of these projects, PG&E will leverage learnings and may operationalize associated results, where applicable and cost-effective.

The results of PG&E's technology demonstrations are also highly applicable to other industry stakeholders. For example, given the significant Distributed Energy Resource (DER) growth, the opportunities for utilities to partner with technology companies will continue to grow and be a key component of developing future capabilities. Utilities may apply learnings from *EPIC 2.02 – Pilot Distributed Energy Resource Management Systems (DERMS)* which is demonstrating a pre-commercial Distributed Energy Resource Management System (DERMS) to coordinate the control of various types of DERs, particularly third-party-aggregated Photovoltaic (PV) solar generation and battery energy storage resources. Development, testing and demonstration of DERMS will further California's goals to adopt higher amounts of DERs on the grid, while providing operators with the necessary control mechanisms to operate the grid safely, reliably and effectively. An effective DERMS could integrate customer-sited Distributed Generation (DG) into grid operations to improve grid resiliency and reliability. It is important to note, however, that this technology is still in its early phases and therefore significant further development is needed before a commercial scale solution may be implemented. The DERMS demonstration will help to define future requirements for utility operating processes and systems, as well as for participating DERs.

In 2018, PG&E will continue to execute in-progress projects, including one EPIC 1 project and thirteen EPIC 2 projects. PG&E also plans to start execution on EPIC 3 projects subject to the timing of CPUC's approval of PG&E's EPIC 3 Application for the 2018-2020 program cycle.⁴

For detailed information on the developments and status of each EPIC 1 and EPIC 2 project, see Appendix A.

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 help make the electric grid safer, more reliable and more affordable for customers. Some notable examples of EPIC 1 achievements in 2017 include:

- *EPIC 1.01 – Energy Storage End Uses*: This project successfully utilized PG&E's Vaca-Dixon and Yerba Buena Battery Energy Storage Systems (BESS) to gain experience that addresses multiple barriers for utility-scale battery storage systems to participate in the California Independent System Operator's (CAISO) Non-Generator Resource (NGR) market. PG&E developed and deployed an automated communications and control solution to fully utilize and evaluate BESS fast-response functionalities to determine their ability to instantaneously switch between different market products as the price of those products change. The project established input to processes for the operation of utility-scale battery storage resources as both market and distribution system assets, which may improve reliability and advance resilience by supporting PG&E customers in the event of a disturbance or outage. These results

⁴ A.17-04-028.

have the potential to be leveraged by other electric utilities. The Association of Edison Illuminating Companies (AEIC) recognized and awarded PG&E the 2017 AEIC Achievement Award for EPIC Project 1.01. The award was granted in recognition of the significant contribution that work on this project has made toward advancing electric energy industry operations.

- *EPIC 1.02 – Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction:* This project demonstrated the ability of utility-owned and controlled energy storage resources to deliver autonomous distribution peak shaving functionality. Energy storage resources hold significant promise to help California address a variety of grid planning and operations challenges, both today and in the future. Energy storage resources have potential to advance Green House Gas (GHG) reduction goals and provide lower peak demand power costs for utility customers. The implementation and operational challenges associated with this project resulted in learnings that will inform PG&E's procurement of future energy storage resources for grid support needs, both utility-owned and utility-contracted, through compliance with the IOU energy procurement targets as set forth in CPUC D.10-03-040 and beyond.

EPIC 2

The projects from EPIC 2 are even more focused on long-term strategic objectives and in many cases are built on the foundation of previous technology investments. Examples of this include analytics projects, such as *EPIC 2.07 – Real Time Loading Data for Distribution Operations & Planning* that uses data made available by the Advanced Metering Infrastructure (AMI) network to provide further grid insights for better projection of grid loading, and new use cases on how customer devices can support grid needs to continue to help enable the quickly emerging DER industry, such as through *EPIC 2.19 – Enable Distributed Demand-Side Strategies & Technologies*.

Additionally, in EPIC 2, PG&E further explored opportunities to leverage synergies between projects with similar objectives to drive the maximum benefit from the overall technology demonstration at the lowest possible cost to customers. As an example, when feasible, this approach can include 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. PG&E has three projects that are being executed in parallel at a single distribution substation in San Jose to generate additional learnings from the interaction of these new technologies. *EPIC 2.02 – Pilot Distributed Energy Resource Management Systems (DERMS)* demonstrates a system that can monitor, optimize and dispatch utility-owned and behind-the-meter (BTM) DERs. This includes PV with Smart Inverters and Battery Storage devices, which PG&E is demonstrating through the following two projects respectively: *EPIC 2.03A – Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)* and *EPIC 2.19 – Enable Distributed Demand-Side Strategies & Technologies*. Coordinating these projects allows both PG&E and the larger industry to gain important new and novel learnings on the individual technologies, as well as how these technologies can work together to maintain a safe and reliable grid for utility customers. 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.

In addition to the above highlights, some project-specific notable examples of EPIC 2 achievements in 2017 include:

- *EPIC 2.02 – Pilot Distributed Energy Resource Management Systems (DERMS)*: The DERMS project successfully developed and deployed a cutting edge DERMS on three distribution feeders in San Jose and has been demonstrating seven use cases related to the impact and functionality of DERMS, including situational awareness about DER grid impacts, optimal dispatch of DERs to provide distribution services, and dual-use of DERs to provide distribution devices and enable market participation. Early results validate potential for DERs to provide distribution services and identify key DER requirements and utility investments in grid technology necessary to enable successful communications and dispatch instructions between the grid operator and DERs. Preliminary findings of the project indicate that DERs can successfully provide distribution services both voltage support and grid capacity; however, market participation of large DERs providing regulation complicates online power flow calculations and load forecasting efforts and will need to be addressed as market participation of DERs increases. As the dynamic, two-way operating environment develops, the DERMS project enables PG&E and other utilities to improve electric reliability and equip customers with valuable services and products that support their choices to adopt clean energy. In 2017, this project received the Greentech Media (GTM) Grid Edge Award⁵ and the Metering & Smart Energy International (MSEI) Innovation of the Year Award.⁶
- *EPIC 2.23 – Integrate Demand Side Approaches into Utility Planning*: This project successfully developed and demonstrated how a utility could integrate a broader range of customer-side technologies and DER approaches into the utility planning process. The project served as a necessary and enabling precursor to the fulfillment of Public Utility Code 769, which requires transparent, consistent and more accurate methods to cost-effectively integrate DERs into the distribution planning process. This project delivered new and more granular load shape profiles and enhanced load forecasting tools and overall analytical processes to allow PG&E to more accurately and consistently integrate DER impact into the distribution system load profile. With these enhancements, PG&E can more effectively assess the impact of DER growth on the timing and need for future distribution and transmission system upgrades. Any deferral of future distribution or transmission system upgrades would lower costs for electric ratepayers.

⁵ Greentech Media has presented the Grid Edge Award for the past 4 years to the leading companies and projects that incorporate DERs and are re-envisioning the concept of centralized, unidirectional electricity delivery and overall addressing electricity management and delivery of the future. For 2017, the submission set was expanded to include international projects and companies, as well.

⁶ The MSEI award focuses on projects demonstrating the use of cutting-edge technology and critical thinking that are advancing utility systems into the 21st century.

Some of PG&E's achievements in EPIC 1 and 2 have also enabled PG&E to file four full patents and one provisional patent to date:

- *EPIC 1.14 – Demonstrate “Next Generation” SmartMeter™ Telecom Network Functionalities*: Patent for the development of the Smart Pole Meter
- *EPIC 1.14 – Demonstrate “Next Generation” SmartMeter™ Telecom Network Functionalities*: Patent for the development of the Smart Pole Meter Socket
- *EPIC 1.14 – Demonstrate “Next Generation” SmartMeter™ Telecom Network Functionalities*: Patent for an algorithm to help identify downed wires
- *EPIC 1.21 – Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability*: Patent for an algorithm which can detect unauthorized PV interconnections
- *EPIC 2.29 – Mobile Meter Applications*: Provisional patent for the multi-purpose mobile meter (Next Generation Meter – NGM).

These patents may provide potential future revenue generating opportunities that would be shared with PG&E's customers and shareholders,⁷ and ultimately support improved affordability if the patents lead to increased revenue. PG&E continues to consider opportunities to license patents, as well as opportunities to identify additional Intellectual Property in these and other projects.

Through the EPIC projects, PG&E has collaborated with national laboratories, universities, other utilities, third-parties, etc. Examples of collaboration include:

- *EPIC 1.02 – Demonstrate Use of Distributed Energy Storage for Transmission and Distribution Cost Reduction*: Early drafts of the BESS test protocols used in EPIC Project 1.02 were shared with the Electric Power Research Institute (EPRI) Energy Storage Integration Council and helped form the foundation for the now released EPRI Energy Storage Test Manual
- *EPIC 1.22 – Demonstrate Subtractive Billing with Submetering for EVs to Increase Customer Billing Flexibility*: In this project the joint IOU Administrators (PG&E, SDG&E and SCE) worked together to execute the project with the overall goal that various submetering scenarios be tested and integrated with the different IOU billing systems. Additionally, the project works with multiple EV Meter Data Management Agents (MDMAs) to test additional business models for submetering customer EV bills.
- *EPIC 2.05 – Inertia Response Emulation for DG Impact Improvement*: This project is currently working with the National Renewable Energy Laboratory (NREL) on equipment and hardware testing of inertia response. NREL is working with PG&E to develop recommendations on future synthetic inertia equipment performance requirements.

⁷ 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.”

NREL's unique ability to test equipment aligned well with the goals of this project to 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 to the grid.

- *EPIC 2.29 – Mobile Meter Applications:* The project worked with Lawrence Livermore National Lab (LLNL) who provided technical support for product development and demonstration of the mobile meter prototype.

In addition to the achievements highlighted above, it is equally important to recognize the value of EPIC in determining that a project is not ready to scale. The results of a number of EPIC projects found that more data, analysis, or technology advancement is necessary before the technology demonstrated is considered for adoption on a larger scale, which ultimately supports affordability for customers by not adopting the technology at scale before refinements are made to make the technology more viable. Below are examples of projects completed in 2017 with this outcome:

- *EPIC 2.03B – Smart Inverter Enhanced Capabilities – Vehicle to Home:* The project successfully demonstrated that a bi-directional EV and charger can support critical household loads through an outage. However, in addition to the technology not being commercially available, the project also determined that it is not cost effective for customers to adopt. This was supported by the project's customer survey results, which indicate the current cost estimate is roughly four times higher than an optimal price for consumers. Therefore, even though the project use cases were technically proven, they are not currently viable due to technology cost, limited market value, and other restrictions between actors (e.g., EV battery warranty coverage).
- *EPIC 2.04 – DG Monitoring & Voltage Tracking:* This project successfully demonstrated an algorithmic process to analyze new data sources to predict the likelihood that an Electric Rule 2 voltage violation was caused by distributed solar generation. Solar energy is by nature intermittent, and ebbs and surges of generation can change the voltage for neighboring, downstream customers. As solar adoption continues to grow, there is an increased likelihood of such voltage violations. However, it was also clear through this project that integration with a larger grid analytics platform is needed for this algorithm to scale into operational use for use cases such as potential improved decision making for power quality engineers responding to customer issues and distribution planners as they work to support safe and reliable solar installation across PG&E's service territory.
- *EPIC 2.19 – Enable Distributed Demand-Side Strategies & Technologies:* This project deployed customer-sited behind-the-meter (BTM) energy storage resources to demonstrate how these resources could support grid needs. This project successfully tested and demonstrated the use of customer-side BTM energy storage technologies to reduce peak loading and absorb DER generation in support of the electric grid and to promote affordability through potential distribution upgrade deferrals. The results of the project suggest that aggregated BTM customer energy storage could be leveraged in addressing capacity constraints with the utility customer benefit of both reliability and affordability. However, current vendor platforms for controlling customer-sited

storage are not ready for utility operations, and communications to devices is not comparable to traditional utility communications. Addressing these issues, as well as considering the implementation of command prioritization for future multiple-use applications, are key next steps to creating scalable use of customer-sited BTM storage to address capacity constraints.

As an innovative 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 to 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 twenty seven of the twenty nine projects proposed by PG&E in the EPIC 1 Investment Plan, since two projects were formally withdrawn by PG&E prior to the issuance of this decision.⁸ In D.15-04-020, the Commission approved the thirty one projects proposed by PG&E in the EPIC 2 Plan.⁹ In Resolution E-4863, the Commission approved two of the six projects proposed by PG&E in the Tier 3 Advice Letter AL 5015-E filed between triennial EPIC Applications.¹⁰ On April 28, 2017, PG&E filed Application A.17-04-028 for the third triennial investment plan period of 2018-2020 (referred to as EPIC 3) which included forty-three proposed projects. PG&E is currently waiting for CPUC decision and approval of this third triennial investment plan.

PG&E has 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 ensure PG&E maximizes this program to continue to meet customer needs while maintaining safety, reliability, and affordability of the grid. PG&E may utilize remaining funds by either adding funding to active projects or further pursuing on-hold projects.

The following table summarizes the projects' funding status by area and triennial investment plan program cycle as of December 31, 2017. (Note: This table does not include information on proposed EPIC 3 projects since they have not yet been approved by the CPUC).

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- ⁸ 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.
- ⁹ 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.
- ¹⁰ In the Tier 3 Advice Letter AL 5015-E filed between triennial EPIC applications, PG&E originally proposed 6 projects. CPUC Resolution E-4863 approved 2 (Projects 2.34 and 2.36) of the 6 proposed projects, allowed PG&E's withdrawal of 1 project (Project 2.31), deferred 2 projects to a future investment plan (Projects 2.32 and 2.33) and rejected 1 project (Projects 2.35).

Table1: 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 End Uses 1.02 Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction 1.05 Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output *Committed Funding: \$6.0M - \$7.3M	Projects: 5 2.02 Pilot Distributed Energy Resource Management Systems 2.03A Test Smart Inverter Enhanced Capabilities – PV 2.03B Test Smart Inverter Enhanced Capabilities – Vehicle to Home 2.04 DG monitoring & Voltage Tracking 2.05 Inertia Response Emulation for DG impact improvement Committed Funding: \$13.7M - \$16.8M	Projects: 8 Committed Funding: \$19.8M-\$24.1M
Grid Modernization & Optimization	Projects: 7 1.08 Improve Distribution System Safety & Reliability through New Data Analytics Techniques 1.09A Test New Remote Monitoring and Control Systems for Existing Transmission & Distribution Assets: Close Proximity Switching 1.09B/1.10B - Test New Remote Monitoring & Control System for T&D Assets / Demonstrate New Strategies and Tech to Improve the Efficacy of Existing Maintenance and Replacement Programs 1.09C Test New Remote Monitoring and Control Systems for T&D Assets: Discrete Series Reactors 1.14 Demonstrate "Next Generation" SmartMeter™ Telecom Network Function 1.15 Demonstrate New Technologies and Strategies That Support Integrated "Customer-to-Market-to-Grid" Operations of the Future 1.16 Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages Committed Funding: \$16.1M - \$19.7M	Projects: 5 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 2.34 Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors Committed Funding: \$10.4M-\$12.7M	Projects: 12 Committed Funding: \$26.5M-\$32.4M
Customer Service & Enablement	Projects: 7 1.18 Demonstrate SmartMeter™-Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information 1.19 Pilot Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform 1.21 Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability 1.22 Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility 1.23 Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility 1.24 Demonstrate DSM for T&D Cost Reduction 1.25 Develop a Tool to Map The Preferred Locations for DC Fast Charging, Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs While Reducing the Impact on PG&E's Distribution Grid Committed Funding: \$8.7M - \$10.6M	Projects: 5 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 2.36 Dynamic Rate Design Tool Committed Funding: \$9.3M-\$11.3M	Projects: 12 Committed Funding: \$18.0M-\$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: \$6.9M-\$8.4M	Projects: 4 Committed Funding: \$6.9M-\$8.4M
Summary	Total Funded Projects: 17 Total Committed Funding: \$30.8M-\$37.7M Total Project Funding Encumbered: \$22.8M Total Project Funding Spent to Date: \$34.2M Total Administrative Costs Spent to Date: \$2.5M	Total Funded Projects: 19 Total Committed Funding: \$40.2M-\$49.2M Total Project Funding Encumbered: \$18.3M Total Project Funding Spent to Date: \$28.0M Total Administrative Costs Spent to Date: 2.0M	Total Funded Projects: 36 Total Committed Funding: \$71.1M-\$86.9M Total Project Funding Encumbered: \$41.1M Total Project Funding Spent to Date: \$62.2M Total Administrative Costs Spent to Date: \$4.5M

* 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 1 to establish the EPIC Program on an interim basis in 2012, and Phase 2 to establish purposes and governance for EPIC to continue from 2013-2020.¹¹ The EPIC Program Administrators include the CEC and three Electric IOUs: Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas and Electric (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 2 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 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.¹² 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 Program 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 Public Utility. 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.

¹¹ See Phase 1 D.11-12-035 and Phase 2 D.12-05-037.

¹² 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.

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) Technology Demonstration and Deployment (TD&D); and (3) Market Facilitation which consists of market research, regulatory permitting and streamlining, and workforce development activities. PG&E and the other IOU administrators were designated to administer EPIC funds only in the area of TD&D. The CEC was designated to administer funds in all areas, including a portion of TD&D.

c. EPIC Program Regulatory Process

The Phase 2 decision defines 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 three Triennial Investment Plans for 2012-2014, 2015-2017 and 2018-2020. PG&E is currently waiting for CPUC decision and approval of the IOUs' third triennial investment plan period of 2018-2020 (EPIC 3). In addition to the Triennial Investment Plans, the Administrators are required to file Annual Reports each year on February 28 through 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 help 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 feedback is received and incorporated. These stakeholder workshops to prepare for the Third Triennial Investment Plan were executed at the beginning of 2017 in advance of the EPIC 3 Application. Additionally, Administrators continue to engage with industry stakeholders by participating in and presenting at conferences, as well as hosting workshops/symposiums annually.

In 2017, EPIC Administrators jointly organized an EPIC 3 scoping workshop on February 3, 2017 at Sacramento, CA and two workshops for IOU-Focused EPIC 3 planning; one on March 9, 2017 in San Francisco, CA and the other on March 24, 2017 in Westminster, CA. EPIC Administrators also organized a Symposium on October 17, 2017 in San Diego, CA. The objective of the all-day symposium was to publicly showcase a variety of EPIC projects from the

four administrators that support the symposium theme of Distribution System Automation. PG&E presented three projects: *EPIC 2.14 – Automatically map phasing information*, *EPIC 2.22 – Demand Reduction through targeted data Analytics* and *2.23 – Integrate demand side approaches into Utility Planning*. These workshops and Symposium provided a mechanism to engage with industry stakeholders and bring transparency to the EPIC program and associated projects. Public 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 and workshops. 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. Commitments¹³/Encumbrances¹⁴

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, 2017.

-
- ¹³ 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.
- ¹⁴ 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.

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	\$30.8 - \$37.7 Million	\$22.8 Million	\$166.2 Million	\$18.5 Million	\$1.2 Million
EPIC 2: 2015-2017	\$40.2 - \$45.7 Million	\$18.3 Million	\$100.2 Million	\$20.4 Million	\$1.3 Million

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, 2017.

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	\$11.6 Million	\$1.4 Million
EPIC 2: 2015-2017	\$11.5 Million	\$1.9 Million

**PG&E In-House TD&D Project Expenditure includes internal staffing and staff augmentation at the project level.*

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 Funds¹⁵

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, 2017.

¹⁵ “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.

Table 5: Total Uncommitted/Unencumbered Funds by Program Cycle

Program Cycle	Uncommitted/Unencumbered Project Funds
EPIC 1: 2012-2014	\$5.7 - \$12.5 Million
EPIC 2: 2015-2017	\$0 - \$5.5 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, 2017. The Project Status Report is based on the format provided in Attachment 6 of D.13-11-025.

c. Project Descriptions and Updates

The project descriptions and updates included below are for both EPIC 1 and EPIC 2 projects as of December 31, 2017. Projects that are on-hold have been included in the summary.

Project #1.01 – Energy Storage End Uses

- 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 PG&E's existing Sodium Sulfur Battery Energy Storage Systems (NaS BESS).
 - This project addresses the following CPUC proceedings:
 - 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 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 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
 - 2.75 years
- viii. EPIC Funds Encumbered
 - \$616,857
- ix. EPIC Funds Spent
 - \$1,833,968
- 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
- xv. Status Update
 - Project completed in 2016.
 - Final Report was included in 2016 EPIC Annual Report.

Project #1.02 – Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction

- 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 (ESTs) and noted in filings with the CPUC/Assembly Bill 2514).

- vii. Schedule
 - 3.5 years
- viii. EPIC Funds Encumbered
 - \$2,686,621
- ix. EPIC Funds Spent
 - \$4,010,510
- 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
- xv. 2017 Status Update
 - Project completed in February 2018
 - This project demonstrated the ability of utility-owned and controlled energy storage resources to deliver autonomous distribution peak shaving functionality.
 - Energy storage resources hold significant promise to help California address a variety of grid planning and operations challenges, both today and in the future. The implementation and operational challenges associated with this project resulted in learnings that will inform PG&E's procurement of future energy storage resources, both utility-owned and utility-contracted, through compliance with the IOU energy procurement targets as set forth in CPUC D. 10-03-040 and beyond.
 - Final Report included in this 2017 EPIC Annual Report

Project #1.03 – Demonstrate Priority Scenarios from the Energy Storage Framework

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

Project #1.04 – Expand Test Lab and Pilot Facilities for New Energy Storage Systems.

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Grid operations/market design
- iii. Objective
 - This project would identify ways to enhance the existing test lab facilities at PG&E's Applied Technology Services (ATS) center to provide lab test and pilot facilities for new energy storage systems not previously lab tested. PG&E's ATS lab will be particularly helpful in working with the CEC and industry to test "next generation" technologies that have the potential to make breakthroughs in cost, performance targets, and other important parameters, in a test grid environment. This testing would be a critical step in accelerating commercialization of potential "game changing" technology. New types of technology that may be tested at ATS include, but are not limited to, advanced lithium devices, new sodium-based systems, zinc-air systems and new flow battery chemistries and formats. The funding required to add full capabilities to ATS is minimal. The costs to perform the tests will be paid by the industry or by entities that have received research grants from agencies such as the CEC or Department of Energy (DOE).
- 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. Status Update
 - Formally Withdrawn. CPUC A.12-11-003, 10/15/2013.

Project #1.05 – Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output

- 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
 - \$823,890
- 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
- xv. Status Update
 - Project completed in 2016.
 - Final Report was included in 2016 EPIC 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
- xv. 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
 - Grid operations/market design
- iii. Objective
 - There are 33 General Electric 7FA gas turbines installed in combined cycle configurations in California, which is considerably more than any other turbine model. GE offers a product marketed as “OpFlex Balance” that uses advanced controls technology to improve ramp rates to as high as 40 MW per minute (or higher in some cases). As of October 2012, none of the 7FAs in California were using this product. This project proposes to demonstrate improved ramp rate capabilities on one 7FA so that it can serve as a model for the rest of the 7FA fleet. It is assumed that there would be cost share with the vendor and the selected plant owner.
- 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. Status Update

- Formally Withdrawn CPUC A.12-11-003, 10/15/2013

Project #1.08 – Improve 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
- xv. Status Update
 - Project completed in 2015.
 - Final report included in 2015 EPIC Annual Report.

Project #1.09A – Test New Remote Monitoring and Control Systems for Existing Transmission and Distribution Assets: 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 various Solid Blades 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

xv. Status Update

- Project completed in 2016.
- Final Report was included in 2016 EPIC Annual Report.

Project #1.09B and 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 and Replacement Programs

- 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
- xv. Status Update
 - Project completed in 2016.
 - Final Report was included in 2016 EPIC Annual Report.

**Project #1.09C – Test New Remote Monitoring and Control Systems for T&D Assets:
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.
 - 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
- xv. Status Update
 - Project completed in 2016.
 - Final Report was included in 2016 EPIC Annual Report.

**Project #1.10A – Demonstrate Automated Asset Notification and Management Systems:
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. Status Update
 - Project is currently on-hold.

**Project #1.10C – Demonstrate Automated Asset Notification and Management Systems:
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. 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. 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. 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. Status Update
 - Project is currently on-hold.

Project #1.14 – Demonstrate “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 such as 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
 - 3.25 years

- viii. EPIC Funds Encumbered
 - \$3,986,281
- ix. EPIC Funds Spent
 - \$4,133,426
- 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)
 - Patents filed for –
 - Smart Pole Meter
 - Smart Pole Meter Socket and
 - An algorithm to help identify downed wires
- xv. Status Update
 - Project completed in 2016.
 - Final Report was included in 2016 EPIC Annual Report.

**Project #1.15 – Demonstrate New Technologies and Strategies That Support Integrated
“Customer-to-Market-to-Grid” Operations of the Future**

- 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, 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
 - \$4,133,173
- 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 (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. Status Update
 - Project completed in 2016.
 - Final Report was included in 2016 EPIC Annual Report.

Project #1.16 – Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages

- 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
 - \$1,688,840

- ix. EPIC Funds Spent
 - \$4,009,788
- 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
- xv. Status Update
 - Project completed in 2016.
 - Final Report was included in 2016 EPIC Annual Report.

Project #1.17 – Leverage EPIC Funds by Participating in Multi-Utility, Industry Wide RD&D Programs Such as EPRI

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Transmission; Distribution
- iii. Objective
 - PG&E can leverage EPIC dollars by participating and collaborating in multi-utility industry-wide research initiatives conducted by third party organizations experienced in the RD&D area. These programs would allow PG&E to cost effectively develop a deeper awareness of industry trends, access real world experience through pilot programs, and identify the gaps that utilities will fill or close with technology. For example, through participation in existing EPRI programs, PG&E would participate in and gain access to demonstrations, analyses, and results of the testing and study of distribution equipment and strategies. High Value EPRI programs include: IntelliGrid, Integration of Distributed Renewables, Energy Storage, Risk Mitigation Strategies, and Distribution Grid Modernization programs.
- 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. Status Update

- Project is currently on-hold.

Project #1.18 – Demonstrate SmartMeter™-Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information

- 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
 - 2.5 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

xv. Status Update

- Project completed in 2016.
- Final Report was included in 2016 EPIC Annual Report.

Project #1.19 – Pilot 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
- \$1,054,506
- ix. EPIC Funds Spent
- \$1,980,499
- 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
- xv. Status Update
- Project completed in 2016.
 - Final Report was included in 2016 EPIC 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
 - Customer Service and Enablement
- iii. Objective
 - This project will fund continued support of Green Button Connect (GBC). GBC provides a small number of vendors in the competitive market with automated access to recurring, machine-to-machine, programmatic data access to customer-authorized SmartMeter™ data in order to develop new, innovative and creative ways for customers to manage their energy consumption. GBC is a small demonstration, not scalable to support the larger customer base and wider vendor audience. PG&E is planning on implementing a robust, broader scale offering as part of its Customer Data Access (CDA) project.
- 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. Status Update

- 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.

Project #1.21 – Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability

- 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
 - \$1,327,782

- 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)
 - Patent filed for an algorithm which can detect unauthorized PV Interconnections.
- xv. Status Update
 - Project completed in 2016.
 - Final Report was included in 2016 EPIC Annual Report.

Project #1.22 – Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility

- 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 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 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.
- vi. Metrics
 - 4a – GHG emissions reductions (MMTCO₂e).
 - 1h – Customer bill savings (megawatt-hours saved).
- vii. Schedule
 - 5 years
- viii. EPIC Funds Encumbered
 - \$2,149,416
- ix. EPIC Funds Spent
 - \$1,924,128

- 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
- xv. 2017 Status Update
 - Project is in the Build/Test phase.
 - Phase 1 evaluation report released in 2016, project received CPUC approval for launch of Phase 2, adding an additional business model for the MDMA to hold contracts with customers be responsible for the EV bill to PG&E.
 - Phase 2 commenced January 1, 2017 with 4 out of 6 approved MDMA confirmed for participation and ended April 30, 2017, yielding 264 of the expected 500 customer enrollment goal.
 - Completed data loggers installation on submeters in participant homes to provide accuracy data for overall evaluation.
 - Presented participant welcome survey to CPUC with the following findings; PG&E achieved an 85% response rate on survey, 55% of Phase 1 participant indicated that the Phase 2 experience has been better, 45% of respondents reported switching to charging off-peak during the demonstration.
 - Next steps include continuation of processing MDMA incentive payments, de-enroll participants and decommission submeters, draft and publish Final Report.

Project #1.23 – Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility

- 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
 - \$1,323,817
- 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
- xv. Status Update
 - Project completed in 2016.
 - Final Report was included in 2016 EPIC Annual Report.

Project #1.24 – Demonstrate 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
- xv. Status Update
 - Project completed in 2016.
 - Final Report was posted to EPIC, CalMac and Plug Load Management Associated (PLMA) websites, and included in 2016 EPIC Annual Report.

Project #1.25 – Develop a Tool to Map the Preferred Locations for DC Fast Charging, Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs While Reducing the Impact on PG&E's Distribution Grid

- 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).
 - 7I – 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
 - \$391,425
- ix. EPIC Funds Spent
 - \$444,469
- 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
- xv. Status Update
 - Project completed in 2016.
 - Final Report was included in 2016 EPIC 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, demonstrate 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. 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
 - TBD
- v. Deliverables
 - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - 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. Status Update
 - Project is currently on-hold.

Project #2.02 – Pilot Distributed Energy Resource 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 (DERs) to manage system constraints and evaluate the potential value of DER flexibility to the grid. The DERMS demonstration will drive learning about the people, process, and technology needed to operate the high DER penetration grid of 2025.

 - Define boundaries and integrations with other PG&E and external systems such as Demand Response Management System (DRMS), Advanced Distribution Management System (ADMS) and CAISO market systems among others.
 - Identify limitations of existing as-built models and field telemetry data
 - Evaluate the performance of aggregated DERs providing distribution services
 - 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.
 - This project informs 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 DERMS demonstration.
- 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
 - 2.75 years
 - viii. EPIC Funds Encumbered
 - \$2,444,324
 - ix. EPIC Funds Spent
 - \$5,730,809
 - 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)
 - N/A
 - xv. 2017 Status Update
 - Project is in the Build/Test phase.
 - Completed site acceptance testing and IT build. DERMS is currently live in the field
 - Nine data interfaces developed and tested: weather and generation forecasters, DG aggregators, AMI and SCADA systems. Successfully completed the DERMS foundation allowing the commencement of use case testing.
 - Began field demonstration of seven use cases in July
 - Installed of Phasor Measurement Units (PMUs) at existing substation and near the BESS and assessed the impacts of market participating BESS on operating conditions.
 - Next steps include completion of use case demonstration, M&V analysis, Final Report completion and project closeout

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. The findings of this report will also support and inform PG&E's position within the Rule 21 open proceeding.
- iv. Scope
 - This project leverages the results of the lab testing of smart inverter functionalities that is being completed by PG&E's Smart Grid Pilot Volt/Var Optimization (VVO) Project at G&E's Applied Technologies Services (ATS) 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, supporting and mitigating grid needs and 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 necessary communications software/hardware/technologies between the utility and third-party aggregator or end devices.
 - Evaluate the performance of Smart Inverters to support grid needs.
- 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
 - 3.5 years
- viii. EPIC Funds Encumbered
 - \$1,574,148

- ix. EPIC Funds Spent
 - \$2,215,346
- x. Partners (if applicable)
 - N/A
- 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
- xv. 2017 Status Update
 - Project is in the Build/Test phase.
 - Successful completed Volt/Watt functionality and Volt/Var functionality acceptance testing in August and September respectively.
 - Initial deployment of the technology showed the following:
 - Customer acquisition and targeted deployment of DERs is challenging.
 - Smart inverter technology is able to affect local premise voltage.
 - Implementation of an aggregator solution unveiled that the uptime communications are not within traditional utility uptime requirements. However, the latency of the devices meets or exceeds that of PG&E's SCADA system.
 - The project is deploying Smart Inverter technology on a commercial feeder in 2018, with ~35% feeder penetration. Through this the project team expects to better understand recommendations around: smart inverter settings, effects of primary and secondary voltage, benefits of a third-party monitor and control platform and cost comparisons of smart inverter technology compared to traditional utility infrastructure upgrades.
 - Next steps include completion of use case testing of smart inverter on a voltage constrained distribution feeder, M&V analysis, Final Report completion and project closeout

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
 - Assessment of the use and impact of EV energy flow capabilities as a complement to the smart inverter assessment related to Photovoltaics (PV) in project 2.03A Smart Inverters for PV.
- iv. Scope
 - Technology demonstration for charging and discharging of the Electric Vehicle (EV) in response to demand response or hard islanding events.
 - Testing multiple test modes.
 - Technology assessment from customer and ratepayer perspectives through a customer survey and a cost-benefit evaluation.
- v. Deliverables
 - Evaluation of the performance of the EV energy flow capabilities to support residential load during DR and hard islanding events.
 - Cost-benefit evaluation
- 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 years
- viii. EPIC Funds Encumbered
 - \$225,158
- ix. EPIC Funds Spent
 - \$459,651
- 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
- xv. 2017 Status Update
 - Project completed in February 2018
 - The project demonstrated that a bi-directional EV and charger can support critical household loads through an outage. However, the project also determined that, in addition to the technology not being commercially available, it is not cost effective for customers to adopt. This was supported by the project's customer survey results which indicate the current cost estimate is roughly 4 times higher than an optimal price for consumers. Therefore, even though the project use cases were technically proven—they are not currently feasible due to technology cost, limited market value, and other restrictions between actors (e.g. EV battery warranty coverage).
 - Final Report included in this 2017 EPIC Annual Report

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
 - Utilization of 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.
 - Use of data analytics techniques and Advanced Metering Infrastructure (AMI) (and other) data to determine the impact of PV penetration on Rule 2 violations and
 - Create 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
 - 2 years
- viii. EPIC Funds Encumbered
 - \$745,762
- ix. EPIC Funds Spent
 - \$1,233,293
- 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
- xv. Status Update
 - Project completed in 2017.
 - This project demonstrated an algorithmic process for analyzing new data sources (including SmartMeter™ devices and databases of solar irradiance) to predict the likelihood that a Rule 2 voltage violation was caused by distributed solar generation. Solar energy is by nature intermittent, and ebbs and surges of generation can change the voltage for neighboring, downstream customers. This functionality, if integrated into a larger grid analytics platform, might improve decision making for power quality engineers responding to customer issues.
 - Final Report included in this 2017 EPIC Annual Report.

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
 - Develop computer models to evaluate inverter capabilities and demonstrate possible future system needs for new inertia support solutions.
 - Analyze and optimize the present technology's energy storage inertial response capabilities via Power-Hardware-In-Loop testing.
- v. Deliverables
 - Evaluation of the power system's need for reliability support, including identifying threshold conditions.
 - Assessment of the capabilities of present energy storage inverters for inertial frequency response functions.
 - Provide recommendations for future inverter and interconnection requirements to provide inertial response.
- vi. Metrics
 - 1a. – Number and total nameplate capacity of distributed generation facilities
 - 1b. – Total electricity deliveries from grid-connected distributed generation facilities
 - 1i. – Nameplate capacity (MW) of grid-connected energy storage
 - 3e. – Non-energy economic benefits (reliability)
 - 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 (PU Code § 8360)
 - 7d. – Deployment and integration of cost-effective distributed resources and generation, including renewable resources (PU Code § 8360)
 - 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 (PU Code § 8360)
- vii. Schedule
 - 2 years

- viii. EPIC Funds Encumbered
 - \$244,974
- ix. EPIC Funds Spent
 - \$102,906
- x. Partners (if applicable)
 - National Renewable Energy Laboratory selected as testing and demonstration provider.
- 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
- xv. 2017 Status Update
 - Project is in the Design/Engineering phase.
 - NREL engaged as demonstration site.
 - Next steps Include, test bed & energy storage commissioning, synthetic inertia use case testing of energy storage, and modeling and simulation to evaluate system-scale capabilities and validate application scenarios

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
 - 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
 - Develop a proof of concept that may demonstrate:
 - 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. 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 interval data to improve feeder modeling, inform near real time 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
 - Utilize AMI and other data sources to develop an algorithm to improve the prediction of grid loading.
 - Demonstrate the aggregation of this loading up through the distribution model to enhance distribution planning as well as real time distribution grid operations.
- 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
 - 3 years
- viii. EPIC Funds Encumbered
 - \$1,574,317
- ix. EPIC Funds Spent
 - \$2,046,403
- 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

xv. 2017 Status Update

- Project is in the Build/Test phase.
- Gathered stakeholder input on preliminary prototype application developed by vendor.
- Transitioned vendor model into PG&E environment, integrated model with real-time data inputs, and continued to refine the model.
- Next steps include addressing remaining issues with model input data, further refining and validating the model, and deriving requirements for future ADMS.

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
 - TBD
- v. Deliverables
 - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - 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. 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
 - TBD
- v. Deliverables
 - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - 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. 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 optimization algorithms to more efficiently allocate crews.
 - Utilize artificial intelligence and statistical methods to model productive rates and automatically develop restoration plans.
- 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
 - 3.5 years
- viii. EPIC Funds Encumbered
 - \$2,425,012

- ix. EPIC Funds Spent
 - \$3,077,092
- 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. 2017 Status Update
 - Project is in the Build/Test phase.
 - Developed initial prototype of optimization model and associated visualization tool.
 - Established live data interfaces to the prototype and demonstrated the model's ability to recommend the optimized allocation of work resources to respond to emergency events.
 - Next steps include migration of the prototype to a self-contained cloud solution, connecting the cloud solution to a real-time data repository, enhancing the user interface and its alignment with predefined use cases and Emergency Operations Center processes, and conducting demonstration assessment of the tool during events this upcoming storm season.

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
 - TBD
- v. Deliverables
 - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - 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. 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
 - TBD
- v. Deliverables
 - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - 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. 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
 - TBD
- v. Deliverables
 - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - 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. 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.
- 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
 - 2.5 years
- viii. EPIC Funds Encumbered
 - \$1,566,518
- ix. EPIC Funds Spent
 - \$1,701,394
- x. Partners (if applicable)
 - PG&E is working with University of California, Riverside to test an alternate algorithm based approach which will be evaluated against other solutions demonstrated in project
- 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

xv. 2017 Status Update

- Project is in the Build/Test phase.
- Brought on 4 vendors that each developed phase identification algorithms and meter to transformer algorithms, developed testing processes and began assessing the performance of each vendor's algorithms.
- Collected additional data from 4 feeders and used to further refine and validate algorithms.
- Next steps include finalizing algorithms and developing a validation model to compare the final results of these various algorithms

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 demonstrate 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.
- iv. Scope
 - Scope is limited to confirming that analysis of Phasor Measurement Unit (PMU) data is better than costly on-site model validation in the target geography. Scope does not include widespread deployment of PMUs.
- v. Deliverables
 - Install synchrophasors (or “PMUs”) on generators or generator tie-lines, and demonstrate 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
 - 3 years
- viii. EPIC Funds Encumbered
 - \$620,157
- ix. EPIC Funds Spent
 - \$726,435
- 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
- xv. 2017 Status Update
 - Project is in the Closeout phase.
 - Installed a fully functional stand-alone PMU system at Colusa Power Generating Station during a scheduled generator outage;
 - Developed generator station models and
 - For the disturbances captured by the PMUs, the existing models were improved and validated without requiring a generator shutdown.
 - Next Steps include completion of final report.

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
 - TBD
- v. Deliverables
 - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - 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. 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
 - TBD
- v. Deliverables
 - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - 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. 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
 - TBD
- v. Deliverables
 - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - 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. 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 energy storage 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 DER 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 resources 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 and/or absorb distributed generation on a utility distribution feeder(s).
 - Demonstrate communications with aggregated 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
 - \$1,678,045

- ix. EPIC Funds Spent
 - \$1,938,292
- 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. 2017 Status Update
 - Project completed in February 2018
 - Demonstration installation complete, field demonstration acceptance testing complete
 - Use Case testing complete
 - Project Key Findings:
 - Current vendor platforms for controlling customer-sited DERs are not ready for utility operations
 - Communications to devices are not comparable to traditional utility communications
 - Latency is comparable to current utility SCADA
 - Aggregated customer storage is effective for premise load drop.
 - Implementation of command prioritization would be required for future multiple-use applications.
 - Final Report included in this 2017 EPIC Annual 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
 - TBD
- v. Deliverables
 - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - 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. 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 their SmartMeter™.
 - Monitor customer usage and issue/collect customer 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
 - 2.25 years
- viii. EPIC Funds Encumbered
 - \$8,451
- ix. EPIC Funds Spent
 - \$213,476
- 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. 2017 Status Update
 - Project completed in February 2018
 - Completed execution of field testing, field surveys, and data to compile results and findings.
 - Identified adoption, integration, and utilization barriers associated with mass deployment of real time Zigbee data through HAN devices.
 - Final Report included in 2017 EPIC Annual 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, and Consumer-oriented Energy Tools).
 - Investigate whether Pacific Gas and Electric Company can achieve a sufficient amount of demand reduction through 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.

- vii. Schedule
 - 2.5 years
- viii. EPIC Funds Encumbered
 - \$656,887
- ix. EPIC Funds Spent
 - \$1,334,029
- 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)
 - N/A
- xiv. Treatment of Intellectual Property (if applicable)
 - N/A
- xv. 2017 Status Update
 - Project is in the Build/Test phase.
 - Integrated Energy Efficiency (EE) Load Shapes into model
 - Completed work on Customer Propensity model
 - Incorporated E3 energy storage model and tested and validated DR model
 - Finalized all DER load shapes, dispatch, customer selection criteria
 - Completed front end development with work on optimization function
 - Next steps include optimization improvement, Traditional Wires Alternatives to be added to tool optimization, Final Report completion and project closeout.

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 PG&E's 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
 - \$1,831,735
- ix. EPIC Funds Spent
 - \$3,074,755
- 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
- xv. 2017 Status Update
 - Project completed in 2017.
 - This project successfully developed and demonstrated the integration of a broader range of customer-side technologies and Distributed Energy Resources (DER) approaches into the utility planning process.
 - The project served as a necessary and enabling precursor to the fulfillment of Public Utility Code 769, which requires transparent, consistent and more accurate methods to cost-effectively integrate DERs into the distribution planning process.
 - This project delivered new load shape profiles, enhanced load forecasting tool and overall analytical process that allows PG&E to more accurately and consistently integrate DER impact to the distribution system load profile.
 - With these enhancements, PG&E can more effectively assess the impact of DER growth on the timing and need for future distribution and transmission system upgrades.
 - Final Report included in this 2017 EPIC Annual Report.

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
 - TBD
- v. Deliverables
 - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - 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. 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
 - TBD
- v. Deliverables
 - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - 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. 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 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 may permit customer and third-party devices to connect to PG&E's 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
 - \$1,113,364
- ix. EPIC Funds Spent
 - \$1,143,675
- 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
- xv. 2017 Status Update
 - Project in Design/Build phase
 - Established use-cases for AMI technology demonstration including –
 - The ability to communicate, control, transmit data, and upgrade firmware onto FLISR overhead and underground devices over the network
 - Direct acquisition and control telemetry solution with enhanced security and cyber isolation for medium-sized energy generation projects.
 - The ability to communicate with RFID equipment over the network.
 - Next Steps include execution of use-cases in lab and/or field environments.

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 for workflow management.
 - Asset management of meter and network equipment regardless of meter or network types.
- 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
 - 3 years
- viii. EPIC Funds Encumbered
 - \$576,433
- ix. EPIC Funds Spent
 - \$1,109,962
- 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
- xv. 2017 Status Update
 - Project is in the Closeout phase.
 - Developed a demonstration grade management platform that successfully identified inventory, configuration, and performance data for all three AMI networks including both networking elements and metering endpoints.
 - The project learned the complexity of adding functions needed such as additional Head-End Network Management functions, integration with GIS layers (i.e., data sources like CC&B, MDMS), and integration with various PG&E ticketing systems (Remedy, FAS). Based on this complexity, an enterprise management system will be needed to scale the functions demonstrated through this project.
 - Next Steps include completion of close-out 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 communication paths for 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 Radio Frequency (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 baseline 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 years
- viii. EPIC Funds Encumbered
 - \$58,518
- ix. EPIC Funds Spent
 - \$251,869
- 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
- xv. 2017 Status Update
 - Project completed in February 2018
 - Developed a network configuration plan that would enable PG&E to gather relevant external data sources through a secure VPN tunnel onto PG&E's network.
 - Identified minimum data points and sources of this data to pursue the technology demonstration.
 - This project has been sunset early based on findings that the data required for the algorithm to be effective was not available (neither via internal nor external sources).
 - Final Report included in 2017 EPIC Annual Report

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.).
- 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.
 - Demonstration 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
 - 3.5 years
- viii. EPIC Funds Encumbered
 - \$984,140
- ix. EPIC Funds Spent
 - \$1,592,326
- 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)
 - Provisional patent filed for the multi-purpose mobile meter (Next Generation Meter - NGM).
- xv. 2017 Status Update
 - Project is in the Build/Test phase.
 - Finalized acceptance testing procedure for Next Gen Meters (NGM)
 - Conducted functional and acceptance testing on alpha and beta NGM prototypes.
 - Demonstrated mobile application of NGM prototype at PG&E
 - Next Steps include refining integration of accelerometer into the NGM, designing, implementing and testing ANSI Standards C12.19 and C12.22 and head end application into NGM, and integrating 900 MHz network card technology into the NGM to leverage the existing AMI network for communication

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
 - TBD
- v. Deliverables
 - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - 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. Status Update
 - Project is currently on-hold.

Project #2.31 – Aggregated Behind-The-Meter Storage Market / Retail Optimization

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operations/Market Design; Demand-Side Management
- iii. Objective
 - Demonstrate how aggregated behind-the-meter energy storage systems that are operated by a third-party dispatcher may address wholesale market needs, while also operating as a customer resource to reduce customers' retail electric bills.
- iv. Scope
 - N/A
- v. Deliverables
 - N/A
- vi. Metrics
 - N/A
- 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. Status Update
 - Formally Withdrawn by PG&E on 07/31/2017 via PG&E Comments on Draft Resolution E-4863

Project #2.32 – Electric Load Management for Ridesharing Electrification

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operations/Market Design; Distribution; Demand-Side Management
- iii. Objective
 - Evaluate grid impacts from Electric Vehicle (EV) charging used for ridesharing applications, to assess the ability to manage the resulting load using active demand management.
- iv. Scope
 - N/A
- v. Deliverables
 - N/A
- vi. Metrics
 - N/A
- 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. Status Update
 - Deferred to a future investment plan by CPUC. Resolution E-4863. 08/10/2017

Project #2.33 – Service Issue Identification Leveraging Momentary Outage Information

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operations/Market Design; Distribution
- iii. Objective
 - Leverage multiple sources of data, including but not limited to SmartMeter™, time of day, location and weather data, to proactively identify potential problems in the Electric Transmission and Distribution (T&D) system, specifically related to identifying locations with high incidences of momentary outages which may be caused by imminent failures of conductors, insulators, transformers and/or vegetation contact.
- iv. Scope
 - N/A
- v. Deliverables
 - N/A
- vi. Metrics
 - N/A
- 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. Status Update
 - Deferred to a future investment plan by CPUC. Resolution E-4863. 08/10/2017

Project #2.34 – Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operations/Market Design; Distribution
- iii. Objective
 - Integrate additional sensing technology into communicating “smart” line sensors and demonstrate the ability to use that Line Sensor platform to monitor the grid and possibly predict potential outages.
- iv. Scope
 - Assess technical feasibility and potential sensor range to validate opportunity for business benefits.
 - Integrate line sensor with additional sensing capability and set up physical test environment at ATS
 - Develop test plan and conduct testing at ATS
- v. Deliverables
 - Solution architecture for integrating additional sensor technology into line sensors.
- vi. Metrics
 - 3a – Maintain / Reduce operations and maintenance costs
 - 5a – Outage number, frequency and duration reductions
 - 5d – Public safety improvement and hazard exposure reduction
- vii. Schedule
 - 1 year
- 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)
 - TBD
- xv. 2017 Status Update
 - Project is in the Plan/Analyze phase.
 - Conducted preliminary assessment of industry capabilities
 - Next steps include assessing technical feasibility and potential sensor range to validate opportunity for business benefits, developing and testing combined sensor solution, project closeout and project final report.

Project #2.35 – Call Center Staffing Optimization

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operations/Market Design
- iii. Objective
 - Optimize call center staffing by developing a real-time algorithm that integrates with and improves upon existing call center staffing software to potentially predict variability in call volume impacts in near real-time.
- iv. Scope
 - N/A
- v. Deliverables
 - N/A
- vi. Metrics
 - N/A
- 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. Status Update
 - Rejected by CPUC. Resolution E-4863. 08/10/2017

Project #2.36 – Dynamic Rate Design Tool

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operations/Market Design; Demand-Side Management
- iii. Objective
 - Develop a new rate design tool that will enable complex rate design such as for DER adoption, with a more robust, quicker and powerful rate design approach than the current rate design process. Leveraging big data technologies, the tool will provide rapid optimization, analysis and evaluation of hypothetical new rate structures which will enable PG&E and parties in a rate case to make rate design decisions based on full information and nuanced sensitivity analysis.
- iv. Scope
 - Design and build cost of service database
 - Design and build rate design model engine and API
 - Build functionality and ability to run DER scenarios
- v. Deliverables
 - Technical architecture specifications
 - Data model and databases
 - Rate design model engine and API
- vi. Metrics
 - Time to complete the process of designing, optimizing, and analyzing the impact of a hypothetical rate design
- vii. Schedule
 - 1.25 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)
 - TBD
- xv. 2017 Status Update
 - Project is in the Plan/Analyze phase
 - Next steps include creating technical architecture specifications, develop data bases, develop test plan, build database and platform engine, develop and build API, final verification testing, project closeout and project final report.

5. Conclusion

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

Through the course of 2017, PG&E's EPIC 1 and 2 Programs made significant progress and achieved noteworthy successes on many of the projects. Of the thirty-six projects started across EPIC 1 and EPIC 2, a total of twenty-two EPIC projects have completed (seven of these twenty-two projects completed in 2017 and/or before filing the 2017 EPIC Annual Report). PG&E is leveraging the learnings across projects and applying results into practice where applicable, including but not limited to:

- Leveraging technology developed in *EPIC 1.01 – Energy Storage End Uses* for future energy storage deployment. This includes the CAISO Automated Dispatch System developed through the project - an automated communications and control software for utility-scale BESS to participate in CAISO wholesale market. This project has informed new battery storage procurements and the project's learnings are being used to enable more efficient and cost-effective integration of future battery storage resources into utility and market operations as PG&E strives to reach energy storage procurement targets.
- Leveraging the solar irradiance database that was developed and demonstrated in *EPIC 1.05 – Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output* to better predict variable resource output for advanced grid control programs in other PG&E projects. This database improves the ability to assess current and future grid impacts from PV generation to inform operational decisions with regard to planning and energy procurement.
- Leveraging some of the technologies developed in *EPIC 1.19 – Pilot Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform* for operations, specifically the algorithm to detect line side tap conditions for revenue assurance, antennas/radios for remote metering communications, and processes for meter conversions to American National Standards Institute (ANSI) C12.19 standard format for more granular voltage and power quality data that was previously only available through on-site troubleshooting field visits. The project has shown the potential to, enable a proactive response to address customer satisfaction concerns on voltage issues, reduce manual meter reading operation and maintenance costs and improve the efficiency and effectiveness of investigating energy diversion cases and to mitigate safety hazards for customers, the public or PG&E.
- Leveraging the enhanced tool for incorporating DER scenarios into PG&E's Distribution Planning load forecasts developed in *EPIC 2.23 – Integrate Demand Side Approaches into Utility Planning*. This includes the load shape catalog which is capable of archiving more than 5 million load shapes. PG&E used SmartMeter™ 2012-2014 interval data for all 5 million PG&E electric customers to create over 320,000 new load shapes (comprised of different aspects such as customer class, DER, feeder, bank and Distribution Planning Area (DPA)). Previously the load shapes catalog contained approximately 1,000 shapes (4 customer class load shapes for each DPA). The new load shapes include feeder load shapes, customer class load shapes, as well as DER adjustments for EV charging, PV production, EE load reduction, and DR program responses. The more accurate and granular load shapes allowed distribution planners to more precisely capture DER impact

on the load growth forecast. As a result, PG&E was able to model DER deployment uncertainty at the circuit level in the context of the distribution planning process in a more standardized and transparent way. Any deferral of future distribution or transmission system upgrades would lower costs for electric ratepayers.

In addition to some of the post EPIC project level achievements listed above, since the inception of the EPIC Program, PG&E has established and maintained strong program management practices to provide oversight of the EPIC Program and ensure the maximum value of the projects to its customer base. 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 regularly scheduled administrator meetings 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 Grant Funding Opportunities (GFOs).

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 customers, the need to modernize the grid to ensure continued safe and reliable operation, and the need to continue improving affordability such as through advancing how to leverage data. These achievements from the EPIC projects, and their future path forward for those technologies that are 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, will continue to host stakeholder workshops and symposiums in 2018. These industry events will continue to focus 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. PG&E will also continue to promote the EPIC Program through participation in both internal and external public forums and other industry events.

PG&E and the other IOUs are currently waiting for CPUC decision and approval of the third triennial investment plan period of 2018-2020 (EPIC 3). Pending the timing of that decision, PG&E is excited to embark on the new technology demonstrations contained within that filing that can help meet emerging grid needs and California policy objectives. PG&E urges that the CPUC approve this plan promptly so as to not lose continuity with past plans and ensure that

the customers and the state can leverage the maximum benefit of this program and the projects within.

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

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

- Changes in the marketplace 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 demonstration size of the project or the vendor may revise their business model such that it is no longer aligned with the projects' objectives.

Although these dynamics may impact a project's progress, it is important to keep in mind that part of the value of RD&D is in both proving what is and what is not ready to scale. While the more obvious goal of technology demonstration is to help advance pre-commercial technologies, there are cases where success may be defined as determining that a project should not proceed to full scale until additional development takes place. This, both avoids more costly full production deployment before a technology is ready, and provides insight for the industry on what may need to be further developed.

PG&E mitigates some of the risk of this rapidly evolving technology landscape 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
APPENDIX A
PROJECT STATUS REPORT

(SEE ATTACHED SPREADSHEET)

APPENDIX A
ELECTRIC PROGRAM INVESTMENT CHARGE
2017 ANNUAL REPORT

Row #	Program Administrator	Project Name	Project Type	Brief Description of the Project - Objective		Brief Description of the Project - Scope	
				A	B	C	D
For Report DOC		i. Investment Plan Period		ii. Objective	iii. Objective	iv. Scope	v. Scope
1		1st Triennial (2012-2014)		1.01 - Energy Storage End Uses	PG&E	- Develop and deploy technology to enable 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.	- Develop and deploy technology to enable 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.
2		1st Triennial (2012-2014)		1.02 - Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction	PG&E	- 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.1003 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 01.1.	- 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.
3		1st Triennial (2012-2014)		1.03 - Demonstrate Priority Scenarios from the Energy Storage Framework	PG&E	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

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(CONTINUED)

Row #		Program Administrator	Project Name	Project Type	Brief Description of the Project - Objective		Brief Description of the Project - Scope
			C	D	E1	E2	
	For Report DOC				iii. Objective	iv. Scope	
4	i. Investment Plan Period 1st Triennial (2012-2014)	PG&E	1.04 - Expand Test Lab and Pilot Facilities for New Energy Storage Systems.	Renewables/DER Resource Integration	This project would identify ways to enhance the existing test lab facilities at PG&E's Applied Technology Services (ATS) center to provide lab test and pilot facilities for new energy storage systems not previously lab tested. PG&E's ATS lab will be particularly helpful in working with the CEC and industry to test "next generation" technologies that have the potential to make breakthroughs in cost, performance targets, and other important parameters, in a test grid environment. This testing would be a critical step in accelerating commercialization of potential "game changing" technology. New types of technology that may be tested at ATS include, but are not limited to, advanced lithium devices, new sodium-based systems, zinc-air systems and new flow battery chemistries and formats. The funding required to add full capabilities to ATS is minimal. The costs to perform the tests will be paid by the industry or by entities that have received research grants from agencies such as the CEC or Department of Energy (DOE).	N/A	
5	1st Triennial (2012-2014)	PG&E	1.05 - Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output	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.	
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	
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	Renewables/DER Resource Integration	There are 33 General Electric 7FA gas turbines installed in combined cycle configurations in California, which is considerably more than any other turbine model. GE offers a product marketed as "OpFlex Balance" that uses advanced controls technology to improve ramp rates to as high as 40 MW per minute (or higher in some cases). As of October 2012, none of the 7FAs in California were using this product. This project proposes to demonstrate improved ramp rate capabilities on one 7FA so that it can serve as a model for the rest of the 7FA fleet. It is assumed that there would be cost share with the vendor and the selected plant owner.	N/A	

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(CONTINUED)**

Row #	Program Administrator	Project Name	Project Type	Brief Description of the Project - Objective		Brief Description of the Project - Scope	
		A	C	D	E1	E2	
For Report DOC		i. Investment Plan Period	Project Name		iii. Objective	iv. Scope	
8	PG&E	1st Triennial (2012-2014)	1.08 - Improve 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.	
9	PG&E	1st Triennial (2012-2014)	1.09A - Test New Remote Monitoring and Control Systems for Existing Transmission & Distribution Assets: 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.	
10	PG&E	1st Triennial (2012-2014)	1.09B and 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 and Replacement Programs	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.	
11	PG&E	1st Triennial (2012-2014)	1.09C - Test New Remote Monitoring and Control Systems for T&D Assets: Discrete Series Reactors	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.	
12	PG&E	1st Triennial (2012-2014)	1.10A - Demonstrate Automated Asset Notification and Management Systems: 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	

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Row #		Program Administrator	Project Name	Project Type	Brief Description of the Project - Objective		Brief Description of the Project - Scope	
			C	D	E1	E2		
	For Report DOC		Project Name		iii. Objective	iv. Scope		
13	i. Investment Plan Period 1st Triennial (2012-2014)	PG&E	1.1.0C - Demonstrate Automated Asset Notification and Management Systems: 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		
14	1st Triennial (2012-2014)	PG&E	1.1.1 - 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		
15	1st Triennial (2012-2014)	PG&E	1.1.2 - 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		
16	1st Triennial (2012-2014)	PG&E	1.1.3 - 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		
17	1st Triennial (2012-2014)	PG&E	1.1.4 - Demonstrate "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 such as 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.		
18	1st Triennial (2012-2014)	PG&E	1.1.5 - Demonstrate New Technologies and Strategies That Support Integrated "Customer-to-Market-to-Grid" Operations of the Future	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, 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.		

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Row #	Program Administrator	Project Name	Project Type	Brief Description of the Project - Objective		Brief Description of the Project - Scope	
				A	B	C	D
For Report DOC		i. Investment Plan Period					
19		1st Triennial (2012-2014)					
	PG&E	1.1.6 - Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages	Grid Modernization and Optimization				
20	PG&E	1.1.7 - Leverage EPIC Funds by Participating in Multi-Utility, Industry Wide RD&D Programs Such as EPRI	Grid Modernization and Optimization				
21	PG&E	1.1.8 - Demonstrate SmartMeter™-Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information	Customer Service and Enablement				
22	PG&E	1.1.9 - Pilot Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	Customer Service and Enablement				

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For Report DOC		i. Investment Plan Period				E1	E2
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.		iii. Objective This project will fund continued support of Green Button Connect (GBC). GBC provides a small number of vendors in the competitive market with automated access to recurring, machine-to-machine, programmatic data access to customer-authorized SmartMeter™ data in order to develop new, innovative and creative ways for customers to manage their energy consumption. GBC is a small demonstration, not scalable to support the larger customer base and wider vendor audience. PG&E is planning on implementing a robust, broader scale offering as part of its Customer Data Access (CDA) project.	N/A
24		1st Triennial (2012-2014)	PG&E	1.21 - Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability		- 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 an 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.
25		1st Triennial (2012-2014)	PG&E	1.22 - Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility		- 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.	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.
26		1st Triennial (2012-2014)	PG&E	1.23 - Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility		- 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).

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For Report DOC		i. Investment Plan Period				E1	E2
27		1st Triennial (2012-2014)		Project Name		iii. Objective	iv. Scope
	PG&E			1.24 - Demonstrate 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 01.3, 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.
28	PG&E	1st Triennial (2012-2014)		1.25 - Develop a Tool to Map The Preferred Locations for DC Fast Charging. Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs While Reducing the Impact on PG&E's Distribution Grid	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.
29	PG&E	1st Triennial (2012-2014)		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, demonstrate 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
30	PG&E	2nd Triennial (2015-2017)		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.	TBD

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31	2nd Triennial (2015-2017)	PG&E	2.02 - Pilot Distributed Energy Resource 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. - Define boundaries and integrations with other PG&E and external systems such as Demand Response Management System (DRMS), Advanced Distribution Management System (ADMS) and CAISO market systems among others. - Enable informed choice for long-term strategic vendor in 2017+ (demonstration is not choosing the long term vendor). - Identify limitations of existing as-built models and field telemetry data - Evaluate the performance of aggregated DERs providing distribution services - 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. - This project informs 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 DERMS demonstration.	
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. The findings of this report will also support and inform PG&E's position within the Rule 21 open proceeding.	- This project leverages the results of the lab testing of smart inverter functionalities that is being completed by PG&E's Smart Grid Pilot Volt/Var Optimization (VVO) Project at PG&E's Applied Technologies Services (ATS) 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, supporting and mitigating grid needs and safety risks.	

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33				2nd Triennial (2015-2017)	PG&E	2.03B- Test Smart Inverter Enhanced Capabilities - Vehicle to Home	Renewables/DER Resource Integration
34				2nd Triennial (2015-2017)	PG&E	2.04- DG Monitoring & Voltage Tracking	Renewables/DER Resource Integration
35				2nd Triennial (2015-2017)	PG&E	2.05- Inertia Response Emulation for DG Impact Improvement	Renewables/DER Resource Integration

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36		2nd Triennial (2015-2017)		2.06 - Intelligent Universal Transformer (IUT)	PG&E	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.
37		2nd Triennial (2015-2017)		2.07 - Real-Time Loading Data for Distribution Operations and Planning	PG&E	This demonstration will leverage interval data to improve feeder modeling, inform near real time 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.	- Utilize AMI and other data sources to develop an algorithm to improve the prediction of grid loading. - Demonstrate the aggregation of this loading up through the distribution model to enhance distribution planning as well as real time distribution grid operations.
38		2nd Triennial (2015-2017)		2.08 - "Smart" Monitoring and Analysis Tools	PG&E	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.	TBD
39		2nd Triennial (2015-2017)		2.09 - Distributed Series Impedance (DSI) Phase 2	PG&E	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.	TBD
40		2nd Triennial (2015-2017)		2.10 - Emergency Preparedness Modeling	PG&E	- 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 optimization algorithms to more efficiently allocate crews. - Utilize artificial intelligence and statistical methods to model productive rates and automatically develop restoration plans.	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.
41		2nd Triennial (2015-2017)		2.11 - New Mobile Technology & Visualization Applications	PG&E	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.	TBD

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42		i. Investment Plan Period 2nd Triennial (2015-2017)		Develop new mobile applications to enhance Pacific Gas and Electric Company's emergency preparedness and response capabilities.	TBD		
43		2.12 - New Emergency Management Mobile Applications 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.	TBD		
44		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.	Project seeks to improve distribution network models through automatic mapping of 3 phase electrical power information.		
45		2.15 - Synchrophasor Applications for Generator Dynamic Model Validation	Grid Modernization and Optimization	This project will demonstrate 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.	Scope is limited to confirming that analysis of Phasor Measurement Unit (PMU) data is better than costly on-site model validation in the target geography. Scope does not include widespread deployment of PMUs.		
46		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.	TBD		
47		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.	TBD		
48		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.	TBD		

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49		2nd Triennial (2015-2017)		2.19 - Enable Distributed Demand-Side Strategies & Technologies	PG&E	Customer Service and Enablement	• Demonstrate distributed energy storage 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 DER locational benefits and addressing capacity constraints through aggregated behind the meter (BTM) customer energy storage.
50		2nd Triennial (2015-2017)		2.20 - Real-Time Energy Usage Feedback to Customers	PG&E	Customer Service and Enablement	TBD
51		2nd Triennial (2015-2017)		2.21 - Home Area Network (HAN) for Commercial Customers	PG&E	Customer Service and Enablement	• 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).
52		2nd Triennial (2015-2017)		2.22 - Demand Reduction through Targeted Data Analytics	PG&E	Customer Service and Enablement	• 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. • 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.

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53		2nd Triennial (2015-2017)				- 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.14-08-01.3 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.
54	PG&E	2.24 - Appliance Level Bill Disaggregation for Non-Residential Customers	Customer Service and Enablement				TBD
55	PG&E	2.25 - Enhanced Smart Grid Communications	Cross-Cutting/Foundational				TBD
56	PG&E	2.26 - Customer & Distribution Automation Open Architecture Devices	Cross-Cutting/Foundational				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.
57	PG&E	2.27 - Next Generation Integrated Smart Grid Network Management	Cross-Cutting/Foundational				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.
58	PG&E	2.28 - Smart Grid Communications Path Monitoring	Cross-Cutting/Foundational				Determine the ability to identify, analyze, and diagnose Radio Frequency interference that can occur along the communication path from the meter through the data collectors to the AMI vendors' control system.

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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.).		
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.	TBD		
61	2nd Triennial (2015-2017)	PG&E	2.31 - Aggregated Behind-The-Meter Storage Market / Retail Optimization	Renewables/DER Resource Integration	Demonstrate how aggregated behind-the-meter energy storage systems that are operated by a third party dispatcher may address wholesale market needs, while also operating as a customer resource to reduce customers' retail electric bills.	N/A		

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62	PG&E	2.32 - Electric Load Management for Ridesharing Electrification	Renewables/DER Resource Integration	Evaluate grid impacts from Electric Vehicle (EV) charging used for ridesharing applications, to assess the ability to manage the resulting load using active demand management.		N/A
63	PG&E	2.33 - Service Issue Identification Leveraging Momentary Outage Information	Grid Modernization and Optimization	Leverage multiple sources of data, including but not limited to SmartMeter™, time of day, location and weather data, to proactively identify potential problems in the Electric Transmission and Distribution (T&D) system, specifically related to identifying locations with high incidences of momentary outages which may be caused by imminent failures of conductors, insulators, transformers and/or vegetation contact.		N/A
64	PG&E	2.34 - Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors	Grid Modernization and Optimization	Integrate additional sensing technology into communicating "smart" line sensors and demonstrate the ability to use that Line Sensor platform to monitor the grid and possibly predict potential outages.		- Assess technical feasibility and potential sensor range to validate opportunity for business benefits. - Work with SMEs to develop best solution architecture for integrating RF sensor product into line sensors. - Integrate line sensor with additional sensing capability and set up physical test environment at ATS - Develop test plan and conduct testing at ATS
65	PG&E	2.35 - Call Center Staffing Optimization	Grid Modernization and Optimization	Optimize call center staffing by developing a real-time algorithm that integrates with and improves upon existing call center staffing software to potentially predict variability in call volume impacts in near real-time.		N/A
66	PG&E	2.36 - Dynamic Rate Design Tool	Customer Service and Enablement	Develop a new rate design tool that will enable complex rate design such as for DER adoption, with a more robust, quicker and powerful rate design approach than the current rate design process. Leveraging big data technologies the tool will provide rapid optimization, analysis and evaluation of hypothetical new rate structures which will enable PG&E and parties in a rate case to make rate design decisions based on full information and nuanced sensitivity analysis		- Design and build cost of service database - Design and build rate design model engine and API - Build functionality and ability to run DER scenarios

*Date of award corrected from previous annual report

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		A	B	C	D	E3	E4	F	G	H	I
		i. Investment Plan Period		Project Name		v. Deliverables	vii. Schedule			ii. Assignment to Value Chain	viii. EPIC Funds Encumbered
	1	1st Triennial (2012-2014)	PG&E	1.01 - Energy Storage End Uses	Renewables/DER Resource Integration	• 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.	2.75 years	9/19/2013	No	Grid Operation/Market Design	\$ 616,857
	2	1st Triennial (2012-2014)	PG&E	1.02 - Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction	Renewables/DER Resource Integration	• 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.	3.5 years	7/25/2014	No	Distribution; Grid Operation/Market Design	\$ 2,686,621
	3	1st Triennial (2012-2014)	PG&E	1.03 - Demonstrate Priority Scenarios from the Energy Storage Framework	Renewables/DER Resource Integration	Project deliverables being further evaluated - TBD	Project schedule being further evaluated - TBD	NA	No	Grid Operation/Market Design	\$ 0

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		A	C	D	E3	F	G	H	I
For Report DOC 4		i. Investment Plan Period			vii. Schedule			ii. Assignment to Value Chain	iii. EPIC Funds Encumbered
	PG&E	1.04 - Expand Test Lab and Pilot Facilities for New Energy Storage Systems.	Renewables/DER Resource Integration	N/A	N/A	NA	No	Grid operations/market design	N/A
5	PG&E	1.05 - Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output	Renewables/DER Resource Integration	- 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.	3.25 years	9/19/2013	No	Distribution	\$ 535,055
6	PG&E	1.06 - Demonstrate Communication Systems Allowing the CAISO to Utilize Available Renewable Generation Flexibility	Renewables/DER Resource Integration	Project deliverables being further evaluated - TBD	Project schedule being further evaluated - TBD	NA	No	Grid Operation/Market Design	\$ 0
7	PG&E	1.07 - Demonstrate Systems to Ramp Existing Gas-Fired Generation More Quickly to Adapt to Changes in Variable Energy Resources Output	Renewables/DER Resource Integration	N/A	N/A	NA	No	Grid operations/market design	N/A

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8	PG&E	1.08 - Improve Distribution System Safety and Reliability through New Data Analytics Techniques	Grid Modernization and Optimization	• 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.	2.25 years	9/19/2013	No	Transmission; Distribution	\$ 1,249,905
9	PG&E	1.09A - Test New Remote Monitoring and Control Systems for Existing Transmission & Distribution Assets: Close Proximity Switching	Grid Modernization and Optimization	• A working prototype for the various Solid Blade in Oil Rotatory Switch tools.	2.5 years	9/19/2013	No	Transmission; Distribution	\$ 301,808
10	PG&E	1.09B and 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 and Replacement Programs	Grid Modernization and Optimization	• 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.	3.25 years	9/19/2013	No	Transmission; Distribution	\$ 484,250
11	PG&E	1.09C - Test New Remote Monitoring and Control Systems for T&D Assets: Discrete Series Reactors	Grid Modernization and Optimization	• Installation, testing and analysis of DSR and server communication links. • 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.	3.25 years	9/19/2013	No	Transmission	\$ 1,449,835
12	PG&E	1.10A - Demonstrate Automated Asset Notification and Management Systems: Dissolved Gas Analysis	Grid Modernization and Optimization	Project deliverables being further evaluated - TBD	Project schedule being further evaluated - TBD	NA	No	Transmission; Distribution	\$ 0

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		A	B	C	D	E3	E4	F	G	H	I
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19	1st Triennial (2012-2014)		PG&E	1.16 - Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages	Grid Modernization and Optimization	- 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.	3.25 years	9/19/2013	No	Distribution	\$ 1,688,840
20	1st Triennial (2012-2014)		PG&E	1.17 - Leverage EPIC Funds by Participating in Multi-Utility, Industry Wide RD&D Programs Such as EPRI	Grid Modernization and Optimization	Project deliverables being further evaluated - TBD	Project schedule being further evaluated - TBD	NA	No	Transmission; Distribution	\$ 0
21	1st Triennial (2012-2014)		PG&E	1.18 - Demonstrate SmartMeter™ Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information	Customer Service and Enablement	- Quantify disaggregation accuracy and compare vendors. - Based on results, provide recommendations for deployment strategy of appliance level billing.	2.5 years	9/19/2013	No	Demand-Side Management	\$ 1,399,248
22	1st Triennial (2012-2014)		PG&E	1.19 - Pilot Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	Customer Service and Enablement	- 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.	3.25 years	9/19/2013	No	Distribution; Grid Operation/Market Design; Demand-Side Management	\$ 1,054,506

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For Report DOC	i. Investment Plan Period		Project Name		v. Deliverables	vii. Schedule		ii. Assignment to Value Chain	iii. EPIC Funds Encumbered
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	NA	No	Demand-Side Management	N/A
24	1st Triennial (2012-2014)	PG&E	1.21 - Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability	Customer Service and Enablement	• 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.	2.5 years	No	Distribution; Demand-Side Management	\$ 868,495
25	1st Triennial (2012-2014)	PG&E	1.22 - Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility	Customer Service and Enablement	• 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.	5 years	No	Distribution; Grid Operation/Market Design; Demand-Side Management	\$ 2,149,416
26	1st Triennial (2012-2014)	PG&E	1.23 - Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility	Customer Service and Enablement	• 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.	2.5 years	No	Grid Ops and Mkt. Design / Distribution / DSM	\$ 950,313

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27	1st Triennial (2012-2014)	PG&E	1.24 - Demonstrate Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	Customer Service and Enablement	• 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.	2 years	No	Transmission; Distribution; Grid Operation/Market Design; Demand-Side Management	\$ 1,196,477
28	1st Triennial (2012-2014)	PG&E	1.25 - Develop a Tool to Map The Preferred Locations for DC Fast Charging, Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs While Reducing the Impact on PG&E's Distribution Grid	Customer Service and Enablement	• 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.	2.5 years	No	Distribution; Demand-Side Management	\$ 391,425
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	Project deliverables being further evaluated - TBD	Project schedule being further evaluated - TBD	No	Grid Operation/Market Design and Demand-side Management.	\$ 0
30	2nd Triennial (2015-2017)	PG&E	2.01 - Evaluate Storage on the Distribution Grid	Renewables/DER Resource Integration	TBD	TBD	No	Grid Operations/Market Design; Transmission; Distribution; DSM	\$ 0

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		i. Investment Plan Period	Project Name	Project Type	Brief Description of the Project - Deliverables	vii. Schedule			ii. Assignment to Value Chain	viii. EPIC Funds Encumbered
31	2nd Triennial (2015-2017)	PG&E	2.02 - Pilot Distributed Energy Resource Management Systems (DERMS)	Renewables/DER Resource Integration	• 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., DERMS, DMS, market systems). - Develops a point of view on the utility role in managing DERs for grid and economic benefits.	2.75years	9/15/2015	No	Grid Operation/Market Design	\$ 2,444,324
32	2nd Triennial (2015-2017)	PG&E	2.03A - Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	Renewables/DER Resource Integration	• 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 necessary communications software/hardware/technologies between the utility and third party aggregator or end devices. • Evaluate the performance of Smart Inverters to support grid needs.	3.5years	4/10/2015	No	Distribution; Demand Side Management	\$ 1,574,148

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33	2nd Triennial (2015-2017)	PG&E 2.03B - Test Smart Inverter Enhanced Capabilities - Vehicle to Home	Renewables/DER Resource Integration	• Evaluation of the performance of the EV energy flow capabilities to support residential load during DR and hard islanding events. • Cost-benefit evaluation	2years	1/8/2016	No	Distribution; Demand-Side Management	\$ 225,158
34	2nd Triennial (2015-2017)	PG&E 2.04 - DG Monitoring & Voltage Tracking	Renewables/DER Resource Integration	• 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.	2years	4/10/2015	No	Grid Operations/Market Design	\$ 745,762
35	2nd Triennial (2015-2017)	PG&E 2.05 - Inertia Response Emulation for DG Impact Improvement	Renewables/DER Resource Integration	• Evaluation of the power system's need for reliability support, including identifying threshold conditions. • Assessment of the capabilities of present energy storage inverters for inertial frequency response functions. • Provide recommendations for future inverter and interconnection requirements to provide inertial response.	2years	1/6/2017	No	Grid Operations/Market Design; Transmission	\$ 244,974

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36	2nd Triennial (2015-2017)	PG&E 2.06 - Intelligent Universal Transformer (IUT)	Renewables/DER Resource Integration	- Develop a proof of concept that may demonstrate: - an Intelligent Universal Transformer (IUT) can be used in lieu of other equipment to connect to Direct Current Fast Charge (DCFC) protocols, and - an IUT can communicate back to the utility.	2.25years	9/15/2015	No	Distribution; Grid Operation/Market Design; Demand-Side Management	\$ 0
37	2nd Triennial (2015-2017)	PG&E 2.07 - Real-Time Loading Data for Distribution Operations and Planning	Grid Modernization and Optimization	Develop a unique loading algorithm and rubrics for determining cost effective data sources and cadences.	3years	4/10/2015	No	Grid Operation/Market Design; Distribution	\$ 1,574,317
38	2nd Triennial (2015-2017)	PG&E 2.08 - "Smart" Monitoring and Analysis Tools	Grid Modernization and Optimization	TBD	TBD	NA	No	Transmission	\$ 0
39	2nd Triennial (2015-2017)	PG&E 2.09 - Distributed Series Impedance (DSI) Phase 2	Grid Modernization and Optimization	TBD	TBD	NA	No	Transmission	\$ 0
40	2nd Triennial (2015-2017)	PG&E 2.10 - Emergency Preparedness Modeling	Grid Modernization and Optimization	- 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.	3.5years	4/10/2015	No	Transmission; Distribution	\$ 2,425,012
41	2nd Triennial (2015-2017)	PG&E 2.11 - New Mobile Technology & Visualization Applications	Grid Modernization and Optimization	TBD	TBD	NA	No	Distribution	\$ 0

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42	2nd Triennial (2015-2017)	2.12 - New Emergency Management Mobile Applications	Grid Modernization and Optimization	TBD	TBD	NA	No	Transmission; Distribution	\$ 0
43	2nd Triennial (2015-2017)	2.13 - Digital Substation/Substation Automation	Grid Modernization and Optimization	TBD	TBD	NA	No	Transmission; Distribution	\$ 0
44	2nd Triennial (2015-2017)	2.14 - Automatically Map Phasing Information	Grid Modernization and Optimization	- 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.	2.5years	9/15/2015	No	Distribution; Demand-Side Management	\$ 1,566,518
45	2nd Triennial (2015-2017)	2.15 - Synchrophasor Applications for Generator Dynamic Model Validation	Grid Modernization and Optimization	- Install synchrophasors (or "PMUs") on generators or generator tie-lines, and demonstrate 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.	3years	4/10/2015	No	Transmission	\$ 620,157
46	2nd Triennial (2015-2017)	2.16 - Enhanced Synchrophasor Analytics & Applications	Grid Modernization and Optimization	TBD	TBD	NA	No	Transmission	\$ 0
47	2nd Triennial (2015-2017)	2.17 - Geomagnetic Disturbance (GMD) Evaluation	Grid Modernization and Optimization	TBD	TBD	NA	No	Transmission	\$ 0
48	2nd Triennial (2015-2017)	2.18 - Optical Instrument Transformers and Sensors for Protection and Control Systems	Grid Modernization and Optimization	TBD	TBD	NA	No	Transmission	\$ 0

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49	2nd Triennial (2015-2017)	PG&E	2.19 - Enable Distributed Demand-Side Strategies & Technologies	Customer Service and Enablement	• Demonstrate and test field results for effectiveness of the use of aggregated customer-sited BTM energy storage resources to peak load reduction and/or absorb distributed generation on a utility distribution feeder(s). • Potential to demonstrate communications with aggregated resources for visualization and control. • Evaluate cost-effectiveness and reliability of BTM energy storage for addressing capacity constraints.	2.75 years	4/10/2015	No	Distribution; Demand-Side Management	\$ 1,678,045
50	2nd Triennial (2015-2017)	PG&E	2.20 - Real-Time Energy Usage Feedback to Customers	Customer Service and Enablement	TBD	TBD	NA	No	Grid Operations/Market Design; Distribution; Demand-Side Management	\$ 0
51	2nd Triennial (2015-2017)	PG&E	2.21 - Home Area Network (HAN) For Commercial Customers	Customer Service and Enablement	• Install Zigbee HAN devices with selected LCI customers and connect devices to their SmartMeter™. • Monitor customer usage and issue/collect customer surveys. • Complete report with identified issues and recommendations for how to integrate with an existing EMS.	2.25 years	9/15/2015	No	Demand-Side Management	\$ 8,451
52	2nd Triennial (2015-2017)	PG&E	2.22 - Demand Reduction through Targeted Data Analytics	Customer Service and Enablement	• 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.	2.5 years	9/15/2015	No	Distribution; Demand-Side Management	\$ 656,887

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53	PG&E	2.23 - Integrate Demand Side Approaches into Utility Planning	Customer Service and Enablement	- Develop enhanced Customer and DER Load Shapes Catalog in PG&E's LoadSEER Planning Tool. - Incorporate DER Scenario Projections into LoadSEER. - Develop interface between LoadSEER and CYME for batch processing integration.	2.25 years	4/10/2015	No	Distribution; Demand-Side Management	\$ 1,831,735
54	PG&E	2.24 - Appliance Level Bill Disaggregation for Non-Residential Customers	Customer Service and Enablement	TBD	TBD	NA	No	Demand-Side Management	\$ 0
55	PG&E	2.25 - Enhanced Smart Grid Communications	Cross-Cutting/Foundational	TBD	TBD	NA	No	Grid Operations/Market Design; Distribution; Demand-Side Management	\$ 0
56	PG&E	2.26 - Customer & Distribution Automation Open Architecture Devices	Cross-Cutting/Foundational	- Conduct 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 may permit customer and third party devices to connect to our AMI network(s).	2.75 years	9/15/2015	No	Distribution; Grid Operation/Market Design; Demand-Side Management	\$ 1,113,364
57	PG&E	2.27 - Next Generation Integrated Smart Grid Network Management	Cross-Cutting/Foundational	- 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 for workflow management. - Asset management of meter and network equipment regardless of meter or network types.	3 years	4/10/2015	No	Grid Operations/Market Design; Distribution; Demand-Side Management	\$ 576,433
58	PG&E	2.28 - Smart Grid Communications Path Monitoring	Cross-Cutting/Foundational	- 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.	1 year	1/6/2017	No	Grid Operation/Market Design	\$ 58,518

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59	2nd Triennial (2015-2017)	PG&E	2.29 - Mobile Meter Applications	Cross-Cutting/Foundational	- 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. - Demonstration of use cases on DG applications and PEV metering, including remote and near real-time tracking of vehicle charge locations and energy flow.	3.5years	4/10/2015	No	Grid Operations/Market Design; Distribution; Demand-Side Management	\$ 384,140
60	2nd Triennial (2015-2017)	PG&E	2.30 - Leverage EPIC Funds to Participate in Industry-Wide RD&D Programs	Grid Modernization and Optimization	TBD	TBD	NA	No	Grid Operations/Market Design; Transmission; Distribution; Demand-Side Management	\$ 0
61	2nd Triennial (2015-2017)	PG&E	2.31 - Aggregated Behind-The-Meter Storage Market / Retail Optimization	Renewables/DER Resource Integration	N/A	N/A	NA	N/A	Grid Operations/Market Design; Demand Side Management	N/A

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62	2nd Triennial (2015-2017)	2.32 - Electric Load Management for Ridesharing Electrification	Renewables/DER Resource Integration	N/A	N/A	NA	N/A	Grid Operations/Market Design; Distribution; Demand Side Management	N/A
63	2nd Triennial (2015-2017)	2.33 - Service Issue Identification Leveraging Momentary Outage Information	Grid Modernization and Optimization	N/A	N/A	NA	N/A	Grid Operations/Market Design; Distribution	N/A
64	2nd Triennial (2015-2017)	2.34 - Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors	Grid Modernization and Optimization	• Solution architecture for integrating additional sensor technology into line sensors.	1 year	8/10/2017	Yes	Grid Operations/Market Design; Distribution	\$ 0
65	2nd Triennial (2015-2017)	2.35 - Call Center Staffing Optimization	Grid Modernization and Optimization	N/A	N/A	NA	N/A	Grid Operations/Market Design	N/A
66	2nd Triennial (2015-2017)	2.36 - Dynamic Rate Design Tool	Customer Service and Enablement	• Technical architecture specifications • Data model and databases • Rate design model engine and API	1.25 years	8/10/2017	Yes	Grid Operations/Market Design; Demand Side Management	\$ 0

*Date of award corrected from previous annual report

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For Report DOC		I. Investment Plan Period		Project Name	Project Type		K	L	M	N	O	P	Q
				Project Name					IX. EPIC Funds Spent			X. Partners (if applicable)	XI. Match Funding (if applicable)
1	1st Triennial (2012-2014)		PG&E	1.01 – Energy Storage End Uses	Renewables/DER Resource Integration	\$1,660,000 - \$2,030,000	\$ 778,040	\$ 1,055,928	\$ 1,833,968	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.	N/A	N/A
2	1st Triennial (2012-2014)		PG&E	1.02 – Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction	Renewables/DER Resource Integration	\$3,610,000 - \$4,412,000	\$ 2,757,650	\$ 1,252,860	\$ 4,010,510	All project costs are related to project activities. Admin costs are tracked separately.	No	N/A	No
3	1st Triennial (2012-2014)		PG&E	1.03 – Demonstrate Priority Scenarios from the Energy Storage Framework	Renewables/DER Resource Integration	\$	\$ 0	\$ 0	\$ 0	0	TBD	TBD	TBD

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For Report DOC		I. Investment Plan Period		Project Name							ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
4		1st Triennial (2012-2014)	PG&E	1.04 - Expand Test Lab and Pilot Facilities for New Energy Storage Systems.	Renewables/DER Resource Integration	N/A	N/A	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 - Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output	Renewables/DER Resource Integration	\$720,000 - \$880,000	\$ 511,681	\$ 312,209	\$ 823,890	N/A	All project costs are related to project activities. Admin costs are tracked separately.	N/A	N/A	N/A	N/A
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	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	N/A	N/A	N/A
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	Renewables/DER Resource Integration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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	A	B	C	D	J	K	L	M	N	O	P	Q
For Report DOC	I. Investment Plan Period		Project Name					ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
8	1st Triennial (2012-2014)	PG&E	1.08 - Improve Distribution System Safety and Reliability through New Data Analytics Techniques	Grid Modernization and Optimization	\$1,900,000 - \$2,320,000	\$ 1,791,805	\$ 320,835	\$ 2,112,640	All project costs are related to project activities. Admin costs are tracked separately.	N/A	N/A	N/A
9	1st Triennial (2012-2014)	PG&E	1.09A - Test New Remote Monitoring and Control Systems for Existing Transmission & Distribution Assets: Close Proximity Switching	Grid Modernization and Optimization	\$464,000 - \$567,000	\$ 382,094	\$ 133,174	\$ 515,268	All project costs are related to project activities. Admin costs are tracked separately.	N/A	N/A	N/A
10	1st Triennial (2012-2014)	PG&E	1.09B and 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 and Replacement Programs	Grid Modernization and Optimization	\$450,000 - \$550,000	\$ 543,414	\$ 4,267	\$ 547,753	All project costs are related to project activities. Admin costs are tracked separately.	N/A	N/A	N/A
11	1st Triennial (2012-2014)	PG&E	1.09C - Test New Remote Monitoring and Control Systems for T&D Assets: Discrete Series Reactors	Grid Modernization and Optimization	\$2,210,000 - \$2,710,000	\$ 1,545,895	\$ 913,838	\$ 2,440,930	All project costs are related to project activities. Admin costs are tracked separately.	N/A	N/A	N/A
12	1st Triennial (2012-2014)	PG&E	1.10A - Demonstrate Automated Asset Notification and Management Systems: Dissolved Gas Analysis	Grid Modernization and Optimization	\$ 0	\$ 0	\$ 0	\$ 0	TBD	TBD	TBD	TBD

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	A	B	C	D	J	K	L	M	N	O	P	Q
For Report DOC	<u>I. Investment Plan Period</u>		<u>Project Name</u>					<u>ix. EPIC Funds Spent</u>			<u>x. Partners (if applicable)</u>	<u>xi. Match Funding (if applicable)</u>
13	1st Triennial (2012-2014)	PG&E	1.10C - Demonstrate Automated Asset Notification and Management Systems: Underground Cable Analysis	Grid Modernization and Optimization	\$ 0 \$	\$ 0 \$	\$ 0 \$	\$ 0 \$	TBD	TBD	TBD	TBD
14	1st Triennial (2012-2014)	PG&E	1.11 - Demonstrate Self-Correcting Tools to Improve System Records and Operations	Grid Modernization and Optimization	\$ 0 \$	\$ 0 \$	\$ 0 \$	\$ 0 \$	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	Grid Modernization and Optimization	\$ 0 \$	\$ 0 \$	\$ 0 \$	\$ 0 \$	TBD	TBD	TBD	TBD
16	1st Triennial (2012-2014)	PG&E	1.13 - Demonstrate New Communication Systems to Improve Substation Automation and Interoperability	Grid Modernization and Optimization	\$ 0 \$	\$ 0 \$	\$ 0 \$	\$ 0 \$	TBD	TBD	TBD	TBD
17	1st Triennial (2012-2014)	PG&E	1.14 - Demonstrate "Next Generation" SmartMeter™ Telecom Network Functionalities	Grid Modernization and Optimization	\$3,780,000 - \$4,550,000	\$ 3,321,005	\$ 812,422	\$ 4,133,426	All project costs are related to project activities. Admin costs are tracked separately.	No	N/A	N/A
18	1st Triennial (2012-2014)	PG&E	1.15 - Demonstrate New Technologies and Strategies That Support Integrated "Customer-to-Market-to-Grid" Operations of the Future	Grid Modernization and Optimization	\$3,780,000 - \$4,620,000	\$ 1,592,302	\$ 2,540,871	\$ 4,133,173	0	N/A	N/A	N/A

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For Report DOC		I. Investment Plan Period		Project Name	Project Type				ix. EPIC Funds Spent	N	O	x. Partners (if applicable)	xi. Match Funding (if applicable)
19		1st Triennial (2012-2014)	PG&E	1.16 - Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages	Grid Modernization and Optimization	\$3,600,000 - \$4,400,000	\$ 2,448,165	\$ 1,561,622	\$ 4,009,788	\$ 125	Department of Energy (DOE) provided test services using National Renewable Energy Lab (NREL) facilities. Approximate cost share to date: \$120,000.	DOE/NREL; Edison Electric Institute engaged for elec. utility industry staging events; Portland General Electric closely collaborating for industry-level requirements	N/A
20		1st Triennial (2012-2014)	PG&E	1.17 - Leverage EPIC Funds by Participating in Multi-Utility, Industry Wide RD&D Programs Such as EPRI	Grid Modernization and Optimization	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	TBD	TBD	N/A
21		1st Triennial (2012-2014)	PG&E	1.18 - Demonstrate SmartMeter™-Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information	Customer Service and Enablement	\$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	N/A	N/A
22		1st Triennial (2012-2014)	PG&E	1.19 - Pilot Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	Customer Service and Enablement	\$1,780,000 - \$2,180,000	\$ 831,015	\$ 1,149,484	\$ 1,980,499	All project costs are related to project activities. Admin costs are tracked separately.	Leveraging existing AMI network investments.	N/A	N/A

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Row #		Program Administrator	Project Name	Project Type	Committed Funding Amount (\$)	Funds Expended to Date: Contract/Grant Amount (\$)	Funds Expended to Date: In-House Expenditures (\$)	Funds Expended to Date: Total Spent to Date (\$)	Administrative and Overhead Costs to Be Incurred for Each Project	Leveraged Funds	Partners	Match Funding
	A	B	C	D	J	K	L	M	N	O	P	Q
For Report DOC	<u>I. Investment Plan Period</u>		<u>Project Name</u>					<u>ix. EPIC Funds Spent</u>			<u>x. Partners (if applicable)</u>	<u>xi. Match Funding (if applicable)</u>
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	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24	1st Triennial (2012-2014)	PG&E	1.21 - Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability	Customer Service and Enablement	\$1,200,000 - \$1,460,000	\$ 890,314	\$ 437,467	\$ 1,327,782	All project costs are related to project activities. Admin costs are tracked separately.	N/A	N/A	N/A
25	1st Triennial (2012-2014)	PG&E	1.22 - Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility	Customer Service and Enablement	\$1,730,000 - \$2,120,000	\$ 1,598,498	\$ 325,629	\$ 1,924,128	All project costs are related to project activities. Admin costs are tracked separately.	N/A	N/A	N/A
26	1st Triennial (2012-2014)	PG&E	1.23 - Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility	Customer Service and Enablement	\$1,200,000 - \$1,460,000	\$ 872,927	\$ 450,890	\$ 1,323,817	All project costs are related to project activities. Admin costs are tracked separately.	N/A	N/A	N/A

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		I. Investment Plan Period	Program Administrator	Project Name	Project Type		Funds Expended to Date: In-House Expenditures (\$)			ix. EPIC Funds Spent	Administrative and Overhead Costs to Be Incurred for Each Project		x. Partners (if applicable)	xi. Match Funding (if applicable)
27		1st Triennial (2012-2014)	PG&E	1.24 - Demonstrate Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	Customer Service and Enablement	\$1,327,000 - \$1,621,000	\$ 77,583	\$ 1,262,770	\$ 77,583	\$ 1,340,353	All project costs are related to project activities. Admin costs are tracked separately.	N/A	N/A	N/A
28		1st Triennial (2012-2014)	PG&E	1.25 - Develop a Tool to Map The Preferred Locations for DC Fast Charging, Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs While Reducing the Impact on PG&E's Distribution Grid	Customer Service and Enablement	\$400,000 - \$490,000	\$ 132,618	\$ 311,851	\$ 132,618	\$ 444,469	All project costs are related to project activities. Admin costs are tracked separately.	N/A	N/A	N/A
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	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	TBD	TBD	TBD	TBD
30		2nd Triennial (2015-2017)	PG&E	2.01 - Evaluate Storage on the Distribution Grid	Renewables/DER Resource Integration	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	TBD	TBD	TBD	TBD

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Row #		A	B	C	D	J	K	L	M	N	O	P	Q
		<u>I. Investment Plan Period</u>	Program Administrator	Project Name	Project Type	Committed Funding Amount (\$)	Funds Expended to Date: Contract/Grant Amount (\$)	Funds Expended to Date: In-House Expenditures (\$)	Funds Expended to Date: Total Spent to Date (\$)	Administrative and Overhead Costs to Be Incurred for Each Project	Leveraged Funds	Partners	Match Funding
For Report DOC				<u>Project Name</u>					<u>ix. EPIC Funds Spent</u>			<u>x. Partners (if applicable)</u>	<u>xi. Match Funding (if applicable)</u>
31	2nd Triennial (2015-2017)		PG&E	2.02 – Pilot Distributed Energy Resource Management Systems (DERMS)	Renewables/DER Resource Integration	\$6,000,000 - \$7,320,000	\$ 2,665,148	\$ 3,065,661	\$ 5,730,809	\$ 8,878	N/A	N/A	\$415,000
32	2nd Triennial (2015-2017)		PG&E	2.03A - Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	Renewables/DER Resource Integration	\$4,767,300 - \$5,826,700	\$ 1,193,609	\$ 1,024,737	\$ 2,215,346	\$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.	N/A	TBD

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	For Report DOC	I. Investment Plan Period		Project Name	Project Type		K	L	M	N	O	P	Q
									ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
33		2nd Triennial (2015-2017)	PG&E	2.03B - Test Smart Inverter Enhanced Capabilities - Vehicle to Home	Renewables/DER Resource Integration	\$414,000 - \$506,000	\$ 192,117	\$ 267,534	\$ 459,651	\$ 11,224	TBD	TBD	TBD
34		2nd Triennial (2015-2017)	PG&E	2.04 - DG Monitoring & Voltage Tracking	Renewables/DER Resource Integration	\$1,110,000 - \$1,360,000	\$ 816,364	\$ 416,929	\$ 1,233,293	\$ 7,583	TBD	TBD	TBD
35		2nd Triennial (2015-2017)	PG&E	2.05 - Inertia Response Emulation for DG Impact Improvement	Renewables/DER Resource Integration	\$1,450,000 - \$1,780,000	\$ 58,939	\$ 43,967	\$ 102,906	TBD	TBD	National Renewable Energy Laboratory selected as testing and demonstration provider.	N/A

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	A	B	C	D	J	K	L	M	N	O	P	Q
For Report DOC	<u>I. Investment Plan Period</u>		<u>Project Name</u>					<u>ix. EPIC Funds Spent</u>			<u>x. Partners (if applicable)</u>	<u>xi. Match Funding (if applicable)</u>
36	2nd Triennial (2015-2017)	PG&E	2.06 - Intelligent Universal Transformer (IUT)	Renewables/DER Resource Integration	\$ 0 \$	\$ 0 \$	\$ 0 \$	\$ 0 \$	0 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	Grid Modernization and Optimization	\$2,420,000 - \$2,558,000	\$ 1,300,099	\$ 746,305	\$ 2,046,403	\$ 10,592	TBD	TBD	TBD
38	2nd Triennial (2015-2017)	PG&E	2.08 - "Smart" Monitoring and Analysis Tools	Grid Modernization and Optimization	\$ 0 \$	\$ 0 \$	\$ 0 \$	\$ 0 \$	TBD	TBD	TBD	TBD
39	2nd Triennial (2015-2017)	PG&E	2.09 - Distributed Series Impedance (DSI) Phase 2	Grid Modernization and Optimization	\$ 0 \$	\$ 0 \$	\$ 0 \$	\$ 0 \$	TBD	TBD	TBD	TBD
40	2nd Triennial (2015-2017)	PG&E	2.10 - Emergency Preparedness Modeling	Grid Modernization and Optimization	\$3,993,000 - \$4,581,000	\$ 2,477,190	\$ 599,902	\$ 3,077,092	\$ 1,538	TBD	TBD	TBD
41	2nd Triennial (2015-2017)	PG&E	2.11 - New Mobile Technology & Visualization Applications	Grid Modernization and Optimization	\$ 0 \$	\$ 0 \$	\$ 0 \$	\$ 0 \$	TBD	TBD	TBD	TBD

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Row #		Program Administrator	Project Name	Project Type	Committed Funding Amount (\$)	Funds Expended to Date: Contract/Grant Amount (\$)	Funds Expended to Date: In House Expenditures (\$)	Funds Expended to Date: Total Spent to Date (\$)	Administrative and Overhead Costs to Be Incurred for Each Project	Leveraged Funds	Partners	Match Funding
		A	C	D	J	K	L	M	N	O	P	Q
For Report DOC			<u>Project Name</u>					<u>ix. EPIC Funds Spent</u>			<u>x. Partners (if applicable)</u>	<u>xi. Match Funding (if applicable)</u>
42	2nd Triennial (2015-2017)	PG&E	2.12 - New Emergency Management Mobile Applications	Grid Modernization and Optimization	\$ 0	\$ 0	\$ 0	\$ 0	TBD	TBD	TBD	TBD
43	2nd Triennial (2015-2017)	PG&E	2.13 - Digital Substation/Substation Automation	Grid Modernization and Optimization	\$ 0	\$ 0	\$ 0	\$ 0	TBD	TBD	TBD	TBD
44	2nd Triennial (2015-2017)	PG&E	2.14 - Automatically Map Phasing Information	Grid Modernization and Optimization	\$1,660,000 - \$2,030,000	\$ 1,528,645	\$ 172,748	\$ 1,701,394	\$ 11,648	TBD	PG&E is working with University of California, Riverside to test an alternate algorithm based approach which will be evaluated against other solutions demonstrated in project	TBD
45	2nd Triennial (2015-2017)	PG&E	2.15 - Synchrophasor Applications for Generator Dynamic Model Validation	Grid Modernization and Optimization	\$654,000 - \$799,000	\$ 545,293	\$ 181,142	\$ 726,435	\$ 800	TBD	TBD	TBD
46	2nd Triennial (2015-2017)	PG&E	2.16 - Enhanced Synchrophasor Analytics & Applications	Grid Modernization and Optimization	\$ 0	\$ 0	\$ 0	\$ 0	TBD	TBD	TBD	TBD
47	2nd Triennial (2015-2017)	PG&E	2.17 - Geomagnetic Disturbance (GMD) Evaluation	Grid Modernization and Optimization	\$ 0	\$ 0	\$ 0	\$ 0	TBD	TBD	TBD	TBD
48	2nd Triennial (2015-2017)	PG&E	2.18 - Optical Instrument Transformers and Sensors for Protection and Control Systems	Grid Modernization and Optimization	\$ 0	\$ 0	\$ 0	\$ 0	TBD	TBD	TBD	TBD

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For Report DOC	I. Investment Plan Period		Project Name	Project Type				ix. EPIC Funds Spent	N	O	P	xi. Match Funding (if applicable)
49	2nd Triennial (2015-2017)	PG&E	2.19 – Enable Distributed Demand-Side Strategies & Technologies	Customer Service and Enablement	\$2,615,000 - \$3,197,000	\$ 1,322,060	\$ 616,233	\$ 1,938,292	\$ 24,686	TBD	TBD	TBD
50	2nd Triennial (2015-2017)	PG&E	2.20 – Real-Time Energy Usage Feedback to Customers	Customer Service and Enablement	\$ 0	\$ 0	\$ 0	\$ 0	TBD	TBD	TBD	TBD
51	2nd Triennial (2015-2017)	PG&E	2.21 – Home Area Network (HAN) for Commercial Customers	Customer Service and Enablement	\$180,000 - \$220,000	\$ 12,302	\$ 201,174	\$ 213,476	\$ 3,193	TBD	Rainforest Automation providing development of the cloud service application used by the customers	TBD
52	2nd Triennial (2015-2017)	PG&E	2.22 – Demand Reduction through Targeted Data Analytics	Customer Service and Enablement	\$1,734,000 - \$2,120,000	\$ 731,667	\$ 602,363	\$ 1,334,029	\$ 13,021	TBD	TBD	N/A

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		I. Investment Plan Period		Project Name	Project Type		K	L	M	N	O	P	Q
				Project Name					ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
53		2nd Triennial (2015-2017)	PG&E	2.23 - Integrate Demand Side Approaches into Utility Planning	Customer Service and Enablement	\$2,831,000 - \$3,461,000	\$ 1,812,991	\$ 1,261,764	\$ 3,074,755	\$ 8,188	TBD	TBD	TBD
54		2nd Triennial (2015-2017)	PG&E	2.24 - Appliance Level Bill Disaggregation for Non-Residential Customers	Customer Service and Enablement	\$ 0	\$ 0	\$ 0	\$ 0	TBD	TBD	TBD	TBD
55		2nd Triennial (2015-2017)	PG&E	2.25 - Enhanced Smart Grid Communications	Cross-Cutting/Foundational	\$ 0	\$ 0	\$ 0	\$ 0	TBD	TBD	TBD	TBD
56		2nd Triennial (2015-2017)	PG&E	2.26 - Customer & Distribution Automation Open Architecture Devices	Cross-Cutting/Foundational	\$3,015,000 - \$3,685,000	\$ 68,481	\$ 1,075,193	\$ 1,143,675	\$ 49,133	TBD	TBD	TBD
57		2nd Triennial (2015-2017)	PG&E	2.27 - Next Generation Integrated Smart Grid Network Management	Cross-Cutting/Foundational	\$1,008,000 - \$1,232,000	\$ 545,754	\$ 564,208	\$ 1,109,962	\$ 6,363	TBD	TBD	TBD
58		2nd Triennial (2015-2017)	PG&E	2.28 - Smart Grid Communications Path Monitoring	Cross-Cutting/Foundational	\$227,000 - \$277,000	\$ 63,687	\$ 188,182	\$ 251,869	TBD	TBD	TBD	TBD

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For Report DOC		I. Investment Plan Period		Project Name	Project Type				ix. EPIC Funds Spent		O	x. Partners (if applicable)	xi. Match Funding (if applicable)
59		2nd Triennial (2015-2017)	PG&E	2.29 - Mobile Meter Applications	Cross-Cutting/Foundational	\$2,610,000 - \$3,190,000	\$ 1,076,773	\$ 515,553	\$ 1,592,326	\$ 30,130	In-kind services for resource time from Lawrence Livermore National Lab (LNL) on technical specification calls	Lawrence Livermore National Lab providing technical support for product development	TBD
60		2nd Triennial (2015-2017)	PG&E	2.30 - Leverage EPIC Funds to Participate in Industry-Wide RD&D Programs	Grid Modernization and Optimization	\$ 0	\$ 0	\$ 0	\$ 0	TBD	TBD	TBD	TBD
61		2nd Triennial (2015-2017)	PG&E	2.31 - Aggregated Behind-The-Meter Storage Market / Retail Optimization	Renewables/DER Resource Integration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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		A	C	D	J	K	L	M	N	O	P	Q
For Report DOC		I. Investment Plan Period	Project Name					ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
62		2nd Triennial (2015-2017)	2.32 - Electric Load Management for Ridesharing Electrification	Renewables/DER Resource Integration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
63		2nd Triennial (2015-2017)	2.33 - Service Issue Identification Leveraging Momentary Outage Information	Grid Modernization and Optimization	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
64		2nd Triennial (2015-2017)	2.34 - Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors	Grid Modernization and Optimization	\$1,655,000 - \$2,023,000	\$0	\$0	\$0	TBD	TBD		TBD
65		2nd Triennial (2015-2017)	2.35 - Call Center Staffing Optimization	Grid Modernization and Optimization	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
66		2nd Triennial (2015-2017)	2.36 - Dynamic Rate Design Tool	Customer Service and Enablement	\$1,913,000 - \$2,338,000	\$0	\$0	\$0	TBD	TBD		TBD

*Date of award corrected from previous annual report

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Row #		Program Administrator	Project Name	Project Type	Match Funding Split	Funding Mechanism	Intellectual Property	Identification of the Method Used to Grant Awards.	If Competitively Selected, Provide the Number of Bidders Passing the Initial Pass/Fail Screening for Project
		A	B	C	D	R	S	T	U
	For Report DOC	I. Investment Plan Period	Project Name		xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)		V
1	1st Triennial (2012-2014)	PG&E	1.01 - Energy Storage End Uses	Renewables/DER Resource Integration	N/A	Pay for performance	N/A	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
2	1st Triennial (2012-2014)	PG&E	1.02 - Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction	Renewables/DER Resource Integration	N/A	Pay for Performance	N/A	Competitive Bid	11
3	1st Triennial (2012-2014)	PG&E	1.03 - Demonstrate Priority Scenarios from the Energy Storage Framework	Renewables/DER Resource Integration	TBD	TBD	TBD	TBD	TBD

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Row #	Program Administrator	Project Name	Project Type	Match Funding Split	Funding Mechanism	Intellectual Property	Identification of the Method Used to Grant Awards.	If Competitively Selected, Provide the Number of Bidders Passing the Initial Pass/Fail Screening for Project
		A	C	D	R	S	T	V
For Report DOC		I. Investment Plan Period	Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)		
8	PG&E	1st Triennial (2012-2014)	1.08 - Improve Distribution System Safety and Reliability through New Data Analytics Techniques	N/A	Pay for performance	N/A	Competitive Bid	11 total bidders 7 passed initial screen
9	PG&E	1st Triennial (2012-2014)	1.09A - Test New Remote Monitoring and Control Systems for Existing Transmission & Distribution Assets: Close Proximity Switching	N/A	Pay for Performance	N/A	Competitive Bid	4
10	PG&E	1st Triennial (2012-2014)	1.09B and 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 and Replacement Programs	N/A	Pay for performance	N/A	Competitive Bid	Phase 1: 5 bids Phase 2: 8 bids
11	PG&E	1st Triennial (2012-2014)	1.09C - Test New Remote Monitoring and Control Systems for T&D Assets: Discrete Series Reactors	N/A	Pay for Performance	N/A	Sole Source - Smart Wires, Inc. selected as they are the developer and sole supplier of DSR devices.	N/A
12	PG&E	1st Triennial (2012-2014)	1.10A - Demonstrate Automated Asset Notification and Management Systems: Dissolved Gas Analysis	TBD	TBD	TBD	TBD	TBD

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Row #	Program Administrator	Project Name	Project Type	Match Funding Split	Funding Mechanism	Intellectual Property	Identification of the Method Used to Grant Awards.	If Competitively Selected, Provide the Number of Bidders Passing the Initial Pass/Fail Screening for Project
		A	D	R	S	T	U	V
For Report DOC		I. Investment Plan Period		xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)		
13	PG&E	1.10C - Demonstrate Automated Asset Notification and Management Systems: Underground Cable Analysis	Grid Modernization and Optimization	TBD	TBD	TBD	TBD	TBD
14	PG&E	1.11 - Demonstrate Self-Correcting Tools to Improve System Records and Operations	Grid Modernization and Optimization	TBD	TBD	TBD	TBD	TBD
15	PG&E	1.12 - Demonstrate New Technologies that Improve Wildlife Safety and Protect Assets from Weather-Related Degradation	Grid Modernization and Optimization	TBD	TBD	TBD	TBD	TBD
16	PG&E	1.13 - Demonstrate New Communication Systems to Improve Substation Automation and Interoperability	Grid Modernization and Optimization	TBD	TBD	TBD	TBD	TBD
17	PG&E	1.14 - Demonstrate "Next Generation" SmartMeter™ Telecom Network Functionalities	Grid Modernization and Optimization	N/A	Pay for Performance	Patents filed for - 1) Smart Pole Meter, 2) Smart Pole Meter Socket and 3) An algorithm to help identify downed wires	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
18	PG&E	1.15 - Demonstrate New Technologies and Strategies That Support Integrated "Customer-to-Market-to-Grid" Operations of the Future	Grid Modernization and Optimization	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

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Row #		Program Administrator	Project Name	Project Type	Match Funding Split	Funding Mechanism	Intellectual Property	Identification of the Method Used to Grant Awards.	If Competitively Selected, Provide the Number of Bidders Passing the Initial Pass/Fail Screening for Project
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	For Report DOC	I. Investment Plan Period	Project Name		xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)		V
19	1st Triennial (2012-2014)	PG&E	1.16 - Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages	Grid Modernization and Optimization	N/A	Pay for performance	N/A	- Phase 1 (Mule Phase): 2 Direct Awards - Efficient Drivetrains, Inc. (ED) 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 ED, 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)
20	1st Triennial (2012-2014)	PG&E	1.17 - Leverage EPIC Funds by Participating in Multi-Utility, Industry Wide RD&D Programs Such as EPRI	Grid Modernization and Optimization	N/A	TBD	TBD	TBD	TBD
21	1st Triennial (2012-2014)	PG&E	1.18 - Demonstrate SmartMeter™-Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information	Customer Service and Enablement	N/A	Pay for performance	N/A	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
22	1st Triennial (2012-2014)	PG&E	1.19 - Pilot Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	Customer Service and Enablement	N/A	Pay for Performance	N/A	Competitive Bid	3

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Row #	Program Administrator	Project Name	Project Type	Match Funding Split	Funding Mechanism	Intellectual Property	Identification of the Method Used to Grant Awards.	If Competitively Selected, Provide the Number of Bidders Passing the Initial Pass/Fail Screening for Project
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For Report DOC	I. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)		
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	N/A	N/A	N/A
24	1st Triennial (2012-2014)	PG&E	1.21 - Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability	Customer Service and Enablement	N/A	Patent filed for an algorithm which can detect unauthorized PV interconnections	Sole Source - Nexant selected due to expertise in PG&E's CC&B database, PV generation data analysis and AMI network.	N/A
25	1st Triennial (2012-2014)	PG&E	1.22 - Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility	Customer Service and Enablement	N/A	N/A	Competitive Bid	15
26	1st Triennial (2012-2014)	PG&E	1.23 - Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility	Customer Service and Enablement	N/A	N/A	- 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

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For Report DOC	I. Investment Plan Period	Project Name		xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)		
27	1st Triennial (2012-2014)	1.24 - Demonstrate Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	Customer Service and Enablement	N/A	Pay for performance	N/A	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
28	1st Triennial (2012-2014)	1.25 - Develop a Tool to Map The Preferred Locations for DC Fast Charging. Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs While Reducing the Impact on PG&E's Distribution Grid	Customer Service and Enablement	N/A	Pay for Performance	N/A	Competitive Bid	4
29	1st Triennial (2012-2014)	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	TBD	TBD	TBD	TBD	TBD
30	2nd Triennial (2015-2017)	2.01 - Evaluate Storage on the Distribution Grid	Renewables/DER Resource Integration	TBD	TBD	TBD	TBD	TBD

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		<u>I. Investment Plan Period</u>	<u>Project Name</u>		<u>xii. Match Funding Split (if applicable)</u>	<u>xiii. Funding Mechanism (if applicable)</u>	<u>xiv. Treatment of Intellectual Property (if applicable)</u>		V
For Report DOC 31		2nd Triennial (2015-2017)	PG&E	2.02 - Pilot Distributed Energy Resource Management Systems (DERMS)	Renewables/DER Resource Integration	N/A	Pay for performance	TBD	Competitive Bid
32		2nd Triennial (2015-2017)	PG&E	2.03A - Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	Renewables/DER Resource Integration	TBD	Pay for Performance	N/A	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.

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For Report DOC	I. Investment Plan Period	Program Administrator	Project Name	Project Type	Match Funding Split	Funding Mechanism	Intellectual Property	Identification of the Method Used to Grant Awards.	If Competitively Selected, Provide the Number of Bidders Passing the Initial Pass/Fail Screening for Project	
33	2nd Triennial (2015-2017)	PG&E	2.03B - Test Smart Inverter Enhanced Capabilities - Vehicle to Home	Renewables/DER Resource Integration	TBD	Pay for Performance	N/A - No current evidences of Intellectual Property development	Quick Bid		4
34	2nd Triennial (2015-2017)	PG&E	2.04 - DG Monitoring & Voltage Tracking	Renewables/DER Resource Integration	TBD	Pay for Performance	N/A	Competitive Bid		12
35	2nd Triennial (2015-2017)	PG&E	2.05 - Inertia Response Emulation for DG Impact Improvement	Renewables/DER Resource Integration	N/A	Pay for performance	N/A	Quick Bid		4

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For Report DOC	I. Investment Plan Period		Project Name		xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)		
36	2nd Triennial (2015-2017)	PG&E	2.06 - Intelligent Universal Transformer (IUT)	Renewables/DER Resource Integration	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	Grid Modernization and Optimization	TBD	Pay for Performance	N/A	Competitive Bid	12
38	2nd Triennial (2015-2017)	PG&E	2.08 - "Smart" Monitoring and Analysis Tools	Grid Modernization and Optimization	TBD	TBD	TBD	TBD	
39	2nd Triennial (2015-2017)	PG&E	2.09 - Distributed Series Impedance (DSI) Phase 2	Grid Modernization and Optimization	TBD	TBD	TBD	TBD	
40	2nd Triennial (2015-2017)	PG&E	2.10 - Emergency Preparedness Modeling	Grid Modernization and Optimization	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
41	2nd Triennial (2015-2017)	PG&E	2.11 - New Mobile Technology & Visualization Applications	Grid Modernization and Optimization	TBD	TBD	TBD	TBD	TBD

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	A	B	C	D	E	F	G	H
For Report DOC	I. Investment Plan Period	Project Name		xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)	U	V
42	2nd Triennial (2015-2017)	PG&E	2.12 - New Emergency Management Mobile Applications	Grid Modernization and Optimization	TBD	TBD	TBD	TBD
43	2nd Triennial (2015-2017)	PG&E	2.13 - Digital Substation/Substation Automation	Grid Modernization and Optimization	TBD	TBD	TBD	TBD
44	2nd Triennial (2015-2017)	PG&E	2.14 - Automatically Map Phasing Information	Grid Modernization and Optimization	TBD	N/A	• 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
45	2nd Triennial (2015-2017)	PG&E	2.15 - Synchrophasor Applications for Generator Dynamic Model Validation	Grid Modernization and Optimization	TBD	N/A	• 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
46	2nd Triennial (2015-2017)	PG&E	2.16 - Enhanced Synchrophasor Analytics & Applications	Grid Modernization and Optimization	TBD	TBD	TBD	TBD
47	2nd Triennial (2015-2017)	PG&E	2.17 - Geomagnetic Disturbance (GMD) Evaluation	Grid Modernization and Optimization	TBD	TBD	TBD	TBD
48	2nd Triennial (2015-2017)	PG&E	2.18 - Optical Instrument Transformers and Sensors for Protection and Control Systems	Grid Modernization and Optimization	TBD	TBD	TBD	TBD

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	A	B	C	D	E	F	G	H
For Report DOC	I. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)		
49	2nd Triennial (2015-2017)	PG&E	2.19 - Enable Distributed Demand-Side Strategies & Technologies	TBD	Pay for Performance	N/A - No current evidence of Intellectual Property development	Competitive Bid	10
50	2nd Triennial (2015-2017)	PG&E	2.20 - Real-Time Energy Usage Feedback to Customers	TBD	TBD	TBD	TBD	
51	2nd Triennial (2015-2017)	PG&E	2.21 - Home Area Network (HAN) for Commercial Customers	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™.	
52	2nd Triennial (2015-2017)	PG&E	2.22 - Demand Reduction through Targeted Data Analytics	N/A	N/A	N/A	Sole Source to Teradata to reduce unnecessary IT redundancy by leveraging existing data platform and data connections rather than re-create them.	

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		A	B	C	D	R	S	T	U	V
		<u>I. Investment Plan Period</u>				<u>xii. Match Funding Split (if applicable)</u>	<u>xiii. Funding Mechanism (if applicable)</u>	<u>xiv. Treatment of Intellectual Property (if applicable)</u>		
53	PG&E	2.23 - Integrate Demand Side Approaches into Utility Planning	Customer Service and Enablement	TBD	Pay for Performance	N/A	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		
54	PG&E	2.24 - Appliance Level Bill Disaggregation for Non-Residential Customers	Customer Service and Enablement	TBD	TBD	TBD	TBD	TBD		
55	PG&E	2.25 - Enhanced Smart Grid Communications	Cross-Cutting/Foundational	TBD	TBD	TBD	TBD	TBD		
56	PG&E	2.26 - Customer & Distribution Automation Open Architecture Devices	Cross-Cutting/Foundational	TBD	TBD	N/A	Competitive Bid			11
57	PG&E	2.27 - Next Generation Integrated Smart Grid Network Management	Cross-Cutting/Foundational	TBD	Pay for Performance	N/A	Competitive Bid			8
58	PG&E	2.28 - Smart Grid Communications Path Monitoring	Cross-Cutting/Foundational	TBD	TBD	N/A	TBD	TBD		

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For Report DOC	I. Investment Plan Period		Project Name		xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)		
59	2nd Triennial (2015-2017)	PG&E	2.29 - Mobile Meter Applications	Cross-Cutting/Foundational	TBD	Pav for Performance	Provisional patent filed for the multi-purpose mobile meter (Next Generation Meter - NGM).	Competitive Bid	8
60	2nd Triennial (2015-2017)	PG&E	2.30 - Leverage EPIC Funds to Participate in Industry-Wide RD&D Programs	Grid Modernization and Optimization	TBD	TBD	TBD	TBD	
61	2nd Triennial (2015-2017)	PG&E	2.31 - Aggregated Behind-The-Meter Storage Market / Retail Optimization	Renewables/DER Resource Integration	N/A	N/A	N/A	N/A	N/A

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For Report DOC	I. Investment Plan Period		Project Name		xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)		
62	2nd Triennial (2015-2017)	PG&E	2.32 - Electric Load Management for Ridesharing Electrification	Renewables/DER Resource Integration	N/A	N/A	N/A	N/A	N/A
63	2nd Triennial (2015-2017)	PG&E	2.33 - Service Issue Identification Leveraging Momentary Outage Information	Grid Modernization and Optimization	N/A	N/A	N/A	N/A	N/A
64	2nd Triennial (2015-2017)	PG&E	2.34 - Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors	Grid Modernization and Optimization	TBD	N/A	TBD	N/A	N/A
65	2nd Triennial (2015-2017)	PG&E	2.35 - Call Center Staffing Optimization	Grid Modernization and Optimization	N/A	N/A	N/A	N/A	N/A
66	2nd Triennial (2015-2017)	PG&E	2.36 - Dynamic Rate Design Tool	Customer Service and Enablement	TBD	Pay for Performance	TBD	N/A	N/A

*Date of award corrected from previous annual report

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	A	B	C	D	W	X	Y	Z
	<u>I. Investment Plan Period</u>		<u>Project Name</u>					
1	1st Triennial (2012-2014)	PG&E	1.01 - Energy Storage End Uses	Renewables/DER Resource Integration	N/A	N/A	N/A	Column applicable to CEC only
2	1st Triennial (2012-2014)	PG&E	1.02 - Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction	Renewables/DER Resource Integration	Cupertino Electric	1	N/A	Column applicable to CEC only
3	1st Triennial (2012-2014)	PG&E	1.03 - Demonstrate Priority Scenarios from the Energy Storage Framework	Renewables/DER Resource Integration	TBD	TBD	TBD	Column applicable to CEC only

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	A	B	C	D	W	X	Y	Z
For Report DOC	I. Investment Plan Period		Project Name					
4	1st Triennial (2012-2014)	PG&E	1.04 - Expand Test Lab and Pilot Facilities for New Energy Storage Systems.	Renewables/DER Resource Integration	N/A	N/A	N/A	Column applicable to CEC only
5	1st Triennial (2012-2014)	PG&E	1.05 - Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output	Renewables/DER Resource Integration	1st award: Weather Decision Technologies 2nd award: Vertum Partners	1st award: 1 2nd award: 1	N/A	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	Renewables/DER Resource Integration	TBD	TBD	TBD	Column applicable to CEC only
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	Renewables/DER Resource Integration	N/A	N/A	N/A	Column applicable to CEC only

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	A	B	C	D	W	X	Y	Z
For Report DOC	I. Investment Plan Period		Project Name					
8	1st Triennial (2012-2014)	PG&E	1.08 - Improve Distribution System Safety and Reliability through New Data Analytics Techniques	Grid Modernization and Optimization	Space Time Insight	1	N/A	Column applicable to CEC only
9	1st Triennial (2012-2014)	PG&E	1.09A - Test New Remote Monitoring and Control Systems for Existing Transmission & Distribution Assets: Close Proximity Switching	Grid Modernization and Optimization	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.	The two RFP vendors tied for first.	N/A	Column applicable to CEC only
10	1st Triennial (2012-2014)	PG&E	1.09B and 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 and Replacement Programs	Grid Modernization and Optimization	Phase 1: Black and Veatch Phase 2: Exponent	Phase 1: 1 Phase 2: 1	N/A	Column applicable to CEC only
11	1st Triennial (2012-2014)	PG&E	1.09C - Test New Remote Monitoring and Control Systems for T&D Assets: Discrete Series Reactors	Grid Modernization and Optimization	N/A	N/A	N/A	Column applicable to CEC only
12	1st Triennial (2012-2014)	PG&E	1.10A - Demonstrate Automated Asset Notification and Management Systems: Dissolved Gas Analysis	Grid Modernization and Optimization	TBD	TBD	TBD	Column applicable to CEC only

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	A	B	C	D	W	X	Y	Z
For Report DOC	I. Investment Plan Period		Project Name					
13	1st Triennial (2012-2014)	PG&E	1.10C - Demonstrate Automated Asset Notification and Management Systems: Underground Cable Analysis	Grid Modernization and Optimization	TBD	TBD	TBD	Column applicable to CEC only
14	1st Triennial (2012-2014)	PG&E	1.11 - Demonstrate Self-Correcting Tools to Improve System Records and Operations	Grid Modernization and Optimization	TBD	TBD	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	Grid Modernization and Optimization	TBD	TBD	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	Grid Modernization and Optimization	TBD	TBD	TBD	Column applicable to CEC only
17	1st Triennial (2012-2014)	PG&E	1.14 - Demonstrate "Next Generation" SmartMeter™ Telecom Network Functionalities	Grid Modernization and Optimization	N/A	N/A	N/A	Column applicable to CEC only
18	1st Triennial (2012-2014)	PG&E	1.15 - Demonstrate New Technologies and Strategies That Support Integrated "Customer-to-Market-to-Grid" Operations of the Future	Grid Modernization and Optimization	BitStew	1	N/A	Column applicable to CEC only

**APPENDIX A
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	A	B	C	D	W	X	Y	Z
For Report DOC	I. Investment Plan Period		Project Name					
19	1st Triennial (2012-2014)	PG&E	1.16 - Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages	Grid Modernization and Optimization	Efficient Drivetrains, Inc. (EDI) (Phase 3 - Beta Phase)	1 (Phase 3 - Beta Phase)	N/A	Column applicable to CEC only
20	1st Triennial (2012-2014)	PG&E	1.17 - Leverage EPIC Funds by Participating in Multi-Utility, Industry Wide RD&D Programs Such as EPRI	Grid Modernization and Optimization	TBD	TBD	TBD	Column applicable to CEC only
21	1st Triennial (2012-2014)	PG&E	1.18 - Demonstrate SmartMeter™-Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information	Customer Service and Enablement	N/A	N/A	N/A	Column applicable to CEC only
22	1st Triennial (2012-2014)	PG&E	1.19 - Pilot Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	Customer Service and Enablement	BitStew & Primestone	Tie for first	N/A	Column applicable to CEC only

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	A	B	C	D	W	X	Y	Z
For Report DOC	I. Investment Plan Period		Project Name					
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	N/A	N/A	Column applicable to CEC only
24	1st Triennial (2012-2014)	PG&E	1.21 - Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability	Customer Service and Enablement	N/A	N/A	N/A	Column applicable to CEC only
25	1st Triennial (2012-2014)	PG&E	1.22 - Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility	Customer Service and Enablement	Nexant, Inc.	1	N/A	Column applicable to CEC only
26	1st Triennial (2012-2014)	PG&E	1.23 - Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility	Customer Service and Enablement	N/A	N/A	N/A	Column applicable to CEC only

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For Report DOC	I. Investment Plan Period		Project Name					
27	1st Triennial (2012-2014)	PG&E	1.24 - Demonstrate Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	Customer Service and Enablement	N/A	N/A	N/A	Column applicable to CEC only
28	1st Triennial (2012-2014)	PG&E	1.25 - Develop a Tool to Map The Preferred Locations for DC Fast Charging. Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs While Reducing the Impact on PG&E's Distribution Grid	Customer Service and Enablement	Energy and Environmental Economics, Inc. (E3)	1	N/A - E3 was the highest scoring vendor.	Column applicable to CEC only
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	TBD	TBD	TBD	Column applicable to CEC only
30	2nd Triennial (2015-2017)	PG&E	2.01 - Evaluate Storage on the Distribution Grid	Renewables/DER Resource Integration	TBD	TBD	TBD	Column applicable to CEC only

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For Report DOC	I. Investment Plan Period		Project Name					
31	2nd Triennial (2015-2017)	PG&E	2.02 - Pilot Distributed Energy Resource Management Systems (DERMS)	Renewables/DER Resource Integration	GE Alstom	1	N/A	Column applicable to CEC only
32	2nd Triennial (2015-2017)	PG&E	2.03A - Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	Renewables/DER Resource Integration	TBD	TBD	TBD	Column applicable to CEC only

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	A	B	C	D	W	X	Y	Z
For Report DOC	i. Investment Plan Period		Project Name					
33	2nd Triennial (2015-2017)	PG&E	2.03B - Test Smart Inverter Enhanced Capabilities - Vehicle to Home	Renewables/DER Resource Integration	Navigant	1	N/A	Column applicable to CEC only
34	2nd Triennial (2015-2017)	PG&E	2.04 - DG Monitoring & Voltage Tracking	Renewables/DER Resource Integration	Nexant, Inc.	1	N/A	Column applicable to CEC only
35	2nd Triennial (2015-2017)	PG&E	2.05 - Inertia Response Emulation for DG Impact Improvement	Renewables/DER Resource Integration	NREL	1	N/A	Column applicable to CEC only

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	A	B	C	D	W	X	Y	Z
For Report DOC	I. Investment Plan Period		Project Name					
36	2nd Triennial (2015-2017)	PG&E	2.06 - Intelligent Universal Transformer (IUT)	Renewables/DER Resource Integration	N/A	TBD	TBD	Column applicable to CEC only
37	2nd Triennial (2015-2017)	PG&E	2.07 - Real-Time Loading Data for Distribution Operations and Planning	Grid Modernization and Optimization	Trove Predictive Data	1 N/A		Column applicable to CEC only
38	2nd Triennial (2015-2017)	PG&E	2.08 - "Smart" Monitoring and Analysis Tools	Grid Modernization and Optimization	TBD	TBD	TBD	Column applicable to CEC only
39	2nd Triennial (2015-2017)	PG&E	2.09 - Distributed Series Impedance (DSI) Phase 2	Grid Modernization and Optimization	TBD	TBD	TBD	Column applicable to CEC only
40	2nd Triennial (2015-2017)	PG&E	2.10 - Emergency Preparedness Modeling	Grid Modernization and Optimization	IBM	1 N/A		Column applicable to CEC only
41	2nd Triennial (2015-2017)	PG&E	2.11 - New Mobile Technology & Visualization Applications	Grid Modernization and Optimization	TBD	TBD	TBD	Column applicable to CEC only

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	A	B	C	D	W	X	Y	Z
For Report DOC	I. Investment Plan Period		Project Name					
42	2nd Triennial (2015-2017)	PG&E	2.12 - New Emergency Management Mobile Applications	Grid Modernization and Optimization	TBD	TBD	TBD	Column applicable to CEC only
43	2nd Triennial (2015-2017)	PG&E	2.13 - Digital Substation/Substation Automation	Grid Modernization and Optimization	TBD	TBD	TBD	Column applicable to CEC only
44	2nd Triennial (2015-2017)	PG&E	2.14 - Automatically Map Phasing Information	Grid Modernization and Optimization	TBD	TBD	TBD	Column applicable to CEC only
45	2nd Triennial (2015-2017)	PG&E	2.15 - Synchrophasor Applications for Generator Dynamic Model Validation	Grid Modernization and Optimization	N/A	N/A	N/A	Column applicable to CEC only
46	2nd Triennial (2015-2017)	PG&E	2.16 - Enhanced Synchrophasor Analytics & Applications	Grid Modernization and Optimization	TBD	TBD	TBD	Column applicable to CEC only
47	2nd Triennial (2015-2017)	PG&E	2.17 - Geomagnetic Disturbance (GMD) Evaluation	Grid Modernization and Optimization	TBD	TBD	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	Grid Modernization and Optimization	TBD	TBD	TBD	Column applicable to CEC only

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	A	B	C	D	W	X	Y	Z
			Project Name					
	i. Investment Plan Period							
For Report DOC 49	2nd Triennial (2015-2017)	PG&E	2.19 - Enable Distributed Demand-Side Strategies & Technologies	Customer Service and Enablement	Solar City (for residential customers); Green Charge Networks (for commercial customers)	1	N/A	Column applicable to CEC only
50	2nd Triennial (2015-2017)	PG&E	2.20 - Real-Time Energy Usage Feedback to Customers	Customer Service and Enablement	TBD	TBD	TBD	Column applicable to CEC only
51	2nd Triennial (2015-2017)	PG&E	2.21 - Home Area Network (HAN) for Commercial Customers	Customer Service and Enablement	TBD	TBD	TBD	Column applicable to CEC only
52	2nd Triennial (2015-2017)	PG&E	2.22 - Demand Reduction through Targeted Data Analytics	Customer Service and Enablement	TBD	TBD	TBD	Column applicable to CEC only

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	A	B	C	D	W	X	Y	Z
For Report DOC	I. Investment Plan Period		Project Name					
53	2nd Triennial (2015-2017)	PG&E	2.23 - Integrate Demand Side Approaches into Utility Planning	Customer Service and Enablement	N/A	N/A	N/A	Column applicable to CEC only
54	2nd Triennial (2015-2017)	PG&E	2.24 - Appliance Level Bill Disaggregation for Non-Residential Customers	Customer Service and Enablement	TBD	TBD	TBD	Column applicable to CEC only
55	2nd Triennial (2015-2017)	PG&E	2.25 - Enhanced Smart Grid Communications	Cross-Cutting/Foundation	TBD	TBD	TBD	Column applicable to CEC only
56	2nd Triennial (2015-2017)	PG&E	2.26 - Customer & Distribution Automation Open Architecture Devices	Cross-Cutting/Foundation	Errigal Inc.	2	Supplier selected had best prices for Use Cases that were selected for award.	Column applicable to CEC only
57	2nd Triennial (2015-2017)	PG&E	2.27 - Next Generation Integrated Smart Grid Network Management	Cross-Cutting/Foundation	Errigal Inc.	1	N/A	Column applicable to CEC only
58	2nd Triennial (2015-2017)	PG&E	2.28 - Smart Grid Communications Path Monitoring	Cross-Cutting/Foundation	TBD	TBD	TBD	Column applicable to CEC only

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	A	B	C	D	W	X	Y	Z
For Report DOC	I. Investment Plan Period		Project Name					
59	2nd Triennial (2015-2017)	PG&E	2.29 - Mobile Meter Applications	Cross-Cutting/Foundational	Offer Communications	1	N/A	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	Grid Modernization and Optimization	TBD	TBD	TBD	Column applicable to CEC only
61	2nd Triennial (2015-2017)	PG&E	2.31 - Aggregated Behind-The-Meter Storage Market / Retail Optimization	Renewables/DER Resource Integration	N/A	N/A	N/A	Column applicable to CEC only

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For Report DOC	I. Investment Plan Period		Project Name	Project Type				
62	2nd Triennial (2015-2017)	PG&E	2.32 - Electric Load Management for Ridesharing Electrification	Renewables/DER Resource Integration	N/A	N/A	N/A	Column applicable to CEC only
63	2nd Triennial (2015-2017)	PG&E	2.33 - Service Issue Identification Leveraging Momentary Outage Information	Grid Modernization and Optimization	N/A	N/A	N/A	Column applicable to CEC only
64	2nd Triennial (2015-2017)	PG&E	2.34 - Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors	Grid Modernization and Optimization	N/A	N/A	N/A	Column applicable to CEC only
65	2nd Triennial (2015-2017)	PG&E	2.35 - Call Center Staffing Optimization	Grid Modernization and Optimization	N/A	N/A	N/A	Column applicable to CEC only
66	2nd Triennial (2015-2017)	PG&E	2.36 - Dynamic Rate Design Tool	Customer Service and Enablement	N/A	N/A	N/A	Column applicable to CEC only

*Date of award corrected from previous annual report

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	A	B	C	D	AB	AC
For Report DOC	i. Investment Plan Period		Project Name			vi. Metrics
1	1st Triennial (2012-2014)	PG&E	1.01 - Energy Storage End Uses	Renewables/DER Resource Integration	Yes. • Power Settlements Consulting - California-based • Trimark Associates - California-based	Column applicable to CEC only • 1j - 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). • 7i - 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).
2	1st Triennial (2012-2014)	PG&E	1.02 - Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction	Renewables/DER Resource Integration	Yes - California-based.	• 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.
3	1st Triennial (2012-2014)	PG&E	1.03 - Demonstrate Priority Scenarios from the Energy Storage Framework	Renewables/DER Resource Integration	TBD	Column applicable to CEC only

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	A	B	C	D	AB	AC
For Report DOC	i. Investment Plan Period		Project Name			vi. Metrics
4	1st Triennial (2012-2014)	PG&E	1.04 - Expand Test Lab and Pilot Facilities for New Energy Storage Systems.	Renewables/DER Resource Integration	Column applicable to CEC only	N/A
5	1st Triennial (2012-2014)	PG&E	1.05 - Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output	Renewables/DER Resource Integration	Column applicable to CEC only	• 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.
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	Column applicable to CEC only	N/A
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	Renewables/DER Resource Integration	Column applicable to CEC only	N/A

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	A	B	C	D	AB	AC
For Report DOC	i. Investment Plan Period		Project Name			vi. Metrics
8	1st Triennial (2012-2014)	PG&E	1.08 - Improve Distribution System Safety and Reliability through New Data Analytics Techniques	Grid Modernization and Optimization	Yes - California-based	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.
9	1st Triennial (2012-2014)	PG&E	1.09A - Test New Remote Monitoring and Control Systems for Existing Transmission & Distribution Assets: Close Proximity Switching	Grid Modernization and Optimization	No	5a - Outage number, frequency and duration reductions. 5e - Utility worker safety improvement and hazard exposure reduction.
10	1st Triennial (2012-2014)	PG&E	1.09B and 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 and Replacement Programs	Grid Modernization and Optimization	No	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.
11	1st Triennial (2012-2014)	PG&E	1.09C - Test New Remote Monitoring and Control Systems for T&D Assets: Discrete Series Reactors	Grid Modernization and Optimization	No	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.
12	1st Triennial (2012-2014)	PG&E	1.10A - Demonstrate Automated Asset Notification and Management Systems: Dissolved Gas Analysis	Grid Modernization and Optimization	TBD	TBD

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	A	B	C	D	AB	AC
For Report DOC	i. Investment Plan Period		Project Name			vi. Metrics
13	1st Triennial (2012-2014)	PG&E	1.10C - Demonstrate Automated Asset Notification and Management Systems: Underground Cable Analysis	Grid Modernization and Optimization	TBD	TBD
14	1st Triennial (2012-2014)	PG&E	1.11 - Demonstrate Self-Correcting Tools to Improve System Records and Operations	Grid Modernization and Optimization	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	Grid Modernization and Optimization	TBD	TBD
16	1st Triennial (2012-2014)	PG&E	1.13 - Demonstrate New Communication Systems to Improve Substation Automation and Interoperability	Grid Modernization and Optimization	TBD	TBD
17	1st Triennial (2012-2014)	PG&E	1.14 - Demonstrate "Next Generation" SmartMeter™ Telecom Network Functionalities	Grid Modernization and Optimization	Column applicable to CEC only	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.
18	1st Triennial (2012-2014)	PG&E	1.15 - Demonstrate New Technologies and Strategies That Support Integrated "Customer-to-Market-to-Grid" Operations of the Future	Grid Modernization and Optimization	Column applicable to CEC only	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 §360). 3a - Maintain/Reduce operations and maintenance costs.

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	A	B	C	D	AB	AC
For Report DOC	i. Investment Plan Period		Project Name			vi. Metrics
19	1st Triennial (2012-2014)	PG&E	1.16 - Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages	Grid Modernization and Optimization	N/A	• 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).
20	1st Triennial (2012-2014)	PG&E	1.17 - Leverage EPIC Funds by Participating in Multi-Utility, Industry Wide RD&D Programs Such as EPRI	Grid Modernization and Optimization	TBD	TBD
21	1st Triennial (2012-2014)	PG&E	1.18 - Demonstrate SmartMeter™-Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information	Customer Service and Enablement	No	• 1f - Avoided customer energy use. • 1h - Customer bill savings (dollars saved).
22	1st Triennial (2012-2014)	PG&E	1.19 - Pilot Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	Customer Service and Enablement	No	• 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.

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	A	B	C	D	AB	AC
For Report DOC	i. Investment Plan Period		Project Name			vi. Metrics
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	Column applicable to CEC only	N/A
24	1st Triennial (2012-2014)	PG&E	1.21 - Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability	No	Column applicable to CEC only	• 5d - Public safety improvement and hazard exposure reduction. • 5f - Reduced flicker and other power quality differences. • 5c - Forecast accuracy improvement.
25	1st Triennial (2012-2014)	PG&E	1.22 - Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility	No	Column applicable to CEC only	• 4a - GHG emissions reductions (MMTCO2e). • 1h - Customer bill savings (megawatt hours saved).
26	1st Triennial (2012-2014)	PG&E	1.23 - Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility	Opower - No Clean Power Research - Yes: California-based	Column applicable to CEC only	• 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).

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	A	B	C	D	AB	AC
For Report DOC	i. Investment Plan Period	Project Name				vi. Metrics
27	1st Triennial (2012-2014)	PG&E	1.24 - Demonstrate Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	Customer Service and Enablement	Column applicable to CEC only	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).
28	1st Triennial (2012-2014)	PG&E	1.25 - Develop a Tool to Map The Preferred Locations for DC Fast Charging, Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs While Reducing the Impact on PG&E's Distribution Grid	Customer Service and Enablement	Column applicable to CEC only	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 (MMTC02e). 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). 7i - Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.
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	Column applicable to CEC only	TBD
30	2nd Triennial (2015-2017)	PG&E	2.01 - Evaluate Storage on the Distribution Grid	Renewables/DER Resource Integration	Column applicable to CEC only	TBD

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	A	B	C	D	AB	AC
For Report DOC	i. Investment Plan Period		Project Name			vi. Metrics
31	2nd Triennial (2015-2017)	PG&E	2.02 - Pilot Distributed Energy Resource Management Systems (DERMS)	Renewables/DER Resource Integration	No	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).
32	2nd Triennial (2015-2017)	PG&E	2.03A - Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	Renewables/DER Resource Integration	TBD	3a - Maintain/Reduce operations and maintenance costs. 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources.

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	A	B	C	D	AB	AC
For Report DOC	i. Investment Plan Period		Project Name			vi. Metrics
33	2nd Triennial (2015-2017)	PG&E	2.03B - Test Smart Inverter Enhanced Capabilities - Vehicle to Home	Renewables/DER Resource Integration	No	3a - Maintain/Reduce operations and maintenance costs. 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources.
34	2nd Triennial (2015-2017)	PG&E	2.04 - DG Monitoring & Voltage Tracking	Renewables/DER Resource Integration	No	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.
35	2nd Triennial (2015-2017)	PG&E	2.05 - Inertia Response Emulation for DG Impact Improvement	Renewables/DER Resource Integration	No	1a. Number and total nameplate capacity of distributed generation facilities 1b. Total electricity deliveries from grid-connected distributed generation facilities 1i. Nameplate capacity (MW) of grid-connected energy storage 3e. Non-energy economic benefits (reliability) 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 (PU Code § 8360) 7d. Deployment and integration of cost-effective distributed resources and generation, including renewable resources (PU Code § 8360) 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 (PU Code § 8360)

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	A	B	C	D	AB	AC
For Report DOC	i. Investment Plan Period		Project Name			vi. Metrics
36	2nd Triennial (2015-2017)	PG&E	2.06 - Intelligent Universal Transformer (IUT)	Renewables/DER Resource Integration	Column applicable to CEC only	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.
37	2nd Triennial (2015-2017)	PG&E	2.07 - Real-Time Loading Data for Distribution Operations and Planning	Grid Modernization and Optimization	Column applicable to CEC only	7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.
38	2nd Triennial (2015-2017)	PG&E	2.08 - "Smart" Monitoring and Analysis Tools	Grid Modernization and Optimization	Column applicable to CEC only	TBD
39	2nd Triennial (2015-2017)	PG&E	2.09 - Distributed Series Impedance (DSI) Phase 2	Grid Modernization and Optimization	Column applicable to CEC only	TBD
40	2nd Triennial (2015-2017)	PG&E	2.10 - Emergency Preparedness Modeling	Grid Modernization and Optimization	Column applicable to CEC only	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.
41	2nd Triennial (2015-2017)	PG&E	2.11 - New Mobile Technology & Visualization Applications	Grid Modernization and Optimization	Column applicable to CEC only	TBD

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	A	B	C	D	AB	AC
For Report DOC	i. Investment Plan Period		Project Name			vi. Metrics
42	2nd Triennial (2015-2017)	PG&E	2.12 - New Emergency Management Mobile Applications	Grid Modernization and Optimization	TBD	TBD
43	2nd Triennial (2015-2017)	PG&E	2.13 - Digital Substation/Substation Automation	Grid Modernization and Optimization	TBD	TBD
44	2nd Triennial (2015-2017)	PG&E	2.14 - Automatically Map Phasing Information	Grid Modernization and Optimization	TBD	7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.
45	2nd Triennial (2015-2017)	PG&E	2.15 - Synchrophasor Applications for Generator Dynamic Model Validation	Grid Modernization and Optimization	No	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 §360).
46	2nd Triennial (2015-2017)	PG&E	2.16 - Enhanced Synchrophasor Analytics & Applications	Grid Modernization and Optimization	TBD	TBD
47	2nd Triennial (2015-2017)	PG&E	2.17 - Geomagnetic Disturbance (GMD) Evaluation	Grid Modernization and Optimization	TBD	TBD
48	2nd Triennial (2015-2017)	PG&E	2.18 - Optical Instrument Transformers and Sensors for Protection and Control Systems	Grid Modernization and Optimization	TBD	TBD

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	A	B	C	D	AB	AC
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49	2nd Triennial (2015-2017)	PG&E	2.19 - Enable Distributed Demand-Side Strategies & Technologies	Customer Service and Enablement	No	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.
50	2nd Triennial (2015-2017)	PG&E	2.20 - Real-Time Energy Usage Feedback to Customers	Customer Service and Enablement	TBD	TBD
51	2nd Triennial (2015-2017)	PG&E	2.21 - Home Area Network (HAN) for Commercial Customers	Customer Service and Enablement	TBD	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).
52	2nd Triennial (2015-2017)	PG&E	2.22 - Demand Reduction through Targeted Data Analytics	Customer Service and Enablement	TBD	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.

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	A	B	C	D	AB	AC
For Report DOC	i. Investment Plan Period		Project Name			vi. Metrics
53	2nd Triennial (2015-2017)	PG&E	2.23 - Integrate Demand Side Approaches Into Utility Planning	Customer Service and Enablement	No	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).
54	2nd Triennial (2015-2017)	PG&E	2.24 - Appliance Level Bill Disaggregation for Non-Residential Customers	Customer Service and Enablement	TBD	TBD
55	2nd Triennial (2015-2017)	PG&E	2.25 - Enhanced Smart Grid Communications	Cross-Cutting/Foundational	TBD	TBD
56	2nd Triennial (2015-2017)	PG&E	2.26 - Customer & Distribution Automation Open Architecture Devices	Cross-Cutting/Foundational	No	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.
57	2nd Triennial (2015-2017)	PG&E	2.27 - Next Generation Integrated Smart Grid Network Management	Cross-Cutting/Foundational	Yes	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.
58	2nd Triennial (2015-2017)	PG&E	2.28 - Smart Grid Communications Path Monitoring	Cross-Cutting/Foundational	TBD	1h - Customer bill savings (dollars saved). 3e - Non-energy economic benefits – reduction operational hours to fix estimated bills due to RF interference.

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59	2nd Triennial (2015-2017)	PG&E	2.29 - Mobile Meter Applications	Cross-Cutting/Foundational	No	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).
60	2nd Triennial (2015-2017)	PG&E	2.30 - Leverage EPIC Funds to Participate in Industry-Wide RD&D Programs	Grid Modernization and Optimization	TBD	TBD
61	2nd Triennial (2015-2017)	PG&E	2.31 - Aggregated Behind-The-Meter Storage Market / Retail Optimization	Renewables/DER Resource Integration	N/A	N/A

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	A	B	C	D	AB	AC
For Report DOC	i. Investment Plan Period		Project Name			vi. Metrics
62	2nd Triennial (2015-2017)	PG&E	2.32 - Electric Load Management for Ridesharing Electrification	Renewables/DER Resource Integration	N/A	N/A
63	2nd Triennial (2015-2017)	PG&E	2.33 - Service Issue Identification Leveraging Momentary Outage Information	Grid Modernization and Optimization	N/A	N/A
64	2nd Triennial (2015-2017)	PG&E	2.34 - Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors	Grid Modernization and Optimization	Column applicable to CEC only	• 3a - Maintain / Reduce operations and maintenance costs • 5a - Outage number, frequency and duration reductions • 5d - Public safety improvement and hazard exposure reduction
65	2nd Triennial (2015-2017)	PG&E	2.35 - Call Center Staffing Optimization	Grid Modernization and Optimization	Column applicable to CEC only	N/A
66	2nd Triennial (2015-2017)	PG&E	2.36 - Dynamic Rate Design Tool	Customer Service and Enablement	Column applicable to CEC only	• Time to complete the process of designing, optimizing, and analyzing the impact of a hypothetical rate design

*Date of award corrected from previous annual report

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1	1st Triennial (2012-2014)	PG&E	1.01 - Energy Storage End Uses	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
2	1st Triennial (2012-2014)	PG&E	1.02 - Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction	• Project completed in February 2018 • This project demonstrated the ability of utility-owned and controlled energy storage resources to deliver autonomous distribution peak shaving functionality. Energy storage resources hold significant promise to help California address a variety of grid planning and operations challenges, both today and in the future. The implementation and operational challenges associated with this project resulted in learnings that will inform PG&E's procurement of future energy storage resources, both utility-owned and utility-contracted through compliance with the IOU energy procurement targets as set forth in CPUC D. 10-03-040 and beyond. • Final Report included in this 2017 EPIC Annual Report
3	1st Triennial (2012-2014)	PG&E	1.03 - Demonstrate Priority Scenarios from the Energy Storage Framework	• Project is currently on-hold.

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4	1st Triennial (2012-2014)	PG&E	1.04 - Expand Test Lab and Pilot Facilities for New Energy Storage Systems.	Renewables/DER Resource Integration	Formally Withdrawn. CPUC A.12-11-003, 10/15/2013.
5	1st Triennial (2012-2014)	PG&E	1.05 - Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output	Renewables/DER Resource Integration	- Project completed in 2016. - Final Report was included in 2016 EPIC Annual Report.
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	Project is currently on-hold.
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	Renewables/DER Resource Integration	Formally Withdrawn. CPUC A.12-11-003, 10/15/2013.

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8	1st Triennial (2012-2014)	PG&E	1.08 - Improve Distribution System Safety and Reliability through New Data Analytics Techniques	• Project completed in 2015. • Final report included in previous 2015 EPIC Annual Report.
9	1st Triennial (2012-2014)	PG&E	1.09A - Test New Remote Monitoring and Control Systems for Existing Transmission & Distribution Assets; Close Proximity Switching	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
10	1st Triennial (2012-2014)	PG&E	1.09B and 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 and Replacement Programs	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
11	1st Triennial (2012-2014)	PG&E	1.09C - Test New Remote Monitoring and Control Systems for T&D Assets; Discrete Series Reactors	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
12	1st Triennial (2012-2014)	PG&E	1.10A - Demonstrate Automated Asset Notification and Management Systems; Dissolved Gas Analysis	• Project is currently on-hold.

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13	1st Triennial (2012-2014)	PG&E	1.10C - Demonstrate Automated Asset Notification and Management Systems: Underground Cable Analysis	Grid Modernization and Optimization	• Project is currently on-hold.
14	1st Triennial (2012-2014)	PG&E	1.11 - Demonstrate Self-Correcting Tools to Improve System Records and Operations	Grid Modernization and Optimization	• 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	Grid Modernization and Optimization	• Project is currently on-hold.
16	1st Triennial (2012-2014)	PG&E	1.13 - Demonstrate New Communication Systems to Improve Substation Automation and Interoperability	Grid Modernization and Optimization	• Project is currently on-hold.
17	1st Triennial (2012-2014)	PG&E	1.14 - Demonstrate "Next Generation" SmartMeter™ Telecom Network Functionalities	Grid Modernization and Optimization	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
18	1st Triennial (2012-2014)	PG&E	1.15 - Demonstrate New Technologies and Strategies That Support Integrated "Customer-to-Market-to-Grid" Operations of the Future	Grid Modernization and Optimization	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.

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19	1st Triennial (2012-2014)	PG&E	1.16 - Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages	Grid Modernization and Optimization	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
20	1st Triennial (2012-2014)	PG&E	1.17 - Leverage EPIC Funds by Participating in Multi-Utility, Industry Wide RD&D Programs Such as EPRI	Grid Modernization and Optimization	• Project is currently on-hold.
21	1st Triennial (2012-2014)	PG&E	1.18 - Demonstrate SmartMeter [™] -Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information	Customer Service and Enablement	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
22	1st Triennial (2012-2014)	PG&E	1.19 - Pilot Enhanced Data Techniques and Capabilities via the SmartMeter [™] Platform	Customer Service and Enablement	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.

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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.	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.
24	1st Triennial (2012-2014)	PG&E	1.21 - Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability	- Project completed in 2016. - Final Report was included in 2016 EPIC Annual Report.
25	1st Triennial (2012-2014)	PG&E	1.22 - Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility	- Project is in the Build/Test phase. - Phase 1 evaluation report released in 2016, project received CPUC approval for launch of Phase 2, adding an additional business model for the MDMA to hold contracts with customers be responsible for the EV bill to PG&E. - Phase 2 commenced January 1, 2017 with 4 out of 6 approved MDMA confirmed for participation and ended April 30, 2017, yielding 264 of the expected 500 customer enrollment goal. - Completed data loggers installation on submeters in participant homes to provide accuracy data for overall evaluation - Presented participant welcome survey to CPUC with the following findings: PG&E achieved an 85% response rate on survey, 55% of Phase I participant indicated that the Phase II experience has been better, 45% of respondents reported switching to charging off-peak during the demonstration - Next steps include continuation of processing MDMA incentive payments, de-enroll participants and decommission submeters, draft and publish Final Report - Project completed in 2016. - Final Report was included in 2016 EPIC Annual Report.
26	1st Triennial (2012-2014)	PG&E	1.23 - Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility	- Project completed in 2016. - Final Report was included in 2016 EPIC Annual Report.

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27	1st Triennial (2012-2014)	PG&E 1.24 - Demonstrate Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	Customer Service and Enablement	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
28	1st Triennial (2012-2014)	PG&E 1.25 - Develop a Tool to Map The Preferred Locations for DC Fast Charging, Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs While Reducing the Impact on PG&E's Distribution Grid	Customer Service and Enablement	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
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	• Project is currently on-hold.
30	2nd Triennial (2015-2017)	PG&E 2.01 - Evaluate Storage on the Distribution Grid	Renewables/DER Resource Integration	• Project is currently on-hold.

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31	2nd Triennial (2015-2017)	PG&E	2.02 – Pilot Distributed Energy Resource Management Systems (DERMS)	Renewables/DER Resource Integration	• Project is in the Build/Test phase. • Completed site acceptance testing and IT build. DERMS is currently live in the field • Nine data interfaces developed and tested: weather and generation forecasters, DG aggregators, AMI and SCADA systems. Successfully completed the DERMS foundation allowing the commencement of use case testing. • Began field demonstration of seven use cases in July • Installed of Phasor Measurement Units (PMUs) at existing substation and near the BESS and assessed the impacts of market participating BESS on operating conditions. • Next steps include completion of use case demonstration, M&V analysis. Final Report completion and project closeout
32	2nd Triennial (2015-2017)	PG&E	2.03A – Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	Renewables/DER Resource Integration	• Project is in the Build/Test phase. • Successful completed Volt/Watt functionality and Volt/Var functionality acceptance testing in August and September respectively. • Initial deployment of the technology showed the following: a) Customer acquisition and targeted deployment of DERs is challenging. b) Smart inverter technology is able to affect local premise voltage. c) Implementation of an aggregator solution unveiled that the uptime communications are not within traditional utility uptime requirements. However, the latency of the devices meets or exceeds that of PG&E's SCADA system. • The project is deploying Smart Inverter technology on a commercial feeder in 2018, with ~35% feeder penetration. Through this the project team expects to better understand recommendations around: smart inverter settings, effects of primary and secondary voltage benefits of a third-party monitor and control platform and cost comparisons of smart inverter technology compared to traditional utility infrastructure upgrades. • Next steps include completion of use case testing of smart inverter on a voltage constrained distribution feeder, M&V analysis, Final Report completion and project closeout

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33	2nd Triennial (2015-2017)	PG&E	2.03B - Test Smart Inverter Enhanced Capabilities - Vehicle to Home	Renewables/DER Resource Integration		• Project completed in February 2018 • The project demonstrated that a bi-directional EV and charger can support critical household loads through an outage. However, the project also determined that, in addition to the technology not being commercially available, it is not cost effective for customers to adopt. This was supported by the project's customer survey results which indicate the current cost estimate is roughly 4 times higher than an optimal price for consumers. Therefore, even though the project use cases were technically proven--they are not currently feasible due to technology cost, limited market value, and other restrictions between actors (e.g. EV battery warranty coverage). • Final Report included in this 2017 EPIC Annual Report
34	2nd Triennial (2015-2017)	PG&E	2.04 - DG Monitoring & Voltage Tracking	Renewables/DER Resource Integration		• Project completed in 2017. • This project demonstrated an algorithmic process for analyzing new data sources (including SmartMeter™ devices and databases of solar irradiance) to predict the likelihood that a Rule 2 voltage violation was caused by distributed solar generation. Solar energy is by nature intermittent, and ebbs and surges of generation can change the voltage for neighboring, downstream customers. This functionality, if integrated into a larger grid analytics platform, might improve decision making for power quality engineers responding to customer issues. • Final Report included in this 2017 EPIC Annual Report.
35	2nd Triennial (2015-2017)	PG&E	2.05 - Inertia Response Emulation for DG Impact Improvement	Renewables/DER Resource Integration		• Project is in the Design/Engineering phase. • NREL engaged as demonstration site. • Next steps include, test bed & energy storage commissioning, synthetic inertia use case testing of energy storage, and modeling and simulation to evaluate system-scale capabilities and validate application scenarios

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36	2nd Triennial (2015-2017)	PG&E	2.06 - Intelligent Universal Transformer (IUT)	Renewables/DER Resource Integration • 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	Grid Modernization and Optimization • Project is in the Build/Test phase. • Gathered stakeholder input on preliminary prototype application developed by vendor. • Transitioned vendor model into PG&E environment, integrated model with real-time data inputs, and continued to refine the model. • Next steps include addressing remaining issues with model input data, further refining and validating the model, and deriving requirements for future ADMS.
38	2nd Triennial (2015-2017)	PG&E	2.08 - "Smart" Monitoring and Analysis Tools	Grid Modernization and Optimization • Project is currently on-hold.
39	2nd Triennial (2015-2017)	PG&E	2.09 - Distributed Series Impedance (DSI) Phase 2	Grid Modernization and Optimization • Project is currently on-hold.
40	2nd Triennial (2015-2017)	PG&E	2.10 - Emergency Preparedness Modeling	Grid Modernization and Optimization • Project is in the Build/Test phase. • Developed initial prototype of optimization model and associated visualization tool. • Established live data interfaces to the prototype and demonstrated the model's ability to recommend the optimized allocation of work resources to respond to emergency events. • Next steps include migration of the prototype to a self-contained cloud solution, connecting the cloud solution to a real-time data repository, enhancing the user interface and its alignment with predefined use cases and Emergency Operations Center processes, and conducting demonstration assessment of the tool during events this upcoming storm season.
41	2nd Triennial (2015-2017)	PG&E	2.11 - New Mobile Technology & Visualization Applications	Grid Modernization and Optimization • Project is currently on-hold.

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42	2nd Triennial (2015-2017)	PG&E	2.12 - New Emergency Management Mobile Applications	Grid Modernization and Optimization	• Project is currently on-hold.
43	2nd Triennial (2015-2017)	PG&E	2.13 - Digital Substation/Substation Automation	Grid Modernization and Optimization	• Project is currently on-hold.
44	2nd Triennial (2015-2017)	PG&E	2.14 - Automatically Map Phasing Information	Grid Modernization and Optimization	• Project is in the Build/Test phase. • Brought on 4 vendors that each developed phase identification algorithms and meter to transformer algorithms, developed testing processes and began assessing the performance of each vendor's algorithms. • Collected additional data from 4 feeders and used to further refine and validate algorithms. • Next steps include finalizing algorithms and developing a validation model to compare the final results of these various algorithms
45	2nd Triennial (2015-2017)	PG&E	2.15 - Synchrophasor Applications for Generator Dynamic Model Validation	Grid Modernization and Optimization	• Project is in the Closeout phase. • Installed a fully functional stand-alone PMU system at Colusa Power Generating Station during a scheduled generator outage; • Developed generator station models and • For the disturbances captured by the PMUs, the existing models were improved and validated without requiring a generator shutdown. • Next Steps include completion of final report.
46	2nd Triennial (2015-2017)	PG&E	2.16 - Enhanced Synchrophasor Analytics & Applications	Grid Modernization and Optimization	• Project is currently on-hold.
47	2nd Triennial (2015-2017)	PG&E	2.17 - Geomagnetic Disturbance (GMD) Evaluation	Grid Modernization and Optimization	• Project is currently on-hold.
48	2nd Triennial (2015-2017)	PG&E	2.18 - Optical Instrument Transformers and Sensors for Protection and Control Systems	Grid Modernization and Optimization	• Project is currently on-hold.

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49	2nd Triennial (2015-2017)	PG&E	2.19 - Enable Distributed Demand-Side Strategies & Technologies	Customer Service and Enablement	• Project completed in February 2018 • Demonstration installation complete, field demonstration acceptance testing complete • Use Case testing complete • Project Key Findings: • Current vendor platforms for controlling customer-sited DERs are not ready for utility operations • Communications to devices are not comparable to traditional utility communications • Latency is comparable to current utility SCADA • Aggregated customer storage is effective for premise load drop. • Implementation of command prioritization would be required for future multiple-use applications. • Final Report included in this 2017 EPIC Annual Report
50	2nd Triennial (2015-2017)	PG&E	2.20 - Real-Time Energy Usage Feedback to Customers	Customer Service and Enablement	• Project is currently on-hold.
51	2nd Triennial (2015-2017)	PG&E	2.21 - Home Area Network (HAN) for Commercial Customers	Customer Service and Enablement	• Project completed in February 2018 • Completed execution of field testing, field surveys, and data to compile results and findings. • Identified adoption, integration, and utilization barriers associated with mass deployment of real time Zigbee data through HAN devices. • Final Report included in 2017 EPIC Annual Report
52	2nd Triennial (2015-2017)	PG&E	2.22 - Demand Reduction through Targeted Data Analytics	Customer Service and Enablement	• Project is in the Build/Test phase. • Integrated Energy Efficiency (EE) Load Shapes into model • Completed work on Customer Propensity model • Incorporated E3 energy storage model and tested and validated DR model • Finalized all DER load shapes, dispatch, customer selection criteria • Completed front end development with work on optimization function • Next steps include optimization improvement, Traditional Wires Alternatives to be added to tool optimization, Final Report completion and project closeout.

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53	2nd Triennial (2015-2017)	PG&E	2.23 - Integrate Demand Side Approaches into Utility Planning	Customer Service and Enablement	- Project completed in 2017 - This project successfully developed and demonstrated the integration of a broader range of customer-side technologies and Distributed Energy Resources (DER) approaches into the utility planning process. - The project served as a necessary and enabling precursor to the fulfillment of Public Utility Code 769, which requires transparent, consistent and more accurate methods to cost-effectively integrate DERs into the distribution planning process. - This project delivered new load shape profiles, enhanced load forecasting tool and overall analytical process that allows PG&E to more accurately and consistently integrate DER impact to the distribution system load profile. - With these enhancements, PG&E can more effectively assess the impact of DER growth on the timing and need for future distribution and transmission system upgrade - Final Report included in this 2017 EPIC Annual Report.
54	2nd Triennial (2015-2017)	PG&E	2.24 - Appliance Level Bill Disaggregation for Non-Residential Customers	Customer Service and Enablement	Project is currently on-hold.
55	2nd Triennial (2015-2017)	PG&E	2.25 - Enhanced Smart Grid Communications	Cross-Cutting/Foundational	Project is currently on-hold.
56	2nd Triennial (2015-2017)	PG&E	2.26 - Customer & Distribution Automation Open Architecture Devices	Cross-Cutting/Foundational	- Project in Design/Build phase - Established use-cases for AMI technology demonstration including – - The ability to communicate, control, transmit data, and upgrade firmware onto FLSR overhead and underground devices over the network - Direct acquisition and control telemetry solution with enhanced security and cyber isolation for medium-sized energy generation projects - The ability to communicate with RFID equipment over the network. - Next Steps include execution of use-cases in lab and/or field environments.
57	2nd Triennial (2015-2017)	PG&E	2.27 - Next Generation Integrated Smart Grid Network Management	Cross-Cutting/Foundational	- Project is in the Closeout phase. - Developed a demonstration grade management platform that successfully identified inventory, configuration, and performance data for all three AMI networks including both networking elements and metering endpoints. - The project learned the complexity of adding functions needed such as additional Head-End Network Management functions, integration with GIS layers (i.e. data sources like CC&B, MDWS), and integration with various PG&E ticketing systems (Remedy, FAS). Based on this complexity, an enterprise management system will be needed to scale the functions demonstrated through this project. - Next Steps include completion of close-out report.
58	2nd Triennial (2015-2017)	PG&E	2.28 - Smart Grid Communications Path Monitoring	Cross-Cutting/Foundational	- Project completed in February 2018 - Developed a network configuration plan that would enable PG&E to gather relevant external data sources through a secure VPN tunnel onto PG&E's network. - Identified minimum data points and sources of this data to pursue the technology demonstration. - This project has been sunset early based on findings that the data required for the algorithm to be effective was not available (neither via internal nor external sources). - Final Report included in 2017 EPIC Annual Report

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59	2nd Triennial (2015-2017)	PG&E	2.29 - Mobile Meter Applications	Cross-Cutting/Foundational	• Project is in the Build/Test phase. • Finalized acceptance testing procedure for Next Gen Meters (NGM) • Conducted functional and acceptance testing on alpha and beta NGM prototypes. • Demonstrated mobile application of NGM prototype at PG&E • Next Steps include refining integration of accelerometer into the NGM, designing, implementing and testing ANSI Standards C12.19 and C12.22 and head end application into NGM, and integrating 900 MHz network card technology into the NGM to leverage the existing AMI network for communication
60	2nd Triennial (2015-2017)	PG&E	2.30 - Leverage EPIC Funds to Participate in Industry-Wide RD&D Programs	Grid Modernization and Optimization	• Project is currently on-hold.
61	2nd Triennial (2015-2017)	PG&E	2.31 - Aggregated Behind-The-Meter Storage Market / Retail Optimization	Renewables/DER Resource Integration	• Formally Withdrawn by PG&E on 07/31/2017 via PG&E Comments on Draft Resolution E-4863

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62	2nd Triennial (2015-2017)	PG&E 2.32 - Electric Load Management for Ridesharing Electrification	Renewables/DER Resource Integration	• Deferred to a future investment plan by CPUC. Resolution E-4863. 08/10/2017
63	2nd Triennial (2015-2017)	PG&E 2.33 - Service Issue Identification Leveraging Momentary Outage Information	Grid Modernization and Optimization	• Deferred to a future investment plan by CPUC. Resolution E-4863. 08/10/2017
64	2nd Triennial (2015-2017)	PG&E 2.34 - Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors	Grid Modernization and Optimization	• Project is in the Plan/Analyze phase. • Conducted preliminary assessment of industry capabilities • Next steps include assessing technical feasibility and potential sensor range to validate opportunity for business benefits, developing and testing combined sensor solution, project closeout and project final report.
65	2nd Triennial (2015-2017)	PG&E 2.35 - Call Center Staffing Optimization	Grid Modernization and Optimization	• Rejected by CPUC. Resolution E-4863. 08/10/2017
66	2nd Triennial (2015-2017)	PG&E 2.36 - Dynamic Rate Design Tool	Customer Service and Enablement	• Project is in the Plan/Analyze phase • Next steps include creating technical architecture specifications, develop data bases, develop test plan, build database and platform engine, develop and build API, final verification testing, project closeout and project final report.

*Date of award corrected from previous annual report

**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

**NOTICE OF AVAILABILITY (IN LIEU) OF
THE 2017 ANNUAL ELECTRIC PROGRAM
INVESTMENT CHARGE REPORT OF PACIFIC GAS
AND ELECTRIC COMPANY (U 39 E)**

CHRISTOPHER J. WARNER

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Attorney for
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**BEFORE THE PUBLIC UTILITIES COMMISSION
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Commission for Approval of Electric Program
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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, 2018, Pacific Gas and Electric Company (PG&E) served its 2017 Annual Electric Program Investment Charge Report. Due to the large file size, PG&E hereby provides this Notice of Availability. The Report consists of the Pleading, Attachment A- 2017 Annual Report, Attachment B- 2017 Annual Report Appendix A and Attachment C- Appendices B-H which are available on PG&E's website at the link provided:.

- 1) Search for Public Case Documents: <https://pgera.azurewebsites.net/Regulation/search>
- 2) Select "**EPIC Investment Plan 2018-20**" from the case dropdown menu;
- 3) Select "**PGE**" from the party dropdown menu;
- 4) Input the date from "**02/28/18**" to "**02/28/18**"; and
- 5) Click Search.

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:

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Respectfully Submitted,

CHRISTOPHER J. WARNER

By: /s/ Christopher J. Warner
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Dated: February 28, 2018

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