

ATTACHMENT A

PACIFIC GAS AND ELECTRIC COMPANY

ELECTRIC PROGRAM INVESTMENT CHARGE (EPIC)

2015 ANNUAL REPORT

FEBRUARY 29, 2016



Pursuant to Decision (D.) 12-05-037 – Phase 2 Decision Establishing Purposes and Governance for Electric Program Investment Charge (EPIC) and Establishing Funding Collections for 2013-2020, Pacific Gas and Electric (PG&E) hereby files the 2015 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 - A.12-11-001, A.12-11-002, A.12-11-003, A.12-11-004, A.15-09-001, A.13-11-003, A.14-11-003, A.14-05-005, A.14-05-003, A.14-05-004, A.14-04-034

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1. Executive Summary

a. Overview of Programs/Plan Highlights

Pursuant to the California Public Utilities Commission (CPUC) Decision (D.) 12-05-037, Pacific Gas and Electric Company (PG&E) and the other administrators of the Electric Program Investment Charge (EPIC) Program were directed to file annual reports each year beginning February 28, 2013 through February 28, 2020 with the Director of the CPUC's Energy Division.¹ Annual Reports shall be served on all parties in the most recent EPIC proceeding; all parties to the most recent general rate case of each electric utility; and each successful and unsuccessful applicant for an EPIC funding award during the previous calendar year. In compliance with Ordering Paragraph (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 Advocates², PG&E files its fourth annual report, documenting activities from January 1 through December 31, 2015.

In D.12-05-037, the Commission authorized funding in the areas of applied Research and Development (R&D), Technology Demonstration and Deployment (TD&D), and Market Facilitation. The Investor-Owned Utility (IOU) Administrators' role was limited to TD&D only. On November 19, 2013, the CPUC issued D.13-11-025, which authorized the first triennial investment period of 2012-2014 (referred to as EPIC 1). On April 15, 2015, the CPUC issued D.15-04-020, which approved the second triennial investment plan period of 2015-2017 (referred to as EPIC 2). This report summarizes PG&E's projects' progress and status for both approved funding cycles, which includes projects in progress in the following areas:

1. **Renewables and Distributed Energy Resource Integration** – Integrate distributed energy resources, generation and store; 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 by leveraging PG&E's SmartMeter™ platform and offering greater billing flexibility; integrate Demand-Side Management (DSM) for grid optimization.
4. **Cross Cutting/Foundational Strategies and Technologies** – Support next generation infrastructure, including smart grid architecture, cybersecurity, telecommunications and standards, as well as other "foundational" activities in support of all three program areas above.

PG&E is enthusiastically committed to the EPIC program and the value it provides to our customers, as it offers the opportunity to test innovation within our network, as well as at the grid edge. In addition to contributing to the areas described above, PG&E's EPIC projects also provide important contributions to enhancing areas tied to our core values of providing safe, reliable and affordable energy for our customers. Furthering advancement in technologies that support our core values and continuing to test innovation for an evolving grid align closely with PG&E's Grid of Things™ strategy. The Grid of Things™ vision integrates new energy devices and technologies with the grid and allows their owners to achieve greater value from their energy technology investments – rooftop solar, electric vehicles (EVs), energy storage, demand

¹ The four EPIC program administrators are PG&E, Southern California Edison Company (SCE), San Diego Gas & Electric Company (SDG&E) and the California Energy Commission (CEC).

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

response technologies, etc. – by virtue of their grid connectivity. PG&E is the key builder and enabler of this interconnected and integrated platform that will help define California's future energy landscape.

PG&E's TD&D Program Highlights

With CPUC approval of EPIC 2 in D.15-04-020, PG&E has added 16 active EPIC 2 projects to the EPIC portfolio, increasing the Portfolio from 17 EPIC 1 projects to a total of 33 currently approved projects across both EPIC 1 and EPIC 2. For detailed information on the developments and status of each project, see Appendix A.

PG&E continues to make significant progress within its portfolio of EPIC projects. In the first triennial cycle, PG&E's EPIC 1 portfolio covered the wide spectrum of technologies that helps make the electrical grid safer, more reliable and more affordable. In a number of instances, this was achieved through the following:

- Testing physical devices, like robots that help perform maintenance on potentially dangerous switches
- Demonstrating viability of grid-supporting trucks that can keep an American Red Cross facility functioning during a wildfire or a planned outage
- Drawing together diverse data sources to give grid operators a more complete perspective to optimize operations with situational intelligence
- Providing customers online access to their estimated solar generation data that has not been previously available to them.

EPIC 1 represented PG&E's ability to adopt a new model for managing, aligning, and tracking research, development and demonstration (RD&D) projects across disparate areas of the grid.

In the second triennial cycle, PG&E's EPIC 2 portfolio builds on the capabilities and organization established in EPIC 1, with an even deeper focus on long-term objectives. Many of our projects will lay the foundation for future capabilities, such as the creation of algorithms that can determine the phase of current being carried by a given power line, or explore the integration challenges of managing Distributed Energy Resources (DERs). These projects reinforce one another, and are increasingly being piloted in shared geographies to take advantage of benefits that are more than the sum of their parts.

As an innovative and integrated way to execute technology demonstration projects, PG&E's EPIC program continues to improve the safety, reliability and affordability of the electric grid, while building integration and cross-dependencies from the ground up. These achievements help prepare PG&E (and the utility industry) for upcoming challenges of a changing grid landscape.

In 2015, the first EPIC 1 project was completed: Project 1.08 Distribution System Safety and Reliability through New Data Analytics Techniques. This project's final report is attached in Appendix B, with details including but are not limited to a comprehensive review of the project, detailed findings and results.³

The following report details the progress made within PG&E's EPIC portfolio in 2015 and below are a few major milestones achieved to date for select EPIC projects:

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

Project 1.01 - Energy Storage for Market Operations leverages the existing two megawatt (MW) PG&E Vaca Dixon Battery Energy Storage System (BESS) and the 4 MW Yerba Buena BESS. In 2014, the energy storage pilot successfully bid as an available energy resource into the California Independent System Operator (CAISO) Non-Generator Resource (NGR) day-ahead market on a manual basis. Due to the unique nature of an energy storage resource, the 2 MW storage facility offers 4 MW of flexibility to the system, since it can serve as both load and generation. This puts energy storage at a competitive advantage compared to traditional generation. In 2015, Vaca Dixon BESS effectively followed real-time dispatches from CAISO, which is the first time in PG&E history that a resource on the Operational Data Network has successfully received and executed CAISO market awards on an automated basis. This now allows Vaca Dixon to participate in the five-minute, real-time market, making the storage resource even more flexible in meeting the dynamic needs of the grid of the future. PG&E anticipates rolling out similar automated functionality with its 4 MW Yerba Buena BESS in 2016.

Project 1.08 - Distribution System Safety and Reliability through New Data Analytics Techniques (also known as System Tool for Asset Risk (STAR)) was successfully completed by demonstrating a visualization tool that calculates asset risk based on an integrated data set from different sources. The successful demonstration of STAR can improve public safety by identifying and addressing higher risk assets, reducing unplanned outages and customer interruptions and supporting asset planning that can help avoid unneeded equipment replacements because of better information.

Project 1.09A - Close Proximity Switching successfully tested three new, safety-focused devices and varied techniques to operate underground oil-filled switches remotely, including the parts and adapters necessary to support various types of switches. These devices are expected to help lower the hazard level when oil filled switches are operated in the field. The project has helped drive the market to satisfy an unmet need and is resulting in future planned orders of these devices beyond the scope of this project.

Project 1.16 - Vehicle-to-Grid Operational Integration developed multiple test vehicles that can export up to 120 kilowatt (kW) of power to the grid, providing temporary power for customers during planned or unplanned outages. During the summer of 2015, the prototype trucks supported the Valley and Butte fire response. These vehicles successfully generated power for two days at a Red Cross shelter and a local church for housing evacuees, which was a cleaner and quickly deployable alternative to the traditional gas-burning generators.

Project 1.19 - Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform explores the effective SmartMeter™ data that can be collected and studied for further grid benefits. In 2015, the project demonstrated that, by collecting and analyzing interval voltage and usage data from SmartMeters™, PG&E can detect energy diversion cases and use that information to remediate safety hazards and prevent unnecessary load loss.

Project 1.23 – Photovoltaic (PV) Submetering effectively deployed estimated generation data for 10,000 solar customers through the PG&E “My Energy” website. This was an important step on the path to providing solar customers further insight into their approximate generation data, since solar customers currently only have access to their net energy usage.

Project 2.23 – Integrating Distributed Energy Resources (DERs) into Utility Planning Tools has successfully combined available SCADA load information data with 3 years of historical interval meter data for all 5 million PG&E electric customers and created a catalog of over 320,000 load shapes, which creates a granular load shape, specific to each feeder.

a. Status of Programs

In D.13-11-025, the Commission approved 27 of the 29 projects proposed by PG&E in the EPIC 1 Plan since two projects were formally withdrawn by PG&E prior to the issuance of this decision.⁴ In D.15-04-020, the Commission approved 31 projects proposed by PG&E in the EPIC 2 Plan.⁵ PG&E has implemented an internal governance structure intended to ensure that approved projects within the TD&D program adhere to the EPIC guiding principles and requirements, as well as the potentially changing marketplaces and evolving technologies. Of the 27 CPUC-approved EPIC 1 projects, PG&E continues to be actively engaged in 17. These 17 projects are in the following phases as of December 31, 2015: zero project are in the Plan/Analyze Phase; four projects are in the Design/Engineering Phase, eight projects are in the Build/Test Phase, one project is in the Staging Phase, three projects are in the Closeout Phase and one is complete. The ten projects that were on hold at the end of 2014 have remained on hold in 2015. As previously indicated in the 2014 PG&E EPIC Annual Report, PG&E may utilize remaining funds by either adding funding to active projects or pursuing on hold projects.

Of the 31 CPUC-approved EPIC 2 projects, PG&E is actively engaged in 16 of them as of December 31, 2015. These 16 projects are in the following phases as of December 31, 2015: fifteen are in the Plan/Analyze Phase and one is in the Build/Test Phase.

Below is a table that summarizes the projects' funding status by area and program cycle.

⁴ 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.

⁵ In the EPIC 2 Plan Application (A.14-05-003), PG&E originally proposed 30 projects. Per the CPUC D.15-04-020 to include an assessment of the use and impact of EV energy flow capabilities, Project 2.3 was split into two projects, resulting in a total of 31 projects.

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

	EPIC 1	EPIC 2	Total
Renewables and DER Integration	<ul style="list-style-type: none"> • 3 Projects (Projects: 1.01, 1.02, 1.05) funded as of December 31, 2015. • Committed Funding Range: \$7.0 – \$8.5 million. 	<ul style="list-style-type: none"> • 5 Projects (Project: 2.02, 2.3A, 2.3B, 2.04, 2.06) funded as of December 31, 2015. • Committed Funding Range: \$9.6 - \$12.6 million. 	<ul style="list-style-type: none"> • 8 Total Projects • Committed Funding Range: \$22.1 - \$27.0 million.
Grid Modernization and Optimization	<ul style="list-style-type: none"> • 7 Projects (Projects: 1.08, 1.09A, 1.09B/10B, 1.09C, 1.14, 1.15, 1.16) funded as of December 31, 2015. • Committed Funding Range: \$16.9 – \$20.7 million 	<ul style="list-style-type: none"> • 4 Projects (Projects: 2.07, 2.10, 2.14, 2.15) funded as of December 31, 2015. • Committed Funding Range: \$5.7 - \$7.0 million. 	<ul style="list-style-type: none"> • 11 Total Projects • Committed Funding Range: \$25.1 - \$30.7 million.
Customer Service and Enablement	<ul style="list-style-type: none"> • 7 Projects (Projects: 1.18, 1.19, 1.21, 1.22, 1.23, 1.24, 1.25) funded as of December 31, 2015 • Committed Funding Range: \$11.0 - \$13.5 million 	<ul style="list-style-type: none"> • 4 Projects (Projects: 2.19, 2.21, 2.22, 2.23) funded as of December 31, 2015. • Committed Funding Range: \$6.9 - \$8.5 million. 	<ul style="list-style-type: none"> • 11 Total Projects • Committed Funding Range: \$13.0 - \$17.1 million.
Cross Cutting/ Foundational	<ul style="list-style-type: none"> • 0 Projects 	<ul style="list-style-type: none"> • 3 Projects (Projects: 2.26, 2.27, 2.29) • Committed Funding Range: \$4.5 - \$5.5 million 	<ul style="list-style-type: none"> • 3 Projects (Projects: 2.26, 2.27, 2.29) • Committed Funding Range: \$4.5 - \$5.5 million.
Summary	<ul style="list-style-type: none"> • <i>Total Funded Projects: 17</i> • <i>Total Project Funding Encumbered: \$19.5 million</i> • <i>*Total Committed Funding: \$34.9 - \$42.7 million</i> • <i>Total Project Funding Spent to Date: \$24.0 million</i> • <i>Total Administrative Costs Spent to Date: \$1.6 million</i> 	<ul style="list-style-type: none"> • <i>Total Funded Projects: 16</i> • <i>Total Project Funding Encumbered: \$2.7 million</i> • <i>*Total Committed Funding: \$26.7 - \$33.5 million</i> • <i>Total Project Funding Spent to Date: \$1.8 million</i> • <i>Total Administrative Costs Spent to Date: \$0.2 million</i> 	<ul style="list-style-type: none"> • <i>Total Funded Projects: 33</i> • <i>Total Project Funding Encumbered: \$22.1 million</i> • <i>*Total Committed Funding: \$61.6 - \$76.2 million.</i> • <i>Total Project Funding Spent to Date: \$25.8 million</i> • <i>Total Administrative Costs Spent to Date: \$1.8 million</i>

** Committed projects are refined through an internal governance, stage-gate approach, in order to manage committed funding. Remaining funds may, as needed, either 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 (PUC) Section 399.8, which governed the Public Goods Charge (PGC) until expiration on January 1, 2012. The Commission opened an Order Instituting Rulemaking (R.11-10-003) to establish the Electric Program Investment Charge to preserve funding for the public ratepayer benefits associated with the renewables and RD&D activities provided by the electric PGC. The rulemaking included two phases with Phase I to establish the EPIC program on an interim basis in 2012, and Phase II to establish purposes and governance for EPIC to continue from 2013-2020.⁶ The EPIC program administrators include three IOUs – PG&E, SCE and SDG&E – and the CEC.

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 Research, Development and Demonstration (RD&D) programs at the same level authorized in 2011. Additionally, the surcharge was imposed on all distribution customers, based on the existing rate allocation between customer classifications, and collected in the Public Purpose Program component of rates.

On May 24, 2012, the Commission issued its Phase II *Decision Establishing Purposes and Governance for Electric Program Investment Charge and Establishing Funding Collections for 2013-2020*. The decision established an annual funding amount of \$162 million annually for the 2012-2014 EPIC program cycle (EPIC 1) and set the funding allocations among the three IOUs as 50.1 percent, 41.1 percent and 8.8 percent for PG&E, SCE and SDG&E, respectively.⁷ On April 15, 2015, the CPUC issued D.15-04-020, which approved the second triennial investment plan period of 2015-2017 (EPIC 2).

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

b. EPIC Program Components

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

⁶ See Phase I D.11-12-035 and Phase II D.12-05-037.

⁷ 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.

c. EPIC Program Regulatory Process

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

d. Coordination

In order to ensure adequate coordination of the EPIC Program, the EPIC Administrators continue to participate in regular review meetings, conduct joint webinars and workshops, and regularly collaborate on EPIC-related matters. The IOU EPIC Administrators generally meet biweekly to discuss EPIC and their respective objectives for the program, as well as to ensure collaboration and avoid duplication. The Administrators work together to leverage consistent approaches, where feasible, for meeting the objectives of the EPIC Program. This collaboration resulted in the development of a common EPIC framework, approved by the Commission in D.13-11-025, to guide the individual investment plans.

e. Transparent and Public Process

The program's administrators hold stakeholder workshops during the planning and implementation of the EPIC Triennial Investment Plans to ensure stakeholder concerns and feedback are received and properly addressed.

In the meantime, administrators continue to engage with industry stakeholders by participating in and presenting at conferences, as well as hosting two workshops/symposiums annually. In 2015, EPIC Administrators jointly organized a workshop in San Diego, CA on August 18, 2015 and a Symposium on December 3rd, 2015 in Folsom, CA, which consisted of three-tracks: Energy Efficiency, Generation and Integration, and Data Analytics and Systems Architecture. These workshops have provided a successful mechanism to engage with industry stakeholders and bring transparency to the projects and program.

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

PG&E's EPIC program continues to remain accessible to the interested public. PG&E's website includes EPIC program information and updates, as well as EPIC annual reports and project final reports.⁸

⁸ www.pge.com/epic

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	\$166.1 million	\$18.5 million	\$1.2 million
EPIC 2: 2015-2017	\$45.7 million	\$5.1 million	\$183.9 million	\$20.4 million	\$1.3 million

*portion remitted by PG&E

b. Commitments⁹/Encumbrances¹⁰

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, 2015.

Table 3. Total Commitments/Encumbrances by Program Cycle

Commitments/Encumbrances	PG&E Total Commitments	PG&E Total Encumbrances	CEC Program Remittance	CEC Admin Remittance	CPUC Remittance
EPIC 1: 2012-2014	\$34.9 - \$42.7 million	\$21.0 million	\$91.8 million	\$18.5 million	\$1.2 million
EPIC 2: 2015-2017	\$26.7 - \$33.5 million	\$2.7 million	\$0 million	\$6.1 million	\$0.4 million

⁹ 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.

¹⁰ Per CPUC D. 13-11-025, "encumbered funds" refer to monies specified within contracts signed during a previous triennial investment plan cycle and associated with specific activities under that contract.

c. Dollars Spent on In-House Activities

The following table outlines the PG&E total in-house project expenditures and administrative costs, beginning from program inception through December 31, 2015.

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	\$9.2 million	\$0.8 million
EPIC 2: 2015-2017	\$0.3 Million	\$0.2 million

d. Fund Shifting Above 5 Percent between Program Areas

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

e. Uncommitted/Unencumbered Funds¹¹

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 tables outlines the PG&E uncommitted/unencumbered funding for each program cycle as of December 31, 2015.

Table 5. Total Uncommitted/Unencumbered Funds by Program Cycle

Program Cycle	Uncommitted/Unencumbered Project Funds
EPIC 1: 2012-2014	\$0.6 million – \$8.4 million
EPIC 2: 2015-2017	\$12.2 million – \$19.0 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, 2015. The Project Status Report is based on the format provided in Attachment 6 of D.13-11-025.

c. Description of Projects

The project descriptions for both EPIC 1 and EPIC 2 projects, provided below, are as of December 31, 2015. Projects that are on-hold have been included in the summary.

¹¹ “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.

Project #1.01 – Energy Storage for Market Operations

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Grid Operation/Market Design
- iii. Objective
 - Develop technologies and strategies for efficient and optimized bidding and scheduling of Energy Storage Technologies (ESTs) in California ISO markets and demonstrate those strategies using PG&E's existing Sodium Sulfur Battery Energy Storage Systems (NaS BESS).
 - This project contributes to objectives in the following CPUC proceeding(s): Energy Storage OIR R.15-03-011.
- iv. Scope
 - Develop and deploy technology to enable fully automated resource response to CAISO market awards.
 - Quantify the values that battery resources can capture in CAISO markets.
 - Inform Cost Effectiveness Models.
 - Provide Guidance on Regulatory Compliance.
- v. Deliverables
 - 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.
- 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 (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)
 - 9c - EPIC project results referenced in regulatory proceedings and policy reports (Business Plan references: CPUC Rulemaking 10-12-007) - this project would provide data to understand the cost-effectiveness of battery storage.
- vii. Schedule
 - 2.5 years
- viii. EPIC Funds Encumbered
 - \$616,287
- ix. EPIC Funds Spent
 - \$1,635,137

- x. Partners
 - Partnered with Energy Regulators Regional Association (ERRA) to leverage battery assets, software and expertise.
 - Partnered with California Independent System Operator (CAISO) to deploy first energy storage asset in Non-Generator Resource market and provided feedback for software improvements.
- xi. Match Funding
 - N/A
- xii. Match Funding Split
 - N/A
- xiii. Funding Mechanism
 - Pay for performance
- xiv. Treatment of Intellectual Property
 - N/A - No current evidence of IP development
- xv. Status Update
 - Project is in Build/Test phase.
 - Deployed and demonstrated primary technological goal of this project - PG&E Vaca Dixon Battery Energy Storage Systems followed CAISO market awards automatically.
 - Next steps are to execute automatic bidding into CAISO market with PG&E's Battery Energy Storage System at Yerba Buena, and continue bidding the Vaca Dixon battery resource into CAISO markets up to project closeout.

Project #1.02 – Energy Storage for Distribution Operations

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Distribution; Grid Operation/Market Design
- iii. Objective
 - Demonstrate the ability of a utility operated energy storage asset to address capacity overloads on the distribution system and improve reliability.
 - This project contributes to objectives in the following CPUC proceeding(s): 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 (PU Code § 8360);
 - 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources (PU 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 / AB 2514.
- vii. Schedule
 - 2.5 years
- viii. EPIC Funds Encumbered
 - \$2,039,117
- ix. EPIC Funds Spent
 - \$429,244
- x. Partners
 - No
- xi. Match Funding
 - No

- xii. Match Funding Split
 - N/A
- xiii. Funding Mechanism
 - Pay for Performance
- xiv. Treatment of Intellectual Property
 - N/A - No current evidence of IP development
- xv. Status Update
 - Project is in Design/Engineering Phase.
 - Identified project site, developed and successfully administered a Request for Proposal (RFP) for project Engineering, Procurement and Construction (EPC) services, signed an EPC contract for 500kW/4 hour lithium-ion battery installation, and initiated electrical and civil design work.
 - Next steps are to finalize designs, mobilize site, and prove use case.

Project #1.03 – Mobile and Stationary Energy Storage Synergies

- i. Investment Plan Period
 - 1st Triennial (2012-2014).
- ii. Assignment to Value Chain
 - Grid Operation/Market Design
- iii. Objective
 - The project aims to reduce existing barriers to deployment of battery energy storage systems by demonstrating whether post-electric vehicle (EV) “second life” batteries can cost-effectively perform electric distribution services. The project will demonstrate the potential for reduced energy storage system costs via a) the development of an integration platform for deploying such batteries (Phase I) 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
 - TBD
- xi. Match Funding
 - TBD
- xii. Match Funding Split
 - TBD
- xiii. Funding Mechanism
 - TBD
- xiv. Treatment of Intellectual Property
 - TBD
- xv. Status Update
 - Project is currently on-hold.

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

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

Project #1.05 – New Forecast Methods for Improved Storm Damage Modeling

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Distribution
- iii. Objective
 - Demonstration of emerging capabilities in mesoscale modeling to provide more granular and accurate weather forecasting input to PG&E's storm damage prediction model, and to other PG&E forecasting applications, like catastrophic wildfire risk and 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.
 - Not in scope for this project is 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
 - \$461,340
- ix. EPIC Funds Spent
 - \$424,434
- x. Partners (if applicable)
 - Partnered with the National Forest Service and the Geographic Area Coordination Center (GACC) to obtain feedback on fire danger model.
- xi. Match Funding (if applicable)
 - N/A
- xii. Match Funding Split (if applicable)
 - N/A

- xiii. Funding Mechanism (if applicable)
 - Pay for performance
- xiv. Treatment of Intellectual Property (if applicable)
 - N/A - No current evidence of IP development
- xv. Status Updates
 - Three use cases are in different Phases: Use Case 1 (Improved Damage Modeling) is in Staging Phase; Use Case 2 (Improved Fire Weather Awareness) is in Build/Test Phase. Use Case 3 (Solar Irradiance Data Use) is in Design/Engineering Phase.
 - Detailed weather forecast data from POMMS improved storm damage modeling in Electric Operations, improving storm response performance - this will continue through 2016 El Nino season.
 - Algorithm allowed POMMS output to a fire danger model -National Fire Danger Rating System and shared with broader fire science community.
 - Working to develop PG&E Fire Index ratings and make operational in pilot system for 2016 fire season.

Project #1.06 – Demonstrate Communication Systems Allowing the California Independent System Operator Corporation 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 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
 - \$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 - No current evidence of IP development
- xv. Status Updates
 - 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**

Formally Withdrawn. CPUC A.12-11-003.

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

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Transmission; Distribution
- iii. Objective
 - Develop and demonstrate a new data analytics technique to improve distribution system safety and reliability. The project specifically developed and tested a System Tool for Asset Risk (STAR), which is an enterprise software application that Electric Operations will use to calculate and display (graphically and geospatially) risk scores for electric transmission, substation and distribution assets. The STAR will enable an automated, system-wide application to improve risk identification, prioritization, and investment decisions to support electric system safety.
- iv. Scope
 - Demonstrate whether the ever-increasing amounts of data can be mined and combined for targeted, cost-effective use for improved asset management.
 - Potential scenarios include risk-based asset management, safety hazard mitigation and proactive outage prediction using self-serve and virtual integration environments.
- v. Deliverables
 - Overview of existing applications and data sources
 - Assessment of existing data source quality
 - High-level future business processes by functional area
 - Inventory of asset risk algorithms (formulas or complexity) for “In Scope” asset classes
 - High-level Change Management Approach
 - Prioritized and phased implementation plan
 - Cost estimate for full implementation of the STAR project
 - Proof of concept prototype
- vi. Metrics
 - 7c - Dynamic optimization of grid operations and resources; including appropriate consideration for asset management and utilization of related grid operations and resource, with cost-effective full cyber security (PU Code §8360)
 - 3a - Maintain/Reduce operations and maintenance costs: With the improved understanding of risk, there could be a better tool for evaluating projects such as asset replacement.
- vii. Schedule
 - 2.25 years
- viii. EPIC Funds Encumbered
 - \$1,249,505

- ix. EPIC Funds Spent
 - \$2,112,640
- x. Partners (if applicable)
 - N/A
- xi. Match Funding (if applicable)
 - N/A
- xii. Match Funding Split (if applicable)
 - N/A
- xiii. Funding Mechanism (if applicable)
 - Pay for performance
- xiv. Treatment of Intellectual Property (if applicable)
 - N/A - No current evidence of IP development
- xv. Status Updates
 - Project is complete.
 - Finalized asset risk score algorithm, as well as visualization and decision support system prototype.
 - Completed user training and testing and evaluation.
 - Project close report finalized and attached to annual report.

Project #1.09A – Close Proximity Switching

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Transmission; Distribution
- iii. Objective
 - This project explores and seeks to discover effective, new tools to safely operate "Solid Blade in Oil Rotatory Switches."
- iv. Scope
 - Test new tools and techniques for safe operation of Solid Blade in Oil Rotatory Switches.
 - Evaluate alternatives to decrease probability of injury to workers and public.
 - Help design a robotic tool to allow remote operation.
 - Develop the necessary parts/adaptors to be used on various types (manufacturer, brand, age, etc.) of Solid Blade in Oil Rotatory Switches.
- v. Deliverables
 - A working prototype for the various Solid Blade in Oil Rotatory Switch tools.
- vi. Metrics
 - 5a - Outage number, frequency and duration reductions.
 - 5e - Utility worker safety improvement and hazard exposure reduction
- vii. Schedule
 - 2.5 years
- viii. EPIC Funds Encumbered
 - \$301,808
- ix. EPIC Funds Spent
 - \$495,333
- 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)
 - TBD
- xv. Status Updates
 - Project is in Close-out Phase.
 - Completed testing of robotic arm prototype from 3 vendors, and created benefits/weaknesses guidance, which will be shared with the wider IOU community. Next steps are to complete final report.

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

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Transmission; Distribution
- iii. Objective
 - The project focus is on development, testing, deployment, and implementation of new technologies, construction methods and techniques, and cost reduction techniques in support of the Supervisory Control and Data Acquisition (SCADA) monitoring systems used on the Distribution Networks. The monitoring system consists of a complex and extensive set of components used to assess the health and condition of the network transformers on a continuous basis. This research is looking at potential failure points on the monitoring system components and what technologies and improvements can be applied to increase life expectancy of these components and reduce production and maintenance costs for this system and similar systems.
- iv. Scope
 - Assess new technologies and feasibility of application on the Distribution Networks.
 - Primary focus on technologies, components and work methods to extend the life expectancy of monitoring systems equipment and reduce long term maintenance costs.
- v. Deliverables
 - Modified or improved components identified for use on Distribution Network Monitoring System.
 - Improved installation and construction work methods.
 - Economic model for maintenance variables based on life expectancy testing of components.
 - Changes to components.
- vi. Metrics
 - 1c - Avoided procurement and generation costs.
 - 3a - Maintain/Reduce operations and maintenance costs.
- vii. Schedule
 - 3.25 years
- viii. EPIC Funds Encumbered
 - \$453,000
- ix. EPIC Funds Spent
 - \$76,012
- x. Partners (if applicable)
 - N/A
- xi. Match Funding (if applicable)
 - N/A

- xii. Match Funding Split (if applicable)
 - N/A
- xiii. Funding Mechanism (if applicable)
 - Pay for performance
- xiv. Treatment of Intellectual Property (if applicable)
 - N/A - No current evidence of IP development
- xv. Status Updates
 - Project is in Build/Test Phase.
 - Completed competitive bidding for the identified research areas and awarded contract.
 - Kicked off project with consultant and PG&E team members.
 - Defined scope and started accelerated component testing (non-destructive).
 - Next steps are to complete testing, and based on the results, design parameters for the next set of testing for component life cycle, to drive cost-based recommendations for system improvements.

Project #1.09C – Discrete Reactors

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Transmission
- iii. Objective
 - Gain operating experience with Discrete Series Reactors to determine whether such devices would be cost effective and operate reliably and safely on PG&E's transmission system.
- iv. Scope
 - Install and test 90 DSR units on the Las Positas-Newark 230 kV line
 - Install and test Server at PG&E's San Francisco General Office (SFGO) headquarters, complete with Smart Wire System Manager Software
 - Communication links between the DSRs and server to support the DSR monitoring and control.
- v. Deliverables
 - Installation, testing and analysis of DSR and server communication links
 - Job Estimate to engineer, procure, construct and test the DSRs
 - White paper describing project including go/no go recommendation
 - Final report describing overall project, including finding from the operations and testing of DSR units and a recommendation as to whether or not to install the DSRs elsewhere in the PG&E system
- vi. Metrics
 - 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources (PU Code §8360)
 - 5a - Outage number, frequency and duration reductions
 - 5b - Electric system power flow congestion reduction
 - 3a - Maintain/Reduce operations and maintenance costs
- vii. Schedule
 - 3.25 years
- viii. EPIC Funds Encumbered
 - \$1,418,585
- ix. EPIC Funds Spent
 - \$1,998,883
- x. Partners (if applicable)
 - N/A
- xi. Match Funding (if applicable)
 - N/A
- xii. Match Funding Split (if applicable)
 - N/A

- xiii. Funding Mechanism (if applicable)
 - Pay for Performance
- xiv. Treatment of Intellectual Property (if applicable)
 - N/A - No current evidence of IP development
- xv. Status Updates
 - Project is in Build/Test Phase.
 - Selected the Las Positas-Newark 230 kV line (including tensile strength tests, identification of acceptable structures and spans for install).
 - Ordered, received, installed DSR units and Power Line Commander Server with a communications link for monitor and control of the DSRs.
 - Next steps are to perform testing, data collection and complete analysis and recommendations.

Project #1.10A – Dissolved Gas Analysis

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Transmission; Distribution
- iii. Objective
 - Develop tools and algorithms that analyze data from monitoring equipment installed on substation equipment (distribution and transmission) that tests for dissolved gasses or other precursor data that would assist in understanding the condition of the equipment.
- iv. Scope
 - Project scope being further evaluated - TBD
- v. Deliverables
 - Project deliverables being further evaluated - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated - TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - Project is currently on-hold.

Project #1.10C – Underground Cable Analysis

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Distribution
- iii. Objective
 - Develop tools and algorithms that analyze load and operating characteristic data from underground cables in order to develop an understanding of potential failure points, cable maintenance needs, and cable life expectancy.
- iv. Scope
 - Project scope being further evaluated - TBD
- v. Deliverables
 - Project deliverables being further evaluated - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated - TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - 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 PG&Es 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 Updates
 - 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 Updates
 - 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 Updates
 - Project is currently on-hold.

Project #1.14 – Next Generation SmartMeter™ Telecom Network Functionalities

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Distribution; Grid Operation/Market Design; Demand-Side Management
- iii. Objective
 - This project explores and discovers effective new network applications and devices to leverage and improve the SmartMeter™ communications network.
- iv. Scope
 - Leverage the existing SmartMeter™ network to support additional applications. Inform future uses of the SmartMeter™ network as to message capability, security, latency, and engineering constraints. Specifically focus on:
 - Test new devices to support network functions and capabilities not previously envisioned (e.g., new data streams, faster data collection).
 - Evaluate alternatives to decrease future upgrade, maintenance and/or operational costs.
 - Demonstrate different network applications, each focused on separate use cases.
- v. Deliverables
 - Evaluate new applications and devices, their associated data traffic impact on the SmartMeter™ network, and recommend which items warrant consideration for full-scale deployment.
 - Develop business case based on findings for full deployment consideration
- vi. Metrics
 - 7f - Deployment of cost-effective smart technologies, including real time, automated, interactive technologies that optimize the physical operation of appliance and consumer devices for metering, communications concerning grid operations and status, and distribution automation (PU Code §8360).
 - 7k - Develop standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid (PU Code §8360).
 - Note: Each technology demonstrated may have additional specific benefits to name. For instance, the following could apply: improved communication for power restoration, improved control of streetlights, etc.
- vii. Schedule
 - 3 years
- viii. EPIC Funds Encumbered
 - \$3,110,836
- ix. EPIC Funds Spent
 - \$2,879,027
- 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)
 - TBD - Smart Pole Meter and Meter Socket
- xv. Status Updates
 - Project is in Build/Test Phase.
 - Completed 13 use cases, including Adaptive control streetlights, Mixed data use, Outage message analyses, etc.
 - Remaining initiatives include improving Storm Center and restoration response, demonstrating communication with Distribution Automation (DA) devices, and demonstrating Smart Pole streetlight use case to remotely read the energy usage from telecommunications equipment and bill the equipment owner.

Project #1.15 – Grid Operations Situational Intelligence

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Distribution; Grid Operation/Market Design; Demand-Side Management
- iii. Objective
 - The objective of this pilot is to develop and pilot a real-time data visualization software platform for use by Electric Distribution Operations end users. Data will be integrated from various data sources and displayed on Distribution Control Center video walls and individual desktop computers, with potential for future scalability to handheld devices.
 - This visualization tool may provide situational intelligence for a variety of end users outside of the Distribution Control Center, including the Emergency Operations Center, Grid Control Center, and potentially crews in the field, as well.
 - This project contributes to objectives in the following CPUC proceeding(s): DRP R.14-08-013 / A. 15-07-006.
- iv. Scope
 - Scope includes the integration of data (network model, loading, SmartMeters™, outages, fire, weather, etc.) and a real-time data visualization platform for Distribution Operations.
 - The Distribution Management System (DMS) platform and predictive analytics are not included in the scope.
- v. Deliverables
 - Demonstrate Real-time Data Visualization Platform, including data integration from a variety of data sources and a visual interface that includes geospatial, list, and trending layers.
- vi. Metrics
 - 5a - Outage number, frequency and duration reductions.
 - 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (PU Code 8360).
 - 3a - Maintain/Reduce operations and maintenance costs.
- vii. Schedule
 - 2.75 years
- viii. EPIC Funds Encumbered
 - \$1,496,446
- ix. EPIC Funds Spent
 - \$3,624,458
- x. Partners (if applicable)
 - N/A
- xi. Match Funding (if applicable)
 - N/A
- xii. Match Funding Split (if applicable)
 - N/A

- xiii. Funding Mechanism (if applicable)
 - Pay For Performance
- xiv. Treatment of Intellectual Property (if applicable)
 - New intellectual property 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.
- xv. Status Updates
 - Project is in Build/Test Phase.
 - Completed Beta go-live in one Control Center and the Emergency Operations Center.
 - Successfully built in-house Distributed Generation Dashboard.
 - Next steps are to pilot in front of Operators, and collect data of lessons learned for close-out report.

Project #1.16 – Vehicle-to-Grid Operational Integration

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Distribution
- iii. Objective
 - Leverage plug-in hybrid vehicle technology emerging in PG&E fleet to generate utility-grade power, supporting distribution circuits during planned or unplanned outage events.
- iv. Scope
 - Develop nominally 120kW 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 - GHG emissions reductions (MMTCO₂e)
- vii. Schedule
 - 3 years
- viii. EPIC Funds Encumbered
 - \$1,479,590
- ix. EPIC Funds Spent
 - \$3,582,003
- x. Partners (if applicable)
 - DOE/NREL; Edison Electric Institute engaged for elec. utility industry staging events; Portland General Electric closely collaborating for industry-level requirements

- xi. Match Funding (if applicable)
 - N/A
- xii. Match Funding Split (if applicable)
 - N/A
- xiii. Funding Mechanism (if applicable)
 - Pay for performance
- xiv. Treatment of Intellectual Property (if applicable)
 - N/A - No current evidence of IP development
- xv. Status Updates
 - Project is in Build/Test Phase.
 - Leveraged National Renewable Energy Lab test facilities and funding for development tests.
 - Used VOGSS vehicles for temporary power in real relief efforts during Northern California wild fires.
 - Beta stage power export vehicles sourced and nearing build completion.
 - Next steps are to complete electric operations field service testing and grid connection process development, with data collection and closeout.

Project #1.17 – Industry Participation to Leverage EPIC Dollars

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Transmission; Distribution
- iii. Objective
 - N/A
- iv. Scope
 - Project scope being further evaluated – TBD
- v. Deliverables
 - Project deliverables being further evaluated – TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated – TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - N/A
- xii. Match Funding Split (if applicable)
 - N/A
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - Project is currently on-hold.

Project #1.18 – Appliance-Level Load Disaggregation

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Demand-Side Management
- iii. Objective
 - This project focuses on delivering the cost by major appliances to customers.
- iv. Scope
 - This project will use the data enabled by the SmartMeter™ platform to provide appliance-level itemization of monthly bill charges to customers, without their completing any audit or subscribing to any new service. This project assumes that minute level meter data is available.
- v. Deliverables
 - Quantify disaggregation accuracy and compare vendors.
 - Based on results, provide recommendations for deployment strategy of appliance-level billing.
- vi. Metrics
 - 1f - Avoided customer energy use
 - 1h - Customer bill savings (dollars saved)
- vii. Schedule
 - 2.5 years
- viii. EPIC Funds Encumbered
 - \$1,043,508
- ix. EPIC Funds Spent
 - \$1,190,639
- x. Partners (if applicable)
 - N/A
- xi. Match Funding (if applicable)
 - N/A
- xii. Match Funding Split (if applicable)
 - N/A
- xiii. Funding Mechanism (if applicable)
 - Pay for performance
- xiv. Treatment of Intellectual Property (if applicable)
 - N/A - No current evidence of IP development
- xv. Status Updates
 - Project is in Close-out Phase.
 - Executed load disaggregation demonstration for ~500 customers. Evaluated the quality of three vendors' disaggregation algorithm results. Completed customer surveys and focus groups to evaluate perception and satisfaction of information.
 - Next steps are to complete final report.

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

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Distribution; Grid Operation/Market Design; Demand-Side Management
- iii. Objective
 - The project is to explore and discover effective, new data that can be collected and studied for further benefits. Demonstrate the type of additional data that can be collected and/or processed through the SmartMeter™ platform. Evaluate impact of any increased data traffic on the SmartMeter™ network. Focus on new data collection that makes the SmartMeter platform more robust for more customers.
- iv. Scope
 - Demonstrate the collection of new data from SmartMeters™. Example use cases include:
 - Power Quality Data (C12.19 format)
 - 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
 - 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
 - 1h - Customer bill savings (dollars saved)
 - 1f - Avoided customer energy use (KWh saved)
 - 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
 - \$1,010,207
- ix. EPIC Funds Spent
 - \$1,510,127
- 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)
 - TBD
- xv. Status Updates
 - Project is in Staging Phase.
 - Completed two use cases.
 - Proved ability to collect power quality data, read meters in remote locations, add new data channels to SmartMetersTM, and detect Line Side Tap energy diversion cases with voltage and usage data.
 - Next steps are to complete all use cases and complete final report.

Project #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 and affordability guiding principles for priority R&D.

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

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Distribution; Demand-Side Management
- iii. Objective
 - This project aims to validate and integrate a software platform to identify photovoltaic (PV) resources by leveraging SmartMeter™ 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 PG&E billing and interconnection database, as well as develop an automated outreach system for identified customers.
 - This project contributes to objectives in the following CPUC proceeding(s): Interconnection R. 11-09-011 Rule 21.
- iv. Scope
 - Identify vendor to develop or pilot software
 - Develop integration and communication platform for auto-identification of Unauthorized Interconnections (UIs)
 - 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
 - \$492,485
- ix. EPIC Funds Spent
 - \$676,140
- 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)
 - TBD
- xv. Status Updates
 - Project is in Design/Engineering Phase.
 - Completed customer surveys to potential UIs that were used as feedback to verify functionality of the algorithm.
 - Improved accuracy of PV identification (ID) and unauthorized interconnections algorithm, and developed method to estimate PV system size.
 - Next steps are to finalize probabilistic algorithm that has the potential to enable ID of other DERs and complete final report.

Project #1.22 – Electric Vehicle Submetering

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Distribution; Grid Operations/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 contributes to objectives in the following CPUC proceeding(s): EV D.13-11-008.
- iv. Scope
 - EV submetering pilot will entail EVSPs 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, EVSP will be responsible for the bill.
- v. Deliverables
 - Process to receive EVSP 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.
 - Obtain 3rd party evaluator for both phases of pilot through a Request for Proposal (RFP).
 - Incentive payments to EV Meter Data Management Agents (MDMA).
- vi. Metrics
 - 4a - GHG emissions reductions (MMTCO₂e)
 - 1h - Customer bill savings (MWh saved)
- vii. Schedule
 - 4.75 years (Extended by 6 mo. per CPUC request)
- viii. EPIC Funds Encumbered
 - \$1,873,328
- ix. EPIC Funds Spent
 - \$924,868
- x. Partners (if applicable)
 - Partnering with the following three Meter Data Management Agents (MDMAs) to assess electric vehicle service provider models: OhmConnect; eMotorWerks, and NRG.
- 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. Status Updates
 - Project in Build/Test phase.
 - Closed enrollment on 8/31/15 with 132 pilot participants and three Meter Data Management Agents (MDMAs).
 - Executed competitive RFP and selected vendor to act as third party evaluator.
 - Next steps include working with IOUs, CPUC and MDMAs to scope, define and launch Phase 2 of the project, as well as obtain evaluation results from Nexant.

Project #1.23 – Photovoltaic (PV) Submetering

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Distribution; Grid Operations and Market Design; Demand-Side Management
- iii. Objective
 - Initiative to obtain additional unnetted 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 contributes to objectives in the following CPUC proceeding(s): DG R.12-11-005.
- iv. Scope
 - Explore four different methods for obtaining PV generation data (Dedicated smart meter, submeter communication via ZigBee radio, 3rd 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 (PU Code 8360)
- vii. Schedule
 - 2.5 years
- viii. EPIC Funds Encumbered
 - \$928,438
- ix. EPIC Funds Spent
 - \$796,288
- x. Partners (if applicable)
 - N/A
- xi. Match Funding (if applicable)
 - N/A
- xii. Match Funding Split (if applicable)
 - N/A
- xiii. Funding Mechanism (if applicable)
 - Pay for performance

- xiv. Treatment of Intellectual Property (if applicable)
 - N/A - No current evidence of IP development
- xv. Status Updates
 - Project is in Build/Test Phase.
 - Completed lab testing and developed process to receive and display solar generation estimates for 10,000 PV systems from third-party solar tool.
 - Deployed sub-meters to measure accuracy of estimated solar generation algorithm.
 - Tested and launched My Energy website with PV generation data for 10,000 customers in 2015.
 - Next steps are to analyze estimated accuracy compared to sub-meters, as well as collect and summarize customer feedback.

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

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Transmission; Distribution; Grid Operation/Market Design; Demand-Side Management
- iii. Objective
 - Assess how to best utilize DSM resources to create a targeted customer- and location-specific approach to assist with distribution capacity constraints.
 - This project contributes to objectives in the following CPUC proceeding(s): DRP R.14-08-013 / A. 15-07-006.
- iv. Scope
 - Improve ability to estimate Heating, Ventilation and Air Conditioning (HVAC) direct load control load impacts at the distribution feeder level to aid in better understanding of the localized impact of HVAC direct load control 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
 - 4A - GHG emissions reductions (MMTCO₂e)
 - 1h - Customer bill savings (MWh saved)
 - 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (PU Code 8360)
- vii. Schedule
 - 2 years
- viii. EPIC Funds Encumbered
 - \$1,196,477
- ix. EPIC Funds Spent
 - \$1,321,096
- x. Partners (if applicable)
 - N/A
- xi. Match Funding (if applicable)
 - N/A
- xii. Match Funding Split (if applicable)
 - N/A

- xiii. Funding Mechanism (if applicable)
 - Pay for performance
- xiv. Treatment of Intellectual Property (if applicable)
 - N/A - No current evidence of IP development
- xv. Status Updates
 - Project is in Close-out Phase.
 - Project team has deployed and tested all 600 real time data loggers.
 - Finalized build and testing of Real-Time Monitoring System (RTMS) dashboard.
 - Developed and implemented RTMS test plan, including collection and analysis of event data.

Project #1.25 – Direct Current (DC) Fast Charging Mapping

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Distribution; Demand-Side Management
- iii. Objective
 - Develop, pilot, and validate approaches that help determine the optimal location of direct current (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 PG&E's 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
 - 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
 - \$285,225
- ix. EPIC Funds Spent
 - \$336,595
- 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)
 - TBD
- xv. Status Updates
 - Project is in the Design/Engineering phase.

- Project kicked-off and partners identified.
- Completed competitive bid process and selected vendor to develop method for site selection.
- Finalized literature review and interviews, as well as the algorithm methodology for rank ordering site locations for placement of the DC fast chargers.
- Next steps are to finalize identification of ~200-500 DCFC locations across PG&E's territory.

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 California Independent System Operator Corporation Wholesale Market

- i. Investment Plan Period
 - 1st Triennial (2012-2014)
- ii. Assignment to Value Chain
 - Grid Operations and Market Design; and Demand-side Management.
- iii. Objective
 - Develop, pilot and validate approaches and technologies that enable the cost-effective integration (specifically, the measurement and telemetry) of mass market DR resources into the CAISO wholesale market. While other DR projects focus on integration of DR resources into various utility and future ISO 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 Updates
 - Project is currently on-hold.

Project #2.01 Evaluate Storage on the Distribution Grid

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operations/Market Design; Transmission; Distribution; Demand-side Management
- iii. Objective
 - Identify and evaluate whether system needs can be cost-effectively addressed with energy storage, including identifying a range of storage deployment locations and grid interconnection requirements on a granular level.
- iv. Scope
 - Project scope being further evaluated – TBD
- v. Deliverables
 - Project deliverables being further evaluated – TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated – TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - Project is currently on-hold.

Project #2.02 Pilot Distributed Energy Management Systems (DERMS)

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operations and Market Design
- iii. Objective
 - Demonstrate new technology to monitor and control DERs to manage system constraints and evaluate the potential value of DER flexibility to the grid. The DERMS pilot will drive learning about the people, process, and technology needed to operate the high DER penetration grid of 2025.
 - Create, test, and iterate on future DERMS requirements (e.g., communication requirements for PG&E and 3rd party owned DERs)
 - Learn about business process change and personnel skills & knowledge needed to implement DERMS
 - Enable informed choice for long-term strategic vendor in 2017 and beyond (pilot is not choosing the long term vendor)
 - This project contributes to objectives in the following CPUC proceeding(s):
DRP R.14-08-013 / A. 15-07-006.
- iv. Scope
 - Demonstrate minimum viable DERMS operation at PG&E to address key DER management use cases.
 - The demonstration will take place in a limited geography with a diverse set of DERs being monitored and controlled by the pilot DERMS.
- v. Deliverables
 - The functional integration of a DERMS software minimum viable product and operational demonstration of the identified use cases.
 - A report that:
 - Determines the most important characteristics of a full deployment solution including detailed functional and technical requirements
 - Identifies best practices and required internal capabilities for a full deployment solution
 - Develops operational processes that can be scaled to a wider system deployment
 - Defines boundaries and integrations with other PG&E systems (e.g., DRMS, DMS, market systems)
 - Develops a point of view on the utility role in managing DERs for grid and economic benefits
- vi. Metrics
 - 7b. Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (PU Code § 8360)
 - 7d. Deployment and integration of cost-effective distributed resources and generation, including renewable resources (PU Code § 8360)

- vii. Schedule
 - 2 years
- viii. EPIC Funds Encumbered
 - \$477,287
- ix. EPIC Funds Spent
 - \$475,503
- x. Partners (if applicable)
 - N/A
- xi. Match Funding (if applicable)
 - N/A
- xii. Match Funding Split (if applicable)
 - N/A
- xiv. Treatment of Intellectual Property (if applicable)
 - Pay for performance TBD
- xv. Status Updates
 - Project is in Plan/Analyze Phase.
 - Benchmarked DERMS strategy and pilots with other leading U.S. utilities.
 - Completed competitive bid process and selected vendor.
 - Next steps are to sign contract with vendor and execute use cases.

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 contributes to objectives in the following CPUC proceeding (s):
DRP R.14-08-013 / A. 15-07-006.
- iv. Scope
 - This project will leverage 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 Lab (as specified by the Smart Inverter Working Group).
 - This EPIC project will deploy smart inverters on one or more feeders to evaluate their effectiveness in improving PV integration and mitigation safety risks.
- v. Deliverables
 - Identify feeder(s) where smart inverters will be installed for demonstration.
 - Demonstrate the use of smart inverters on one or more feeders to demonstrate the inverters' local voltage control capabilities and impacts related to high penetration of customer-sited solar PV.
 - Develop any necessary communications software/hardware/technologies between the utility and 3rd party aggregator or end devices.
 - Evaluate the performance of smart inverters.
- vi. Metrics
 - 3a. Maintain / Reduce operations and maintenance costs.
 - 7d. Deployment and integration of cost-effective distributed resources and generation, including renewable resources
- vii. Schedule
 - 2.5 years
- viii. EPIC Funds Encumbered
 - \$146,000
- ix. EPIC Funds Spent
 - \$27,275
- x. Partners (if applicable)
 - PG&E Smart Grid VVO Pilot
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD

- xiii. Funding Mechanism (if applicable)
 - Pay for Performance
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - Project is in Plan/Analyze Phase.
 - Identified short list of substations and feeders to propose for site location.
 - Next steps are to finalize smart inverter testing, select transformer bank/feeders for deployment, select vendor, and commence field deployment of smart inverters.

Project #2.03B Test Smart Inverter Enhanced Capabilities - Electric Vehicle (EV)

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Distribution; Demand-Side Management
- iii. Objective
 - As a complement to the smart inverter assessment related to Photovoltaics (PV) in project 2.03A. Smart Inverters for PV, this project will assess the use and impact of EV energy flow capabilities, as required by D.15-04-020.
 - This project contributes to objectives in the following CPUC proceeding (s):
DRP R.14-08-013 / A. 15-07-006.
- iv. Scope
 - This EPIC project will enable dispatchable charging and discharging of the EV in response to an Open Automated Demand Response (OADR) event signals. Varied test modes will be tested.
- v. Deliverables
 - Evaluation of the performance of the EV in response to OADR signals and impacts on energy flow capabilities
- 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
 - 1.5 years
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - Pay for Performance
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - Project is in Plan/Analyze Phase.
 - Identified potential site location and partner to execute project.
 - Next steps are to finalize partner, execute SOW, and commence testing.

Project #2.04 DG Monitoring & Voltage Tracking

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operation/Market Design
- iii. Objective
 - This project aims to utilize the voltage measurement capabilities of SmartMeters™ to monitor DG output and identify voltage fluctuations caused by the intermittent nature of distributed renewable resources. Project will use data analytics techniques and Advanced Metering Infrastructure (AMI) (and other) data to determine the impact of PV penetration on Rule-2-violations and create a rating for the probability that a Rule 2 violation is caused by DG.
 - This project contributes to objectives in the following CPUC proceeding(s):
DRP R.14-08-013 / A. 15-07-006.
- 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 (PU Code 8360)
 - 7d. Deployment and integration of cost-effective distributed resources and generation, including renewable resources
- vii. Schedule
 - 1.75 Years
- viii. EPIC Funds Encumbered
 - \$158,500
- ix. EPIC Funds Spent
 - \$95,026
- 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 Updates
 - Project is in Plan/Analyze Phase.
 - Established success criteria for Phase 2-5.
 - Next steps are to plan for and execute vendor selection process and develop algorithm.

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 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
 - 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 Updates
 - Project is currently on-hold.

Project #2.06 Intelligent Universal Transformer (IUT)

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Distribution; Grid Operation/Market Design; Demand-Side Management
- iii. Objective
 - The project objective is to develop and demonstrate a solid-state transformer field prototype Medium Voltage Fast Charger (MVFC) system, as an application use case of solid-state transformers for DC fast charging of plug-in electric vehicles (PEV), featuring intelligent controls and multiple fast charging of PEVs
- iv. Scope
 - Test demonstration and communication to the same DC solid-state transformer with two protocols.
- v. Deliverables
 - Demonstrate a proof of concept that 1) an 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
 - 2.25 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)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD

xv. Status Updates

- Project is in Plan/Analyze Phase.
- Next steps are to identify partners/vendors, select site, develop testing protocols, finalize component build, complete field testing and monitoring, and analyze results.

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

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operation/Market Design; Distribution
- iii. Objective
 - This demonstration will leverage near real time and interval data to improve feeder modeling, inform load allocation throughout the distribution grid and transformer loading profiles, and identify opportunities to enhance current load forecasting processes for distribution transformers, feeders and substation transformers.
- iv. Scope
 - Current technology does not allow for real time line or transformer loading information without full Supervisory Control and Data Acquisition (SCADA) penetration.
 - Project will aggregate the meter loading to the transformer level at a higher frequency level.
- v. Deliverables
 - Develop a unique loading algorithm and rubrics for determining cost-effective data sources and cadences.
- vi. Metrics
 - 7b. Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid
- vii. Schedule
 - 1.75 years
- viii. EPIC Funds Encumbered
 - \$198,867
- ix. EPIC Funds Spent
 - \$138,829
- 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 Updates
 - Project is in Plan/Analyze Phase.
 - Next steps are to prepare vendor requirements, execute competitive bid process and develop algorithm.

Project #2.08 “Smart” Monitoring and Analysis Tools

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Transmission
- iii. Objective
 - Demonstrate strategies and technologies for real time, online monitoring of substation equipment; Demonstrate communication protocols and equipment to support the smart devices; Develop visualization techniques for improved monitoring; and evaluate new vendor technologies that enable data correlation and predictive analysis to better identify and respond to potential safety, reliability and/or operational issues.
- iv. Scope
 - Project scope being further evaluated – TBD
- v. Deliverables
 - Project deliverables being further evaluated – TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated – TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - Project is currently on-hold.

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

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Transmission
- iii. Objective
 - Demonstrate congestion mitigation by installing DSIs on parallel transmission facilities to demonstrate the next generation of the Distributed Series Reactor (DSR) devices from the First EPIC Triennial Plan, which may allow for better control of transmission line loading.
- iv. Scope
 - Project scope being further evaluated – TBD
- v. Deliverables
 - Project deliverables being further evaluated – TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated – TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - 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 PG&E facilities to enable faster response and restoration.
 - Provide the ability to prepare for these hazards by proactively modeling the impacts of potential hazards, to understand system vulnerabilities and restoration resource requirements.
 - Incorporate work efficiency optimization algorithms to more efficient allocate crews.
- iv. Scope
 - Develop optimization algorithms and visualization tool that includes asset locations and conditions with multiple potential hazards, which allows for the aggregation of equipment damage estimates (via damage models, outage information systems, and damage assessments), est. hours to repair, and recommended allocation of work resources to efficiently respond to a natural hazard
- v. Deliverables
 - Complete algorithms that aggregates 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. GHG emissions reductions (MMTCO₂e)
 - 5a. Outage number, frequency and duration reductions
 - 5d. Public safety improvement and hazard exposure reduction
 - 5e. Utility worker safety improvement and hazard exposure reduction
 - 5c. Forecast accuracy improvement
- vii. Schedule
 - 2.25 years
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$25
- 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 Updates
 - Project is in Plan/Analyze Phase.
 - Next steps are to complete competitive bid process, select vendor, gather data, and develop resource allocation algorithm/tool.

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 PG&E field operations that build upon Grid Operations Situational Intelligence (Project #15) demonstration projects in the EPIC First Triennial Plan as well as existing “baseline” mobile deployments underway.
- iv. Scope
 - Project scope being further evaluated – TBD
- v. Deliverables
 - Project deliverables being further evaluated – TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated – TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - 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 PG&E's emergency preparedness and response capabilities.
- iv. Scope
 - Project scope being further evaluated – TBD
- v. Deliverables
 - Project deliverables being further evaluated – TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated – TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - Project is currently on-hold.

Project #2.13 Digital Substation/Substation Automation

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

Project #2.14 Automatically Map Phasing Information

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Distribution; Demand-Side Management
- iii. Objective
 - This project aims to explore a variety of pre-commercial analytics and/or hardware options to automatically map 3-phase electrical power information in order to improve the distribution network models. Use of Advanced Metering Infrastructure (AMI) data; Light Detection and Ranging mapping technology; Micro Phasor Measurement Units (PMUs); and hardware at the transformer may provide this automated capability.
- iv. Scope
 - Project seeks to improve distribution network models through automatic mapping of 3-phase electrical power information.
- v. Deliverables
 - Develop algorithm or novel process to use AMI data and other sources to determine the assignment of Phases to conducting components.
 - Complete an analysis on the most cost-effective frequency for running such a mapping process.
- vi. Metrics
 - 7b. Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid
- vii. Schedule
 - 1.75 years
- viii. EPIC Funds Encumbered
 - \$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 Updates
 - Project is in Plan/Analyze Phase.
 - Next steps are to execute competitive bid process and develop algorithm/analytics options.

Project #2.15 Synchrophasor Applications for Generator Dynamic Model Validation

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Transmission
- iii. Objective
 - This project will evaluate new Synchrophasor analysis applications that can perform generator dynamic model parameter estimation and validation using disturbance data recorded by the Synchrophasor system. New Synchrophasor applications could perform mandated generator model validation without requiring time- and labor-intensive on-site tests, and could detect sub-synchronous resonance and other conditions which can cause generator outages. The objective of this project is to determine if this analysis is accurate and cost-effective on PG&E's system.
- iv. Scope
 - Scope is limited to confirming that analysis of Phasor Measurement Unit (PMU) data is equal to costly on-site model validation in the target geography. Scope does not include widespread deployment of PMUs or validation process.
- v. Deliverables
 - Install Synchrophasors (or "PMUs") on generators or generator tie-lines, and test new data analysis software applications.
 - Evaluate the applications' ability to perform generator dynamic model validation by analyzing Synchrophasor data following transient disturbances on the transmission system.
- vi. Metrics
 - 3a. Maintain / Reduce operations and maintenance costs
 - 5a. Outage number, frequency and duration reductions
 - 7b. Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (PU Code 8360)
- vii. Schedule
 - 2.5 year
- viii. EPIC Funds Encumbered
 - \$148,050
- ix. EPIC Funds Spent
 - \$90,355
- 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 Updates
 - Project is in Plan/Analyze Phase.
 - Next steps are to identify appropriate test facilities/ geography, contract with additional vendors, install Synchrophasors, and test.

Project #2.16 Enhanced Synchrophasor Analytics & Applications

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Transmission
- iii. Objective
 - Demonstrate new techniques to synthesize Synchrophasor data and utilize the data for advanced real-time system applications, such as wide-area monitoring, protection, and control systems, which could help move Synchrophasor applications beyond planning, forensics, and visualization to enhanced wide-area monitoring, protection, and control applications.
- iv. Scope
 - Project scope being further evaluated – TBD
- v. Deliverables
 - Project deliverables being further evaluated – TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated – TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - 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 Geomagnetic Disturbance (GMD) by modeling GMD that occurs during a geomagnetic storm and evaluating the impact on transmission lines, interconnection lines, substations and system voltages.
- iv. Scope
 - Project scope being further evaluated – TBD
- v. Deliverables
 - Project deliverables being further evaluated – TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated – TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - Project is currently on-hold.

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

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Transmission
- iii. Objective
 - Demonstrate newer technologies, such as optical sensors, as well as strategies and technologies to configure appropriate protection settings, including the coordination required between both new and conventional instrumentation.
- iv. Scope
 - Project scope being further evaluated – TBD
- v. Deliverables
 - Project deliverables being further evaluated – TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated – TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - Project is currently on-hold.

Project #2.19 Enable Distributed Demand-side Strategies & Technologies

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Distribution; Demand-Side Management
- iii. Objective
 - Demonstrate distributed demand-side technologies and approaches to address local and flexible resource needs.
 - This project contributes to objectives in the following CPUC proceeding(s): Energy Storage OIR R.15-03-011.
- iv. Scope
 - Deploy an aggregation of BTM customer energy storage resource to reduce peak loading or absorb distributed generation on a utility distribution feeder(s).
- v. Deliverables
 - Demonstrate and test field results for effectiveness of the use of aggregated customer-sited BTM energy storage resources to peak load reduction reduce peak loading or absorb distributed generation on a utility distribution feeder(s).
 - Potential to demonstrate communications with aggregate resources for visualization and control.
 - Evaluate cost-effectiveness and reliability of BTM energy storage for addressing capacity constraints.
- vi. Metrics
 - 1c. Avoided procurement and generation costs
 - 1i. Nameplate Capacity of Grid-Connected Storage
 - 3f. Improvements in system operation efficiencies stemming from increased utility dispatchability of customer demand side management
 - 5b. Electric system power flow congestion reduction
 - 5d. Public safety improvement and hazard exposure reduction
 - 7b. Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid
 - 7d. Deployment and integration of cost-effective distributed resources and generation, including renewable resources
- vii. Schedule
 - 2.25 years
- viii. EPIC Funds Encumbered
 - \$146,000
- ix. EPIC Funds Spent
 - \$55,253
- 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 Updates
 - Project is in Plan/Analyze Phase.
 - Identified a short list of substations and feeders to propose for site location.
 - Next steps are to select transformer bank/feeders for deployment, complete RFP to select vendor, develop contracts, acquire customer participants and commence field deployment of BTM batteries.

Project #2.20 Real-time Energy Usage Feedback to Customers

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operations/ Market Design; Distribution; Demand-side Management
- iii. Objective
 - Evaluate innovative feedback technologies to provide near real-time energy usage information to customers and to drive greater customer performance during DR events.
- iv. Scope
 - Project scope being further evaluated – TBD
- v. Deliverables
 - Project deliverables being further evaluated – TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated – TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - 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 PG&E's commercial customers.
 - This project contributes to objectives in the following CPUC proceeding(s): A.11-03-001.
- iv. Scope
 - This project will enable the ZigBee HAN radio on Large Commercial and Industrial (LC&I) meters, to facilitate LC&I 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 LC&I customers and connect devices to SmartMeters.
 - Monitor customer usage and issue/collect customer and vendor surveys.
 - Complete report with identified issues and recommendations for how to integrate with an existing EMS.
- vi. Metrics
 - 1e. Peak load reduction (MW) from summer and winter programs
 - 1f. Avoided customer energy use (kWh 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 (PU Code § 8360)
- vii. Schedule
 - 1.5 years
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD

- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - Project is in Plan/Analyze Phase.
 - Developed business plan and identified vendor/partner.
 - Next steps are to complete design, build and test phases, including customer site identification, lab testing, deployment of devices, field testing and integration with EMS.

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 (DSM) technologies (e.g., Energy Efficiency (EE), Demand Response (DR), Distributed Energy Storage, Consumer-oriented Energy Tools).
 - Investigate whether PG&E can achieve a sufficient amount of demand reduction, give visibility into the customer-side resources and improve the reliability of customer-side resources at the local level, in order to reschedule local capacity expansion expenditures.
 - This project contributes to objectives in the following CPUC proceeding(s):
DRP R.14-08-013 / A. 15-07-006.
- 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-Distributed Energy Resource (DER) customer targeting to address forecasted capacity challenges at specific assets, for specific days and times of year, leveraging interval data and other customer attributes
- v. Deliverables
 - Create a data analytics platform capable of combining and analyzing multi-structured data, linking to a variety of data sources.
 - Develop a method for identification, valuation, implementation, and tracking of targeted DERs.
 - Create a quantitative screening/rank order tool.
 - Develop actionable DER recommendations to customer outreach teams for reaching demand reduction goals
- vi. Metrics
 - 3a. Maintain / Reduce capital costs
 - 7b. Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid
 - 7e. Development and incorporation of cost-effective demand response, demand-side resource, and energy efficient resources
 - 7h. Deployment and integration of cost-effective advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air-conditioning
- vii. Schedule
 - 2.25 years
- viii. EPIC Funds Encumbered
 - \$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 Updates
 - Project is in Plan/Analyze Phase.
 - Identified data integration and analytics platform vendor and narrowed grid assets to be analyzed in the project.
 - Next steps are to complete data gathering, integrate or staging of datasets, develop analytics platform, create quantitative screening tool, and build interface with targeted DER sales guidance.

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 PG&E's ability to incorporate the growing usage of DERs 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.
 - This project contributes to objectives in the following CPUC proceeding(s):
DRP R.14-08-013 / A. 15-07-006.
- iv. Scope
 - Integrate a broader range of customer-side technologies and DER approaches into grid planning and operations in a least cost framework by enhancing distribution load forecasting tools to include new customer load shapes based on the usage of DERs and to model the uncertainty of DER deployment at the circuit level.
- v. Deliverables
 - Develop enhanced Customer and DER Load Shapes Catalog in LoadSEER Planning Tool.
 - Incorporate DER Scenario Projections into LoadSEER.
 - Develop interface between LoadSEER/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 (PU Code § 8360)
- vii. Schedule
 - 2 years
- viii. EPIC Funds Encumbered
 - \$1,250,085
- ix. EPIC Funds Spent
 - \$551,221
- 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 Updates
 - Project is in Build/Test Phase.
 - Developed Statement of Work (SOW) and selected vendor, completed initial data transfer to vendor, and incorporated enhanced customer and DER load shapes catalog into LoadSEER planning tool.
 - Next steps are to incorporate DER scenario projections into LoadSEER, complete user acceptance testing, develop interface between LoadSEER and CYME, and develop the integrated capacity analysis modules within LoadSEER.

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

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Demand-Side Management
- iii. Objective
 - Demonstrate the ability to use sub-minute level usage information to determine appliance load for non-residential customers.
- iv. Scope
 - Project scope being further evaluated – TBD
- v. Deliverables
 - Project deliverables being further evaluated – TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated – TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - Project is currently on-hold.

Project #2.25 Enhanced Smart Grid Communications

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operations/ Market Design; Distribution; Demand-side Management
- iii. Objective
 - Evaluate license spectrum providers that have developed technologies offered on the Federal Communications Commission (FCC) license frequency range/spectrum.
- iv. Scope
 - Project scope being further evaluated – TBD
- v. Deliverables
 - Project deliverables being further evaluated – TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated – TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - 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 PG&Es 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 (HAN), Electric Vehicle (EV) charging, smart appliances, etc.) with the AMI network (IPv6) in an effective manner.
- v. Deliverables
 - Conduct lab testing that will certify customer open architecture devices/applications that are AMI compatible, secure and interoperable.
 - Provide physical and application interfaces, as a Proof of Concept, which will permit customer and third party devices to connect to our AMI network(s).
- vi. Metrics
 - 3f. Improvements in system operation efficiencies stemming from increased utility dispatchability of customer demand side management
 - 5i. Increase in the number of nodes in the power system at monitoring points
 - 7j. Provide consumers with timely information and control options
- vii. Schedule
 - 2 years
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$265
- 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 Updates
 - Project is in Plan/Analyze Phase.

- Next steps are to review and approve business plan, develop use cases, then design, build, and test.

Project #2.27 Next Generation Integrated Smart Grid Network Management

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operations/Market Design; Distribution; Demand-side Management
- iii. Objective
 - Evaluate new technologies to holistically monitor, control and evolve the communications network and supporting infrastructure as a platform to enable Smart Grid solutions.
- iv. Scope
 - Demonstrate a new Advanced Metering Infrastructure (AMI) Network management system to holistically monitor, control, and evolve the existing AMI network and infrastructure from a billing-centric platform to a fully operational AMI solutions platform that will meet evolving customer and grid needs
- v. Deliverables
 - Demonstrate an integrated, multi-tenant network management system that may include the following features:
 - Integrated network management & control that will monitor and prioritize data traffic
 - Automate trouble ticketing creation process
 - Workflow management
 - Asset management of meter and network equipment regardless of meter or network types
 - Business continuity planning to streamline maintenance and operations
- vi. Metrics
 - 3a. Maintain / Reduce operations and maintenance costs
 - 5a. Outage number, frequency and duration reductions
 - 5d. Public safety improvement and hazard exposure reduction
 - 5e. Utility worker safety improvement and hazard exposure reduction
- vii. Schedule
 - 2 years
- viii. EPIC Funds Encumbered
 - \$58,658
- ix. EPIC Funds Spent
 - \$66,706
- 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 Updates
 - Project is in Plan/Analyze Phase.
 - Developed business plan and use cases.
 - Next steps are to complete competitive bid process, evaluate and select vendor(s) and launch design, build and test phases.

Project #2.28 Smart Grid communications path monitoring

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operation/Market Design
- iii. Objective
 - Evaluate more efficient communication paths for 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
 - 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 #2.29 Mobile Meter Applications

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operations/Market Design; Distribution; Demand-Side Management (DSM)
- 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 (PEVs), Distributed Generation (DG), mobile storage, etc.).
 - Monitor the grid impact of knowing when, where, and what size load will be necessary to support new, flexible location technologies such as: PEVs, mobile distributed generation, and mobile storage.
- v. Deliverables
 - Design specification of mobile meter.
 - Demonstration of mobile meter hardware prototype.
 - End-to-end meter to cash testing using existing AMI or cellular based network.
 - Lab testing of use cases on DG applications and PEV metering, including remote and near real-time tracking of vehicle charge locations and energy flow.
- vi. Metrics
 - 3a. Maintain / Reduce operations and maintenance costs (Affordability)
 - 7b. Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Reliability)
 - 7j. Provide consumers with timely information and control options (Customer)
- vii. Schedule
 - 2 years
- viii. EPIC Funds Encumbered
 - \$74,827
- ix. EPIC Funds Spent
 - \$261,155
- 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 Updates

- Project is in Plan/Analyze Phase.
- Developed specification for Next Generation Mobile Meter that covers various test use cases (EV charging stations, EVs, and DG).
- Next steps are to complete competitive bid process for vendor selection, develop Next Generation Meter prototype, and begin testing.

Project #2.30 Leverage EPIC funds to participate in industry-wide RD&D programs

- i. Investment Plan Period
 - 2nd Triennial (2015-2017)
- ii. Assignment to Value Chain
 - Grid Operations/ Market Design; Transmission; Distribution; Demand-side Management
- iii. Objective
 - Leverage EPIC dollars by participating and collaborating in multi-utility, industry-wide research, demonstration and deployment initiatives conducted by third-party organizations
- iv. Scope
 - Project scope being further evaluated - TBD
- v. Deliverables
 - Project deliverables being further evaluated - TBD
- vi. Metrics
 - TBD
- vii. Schedule
 - Project schedule being further evaluated - TBD
- viii. EPIC Funds Encumbered
 - \$0
- ix. EPIC Funds Spent
 - \$0
- x. Partners (if applicable)
 - TBD
- xi. Match Funding (if applicable)
 - TBD
- xii. Match Funding Split (if applicable)
 - TBD
- xiii. Funding Mechanism (if applicable)
 - TBD
- xiv. Treatment of Intellectual Property (if applicable)
 - TBD
- xv. Status Updates
 - Project is currently on-hold.

5. Conclusion

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

Throughout the course of 2015, PG&E's EPIC 1 and 2 Programs have made significant progress and achieved noteworthy successes on many of the projects. Of the 33 active projects across EPIC 1 and EPIC 2, fifteen are in the Plan/Analyze Phase, four are in the Design/Engineering Phase, nine are in the Build/Test Phase, one is in the Staging Phase, three are in the Close-out Phase, and one is complete.

The progress and achievements of these projects have been identified in the Project Status Report found in Appendix A. In 2015, a number of projects have achieved significant milestones, including but not limited to the following:

- **Project 1.01 - Energy Storage for Market Operations** successfully followed CAISO market awards on an automated basis;
- **Project 1.08 - Distribution System Safety and Reliability through New Data Analytics Techniques** demonstrated a visualization tool that calculates asset risk based on an integrated data set from multiple data sources;
- **Project 1.16 - Vehicle-to-Grid Operational Integration**, successfully supported the Valley and Butte fire response, generating power for two days at a Red Cross shelter and a local church for housing evacuees.

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

- Communications with interested vendors and suppliers through channels such as referrals and industry events (e.g., Grid Edge Executive Council, Silicon Valley Leadership Group, DistribuTECH, etc.).
- Coordination with the other IOUs and CEC through regular administrator calls and collaboration.
- Administrator-coordinated execution of industry-wide EPIC workshops and symposiums.
- Other EPIC program support, such as providing comments to select CEC Program Opportunity Notices (PONs).

PG&E's EPIC portfolio of active projects continue to address challenges of the changing grid landscape, including an increase in renewable adoption by our customers, declining battery costs, more affordable electric vehicles, etc. These developments in the marketplace requires a focus on enhanced data analytics and forecasting approaches, effectively addressing two-way power flow, and extracting value from DERs. These achievements from the EPIC projects and their future project plans 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, hosted stakeholder workshops, and symposiums with accompanied webinars. The workshop and symposium took place on August 18, 2015 and December 3, 2015, respectively. These industry events focused on the sharing progress, results, and future plans, improving coordination and understanding among administrators, parties, and the Commission, raising awareness and visibility of EPIC investments, and promoting program transparency.

In 2016, PG&E and Administrators will continue to host a workshop and symposium to achieve the above stated goals. PG&E will also continue to promote the EPIC program through participation in both internal and external public forums, such as industry events and taking vendor and supplier referrals.

Additionally, PG&E anticipates the closure of many EPIC 1 projects in 2016 and eagerly anticipates sharing its findings via the projects' final reports.

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

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

- Changes in the market place have made the project obsolete (or relatively less attractive)
- Different technologies have emerged that could produce the desired results at a lower cost, so the original project is no longer a compelling use of funds
- The technology may prove to not yet be ready for commercialization
- The vendor interest may drop due to the small-scale pilot size of the project or they may revise business model that is no longer aligned with the projects' objectives

Furthermore, while the more obvious goal of technology demonstration is to help advance the pre-commercial technologies to market, there are related goals, which include determining the clean technology areas that are feasible for additional study and investment versus the areas that should no longer be pursued. In some cases, success may be defined by determining a conclusion about a lack of commercial scalability for the technology prior to spending the entire amount for which the project was budgeted.

PG&E is mitigating some of this risk by managing the EPIC projects and phases with a stage-gated approach, providing an off-ramp for projects if they are deemed no longer efficient uses of funds.