PACIFIC GAS AND ELECTRIC COMPANY

ELECTRIC PROGRAM INVESTMENT CHARGE (EPIC)
2018 ANNUAL REPORT

IN COMPLIANCE WITH CPUC DECISION 12-05-037

SUBMITTED FEBRUARY 28, 2019

VOLUME 1

ATTACHMENT A:
2018 Annual Report

ATTACHMENT B:
2018 Annual Report Appendix A

PACIFIC GAS AND ELECTRIC COMPANY

ATTACHMENT A

2018 EPIC ANNUAL REPORT

PACIFIC GAS AND ELECTRIC COMPANY

ELECTRIC PROGRAM INVESTMENT CHARGE (EPIC)
2018 ANNUAL REPORT

FEBRUARY 28, 2019

Pursuant to Decision (D.) 12-05-037 – Phase 2 Decision Establishing Purposes and Governance for Electric Program Investment Charge (EPIC) and Establishing Funding Collections for 2013-2020, Pacific Gas and Electric Company (PG&E) hereby files the 2018 Annual Report for the EPIC Program.

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

Service Lists:

EPIC 2012-2014: Application (A.) 12-11-001, A.12-11-002, A.12-11-003, and A.12-11-004.

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

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

PG&E recently filed GRC: A.18-12-009.

SCE recently filed GRC: A.17 10 008.

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

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1. Executive Summary

A. Overview of Program and Highlights

Pursuant to the California Public Utilities Commission (CPUC or Commission) D.12-05-037, PG&E, and the other Administrators of the 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 GRC of each electric utility, and to each successful and unsuccessful applicant for an EPIC funding award during the previous calendar year. In compliance with OP 16 of D.12-05-037, and consistent with the Annual Report outline developed collaboratively by the EPIC Administrators and the Public Advocates Office at the California Public Utilities Commission,[2] PG&E files its seventh annual report.

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

On November 19, 2013, the CPUC issued D.13-11-025, which authorized the first triennial investment period of 2012-2014 (referred to as EPIC 1). On April 15, 2015, the CPUC issued D.15-04-020, which approved the second triennial investment plan period of 2015-2017 (referred to as EPIC 2). On August 10, 2017, the CPUC issued Resolution (Res.) E-4863, which approved two of the six new EPIC projects proposed by PG&E via a Tier 3 Advice Letter (AL) 5015-E filed on February 7, 2017, between triennial EPIC Applications as permitted by D.15-09-005. On April 28, 2017, PG&E filed its A.17-04-028 for the third triennial investment plan period of 2018-2020

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

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

(referred to as EPIC 3). On October 25, 2018, the CPUC issued D.18-10-052, which approved the third triennial investment plan period of 2018-2020.

This report summarizes PG&E's projects' progress and status for the approved funding cycles, which includes TD&D projects in the following areas:

1) **Renewables and Distributed Energy Resource (DER) Integration** – Integrate DERs, generation and storage; improve transparency of resource information; increase generation flexibility.

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

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

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

PG&E continues to be strongly committed to the EPIC Program and the value it provides to its customers, as it offers the opportunity to cost-effectively develop and demonstrate innovative technologies which can advance the company's core values of Safety, Reliability, Resiliency, and Affordability. Through these projects, the EPIC Program also contributes learnings that support important California clean energy policy goals, such as Greenhouse Gas (GHG) reduction goals and renewable energy targets.

Additionally, the main goals of EPIC align closely with PG&E's grid modernization vision, which drives the advancement of innovative technologies that support PG&E's core values and an evolving grid. This vision calls for a secure, reliable, and resilient platform that enables continued gains for clean-energy technology to increase customer choice, prepare for climate change impacts and meet state policy goals. This Integrated Grid Platform (IGP) will improve today's operational capabilities, as well as develop new capabilities required to manage a more dynamic grid. EPIC supports the grid modernization vision to deliver improved situational awareness,

operational efficiency, and enhanced resiliency. PG&E is the key builder and enabler of this interconnected and integrated grid that will continue to help define and shape California's future energy landscape.

Looking forward, given the impacts of climate change, EPIC 3 will have an increased focus on safety and resiliency. With the climate induced challenges of increasing wildfires and extreme weather events, increased grid visibility and advanced technology driven operations are key. New EPIC technology demonstrations contained within this program cycle can help build on past projects, meet emerging grid needs and help address the threat of climate change, and ensure that the customers and the state can leverage the maximum benefit of this program.

PG&E's 2018 TD&D Program Highlights

PG&E is pleased to report the significant achievement of completing eleven EPIC 2 projects between the publishing of the 2017 and 2018 annual reports, which brings the total number of completed EPIC 1 and 2 projects to date to 33.

Below are the eleven EPIC projects that have closed in 2018 and/or in early 2019 before filing the 2018 EPIC Annual Report:

1) EPIC 2.02 – Pilot Distributed Energy Resource Management System (DERMS)
2) EPIC 2.03A – Test Smart Inverter (SI) Enhanced Capabilities – Photovoltaics (PV)
3) EPIC 2.05 – Inertia Response Emulation for Distributed Generation (DG) Impact Improvement
4) EPIC 2.07 – Real-Time Loading Data for Distribution Operations and Planning
5) EPIC 2.10 – Emergency Preparedness Modeling
6) EPIC 2.14 – Automatically Map Phasing Information
7) EPIC 2.15 – Synchrophasor Applications for Generator Dynamic Model Validation
8) EPIC 2.22 – Demand Reduction Through Targeted Data Analytics

9) EPIC 2.26 – Customer & Distribution Automation Open Architecture Devices

10) EPIC 2.27 – Next Generation Integrated Smart Grid Network Management

11) EPIC 2.29 – Mobile Meter Applications

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

PG&E will continue to leverage learnings and may operationalize associated results, where applicable and cost-effective.

Several of the EPIC 2 projects closed over the past year are being transitioned to production, and are expected to provide significant operational value going forward. For example, *EPIC 2.14 – Automation of Phase ID* demonstrated methods to provide visibility into grid connectivity by automatically identifying which meters are connected to which phases using SmartMeter™, Supervisory Control and Data Acquisition (SCADA), and Geographic Information System (GIS) data. Being able to accurately identify phasing information will be an important component of PG&E's Advanced Distribution Management System (ADMS). As utilities strive to modernize their distribution networks for increasing DER adoption, actively being able to manage the distribution system is critical. An automated solution, as developed in 2.14, may result in significant avoided cost compared to the alternative conventional method to identify meter phasing that would require field visits across the entire service territory.

Examples of other projects being transitioned to, and expected to provide significant value in, production include *EPIC 2.10 – Emergency Preparedness Modeling* and *EPIC 2.22 – Demand Reduction Through Targeted Data Analytics*. The tool developed in *EPIC 2.10* is being deployed within PG&E's Emergency Operations Center, and will provide users with faster and more analytical methods for developing restoration plans following events. The tool developed in *EPIC 2.22* may help to improve the Distribution Planning process by automatically identifying candidate customers and associated non-wires

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

alternative (NWA) solutions as alternatives to asset upgrades, and has already been used to support PG&E's first Distribution Deferral Opportunity Report (DDOR).

For detailed information on the developments and status of each EPIC 1, EPIC 2, and EPIC 3 project see Appendix A.

EPIC 1

In the first triennial cycle, the EPIC 1 portfolio demonstrated PG&E's ability to adopt a new model for managing, aligning, tracking and executing research, development and demonstration (RD&D) activities. This portfolio covered a wide spectrum of technologies that help make the electric grid safer, more reliable and more affordable for customers. Most of the EPIC 1 projects closed out in 2017 and examples of their achievements are detailed in prior annual reports.

EPIC 2

The projects from EPIC 2 are even more focused on long-term strategic objectives and in many cases are built on the foundation of previous technology investments. An example of this includes one analytics project, such as *EPIC 2.22 – Demand Reduction through Targeted Data Analytics* that uses over a dozen data sources and developed a solution to optimally identify where addition of DERs could provide grid value. This project built upon the work done in *EPIC 2.23 – Integrate Demand Side Approaches into Utility Planning*, which delivered new and more granular customer load shape profiles and enhanced load forecasting tools and overall analytical processes to allow PG&E to more accurately and consistently integrate DER impact into the distribution system load profile. The resulting forecasts feed into the analytics platform in EPIC 2.22 that allow PG&E to integrate DERs into distribution planning by matching customers to different DER options based on personalized propensity scores to potentially solve a feeder overload.

In addition to the above highlight, some project-specific notable examples of EPIC 2 achievements in 2018 include:

- *EPIC 2.10 – Emergency Preparedness Modeling:* This project successfully developed the Restoration Work Plan (RWP) system to demonstrate rapid and accurate restoration plan development for emergencies. It demonstrated the potential to apply current computer

technology, predictive analytics using big data, and artificial intelligence with machine learning algorithms to improve the certainty in understanding work demand and resource requirements as well as the positioning of resources, which results in a safer environment and improved customer service reliability. In addition, applying these advanced technologies not only makes critical information more visible to key decision makers at the right time, but also provides consistency and transparency to the development and revision of restoration plans. This RWP is being leveraged in a field demonstration setting by running the tool in parallel to existing processes to further validate the RWP and fine tune the tool before deploying at full scale.

- *EPIC 2.14 – Automatically Map Phasing Information:* This project demonstrated several analytical methods for automatically identifying meter phasing and meter-to-transformer connectivity using SmartMeter™, SCADA, and GIS data. As the load characteristics of the distribution network evolve and DER adoption increases, it is becoming more important to actively manage the distribution system, and accurate phasing information will be an important component of PG&E's ADMS. The in-house method developed by PG&E delivered promising results and PG&E is currently working towards further improving the performance of the algorithms, so that an automated solution can be implemented at scale. An automated solution would result in significant avoided cost compared to the alternative manual field detection method to identify meter phasing across the entire service territory.
- *EPIC 2.22 – Demand Reduction Through Targeted Data Analytics:* This project has developed and demonstrated an affordable and scalable data science driven solution for integrating DERs into Distribution Planning. The project results in the enhancement of utility distribution planning tools and processes by facilitating the identification of the lowest cost portfolio capable of deferring, or completely mitigating, asset upgrades. Project tools produced by EPIC 2.22 consider both traditional wires solutions and NWAs, which includes DER portfolios, and allow Distribution Planners to complete advanced scenario analysis. The

analytical solution draws on over a dozen data sources and can match customers to nearly 100 different energy efficiency (EE), demand response (DR), DG, and energy storage technology options, based on personalized propensity scores. This work builds on PG&E's Targeted Demand Side Management (TDSM) initiative and *EPIC 2.23 – Integrate Demand Side Approaches into Utility Planning* by incorporating the customer load shape profiles developed in EPIC 2.23 as an input to the optimization model. EPIC 2.22 tools and platforms were used to support PG&E's first DDOR. EPIC 2.22 was leveraged by PG&E to complete detailed analysis and scenario comparison at low costs, in a timely fashion, and with a level of analytical rigor that exceeded regulatory requirements (Rulemaking (R.) 14-08-013). The construction of a new transmission line would likely affect more than 250,000 customers while a non-wires alternative (NWA) portfolio would minimize customer impact. Any deferral of future distribution or transmission system upgrades would lower costs for electric ratepayers.

EPIC Intellectual Property

Some of PG&E's achievements in EPIC 1 and 2 have also enabled PG&E to file for non-provisional patent protection with the United States Patent and Trademark Office and international protection through the Patent Cooperation Treaty for the following EPIC projects:

- *EPIC 1.14 – Demonstrate "Next Generation" SmartMeter™ Telecom Network Functionalities*: Patent for the development of the Smart Pole Meter, Smart Pole Meter Socket, Patent for an algorithm to help identify downed wires.
- EPIC 1.21 – Pilot Methods for Automatic Identification of DERs (such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability: Patent for an algorithm which can detect unauthorized PV interconnections.
- *EPIC 2.26 – Customer and Distribution Automation Open Architecture Devices:* Patent for algorithms to communicate and control edge devices through the Advanced Metering Infrastructure (AMI) network.

- EPIC 2.29 – Mobile Meter Applications (NextGen Meter – NGM): Patent on mobile meter with modular housing/board assembly

One additional provisional patent was also filed in January 2019 for the following EPIC project:

- *EPIC 2.22 – Demand Reduction Through Targeted Data Analytics:* Provisional patent for system and server for parallel processing mixed integer programs for load management.

These patents may provide potential future revenue generating opportunities that would be shared with PG&E's customers and shareholders,[4] and ultimately support improved affordability if the patents lead to increased revenue. PG&E continues to consider opportunities to license patents, as well as opportunities to identify additional Intellectual Property in these and other projects.

External Collaboration

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

- *EPIC 2.03A – Test Smart Inverter Enhanced Capabilities – Photovoltaics (PV):* The effort evaluated the grid impacts of PV SIs through two field demonstrations and used PG&E laboratory facilities to evaluate the ability of multiple vendors' SI products to execute Rule 21 SI functions. The project also employed the Electric Power Research Institute (EPRI) to model SI performance and economic analysis on simulated PG&E distribution feeders. EPIC 2.03A findings demonstrated basic technical functionality of SI autonomous functions designed to mitigate local voltage issues associated with high DER penetration and characterized remaining hurdles to scaled SI deployment for grid support. The findings from this project on the potential use of SI autonomous capabilities to support local

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4 The revenue sharing mechanism is based on the guidance provided in CPUC D.13-110-25 OP 34, which states:

> [IOUs] must apply a 75 percent/25 percent (ratepayer/shareholder) revenue sharing mechanism for net revenues (from future or ongoing royalties, license fees, and other "financial benefits of Intellectual Property (IP)") related to financial benefits of IP that was developed under IOU contracts with Electric Program Investment Charge funds.

voltage are expected to be valuable for distribution grid operations, electric generation interconnection, distribution planning, and customer programs. Learnings from this technology demonstration can inform process changes and utility requirements needed to successfully integrate renewable resources controlled by SIs, specifically during the interconnection process. Learnings can also inform the Distribution Resources Plan (DRP) and Integrated Distributed Energy Resource (IDER) proceedings, including Distribution Infrastructure Deferral Framework, Competitive Solicitation Framework, ongoing Rule 21 Order Instituting Rulemaking (OIR), and Grid Modernization Planning filings. SIs can help to better integrate renewables, and, therefore, advance California energy policy to increase the amounts of renewable and DG on the grid.

- *EPIC 2.05 – Inertia Response Emulation for DG Impact Improvement*: This project focused on clarifying the various functions of synthetic inertia and understanding the opportunities and limitations for obtaining these inertia functions from Inverter-Based Renewable Generation resources (IRG)to benefit the electric grid. This included understanding how these synthetic inertia functions relate to the level of IRG deployment that the system can support. The team worked with the National Renewable Energy Laboratory (NREL) on modeling, simulation, and hardware testing of inertia response capabilities and their impact on the distribution and transmission systems. NREL's unique ability to test equipment aligned well with the goals of this project to demonstrate the capability to emulate inertia injection and support primary frequency control using energy storage and SI technologies. Ultimately, this could mitigate potential impacts due to the loss of inertia from large-scale centralized generation on the grid. The recommendations on future equipment performance requirements could help inform grid requirements, such as the Nuclear Energy Regulatory Commission's issuance of 2018 reliability guidelines (2018), as well as the California Electric Rule 21 SI provisions, to address reliability issues with inverter-based resources like PV and energy storage. Equipment standards, such as Institute of Electrical and Electronics Engineers 15473 for inverters, are also evolving and could evolve based on a more complete understanding of synthetic inertia.

- *EPIC 2.14 – Automatically Map Phasing Information:* This project partnered with the University of California (UC) Riverside to test an alternate algorithm-based approach using AMI and other data sources to determine the assignment of phases to meters and transformers, which was evaluated against other solutions demonstrated in the project.

Further Technology Advancement Needs

In addition to the achievements highlighted above, it is equally important to recognize the value of EPIC in determining that a technology is not ready to scale. The results of several EPIC projects found that more data, analysis, or technology advancement is necessary before the technology demonstrated is considered for adoption on a larger scale, which ultimately supports affordability for customers by not adopting the technology at scale before refinements are made to make the technology more viable. One of example of this is *EPIC 2.07 – Real-Time Loading Data for Distribution Operations and Planning.* This project built a platform to ingest and process AMI, SCADA, weather, PV generation, and topological data in real-time to generate near real-time load forecast information at a scale not previously implemented at PG&E. However, what was developed is not ready to be used in production at this time due to needs to improve the accuracy of the underlying forecast models. It is important that in further development of these models, systematic errors unrelated to the models that can have significant impact on forecast errors also be addressed.

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

B. Status of Programs

In D.13-11-025, the CPUC approved twenty seven of the 29 projects proposed by PG&E in the EPIC 1 Investment Plan, since two projects were

formally withdrawn by PG&E prior to the issuance of this decision.[5] In D.15-04-020, the Commission approved the thirty one projects proposed by PG&E in the EPIC 2 Plan.[6] In Res.E-4863, the Commission approved two of the six projects proposed by PG&E in the Tier 3 AL 5015-E filed between triennial EPIC Applications.[7] On April 28, 2017, PG&E filed A.17-04-028 for the third triennial investment plan period of 2018-2020 (referred to as EPIC 3) which included 43 proposed projects. On October 25, 2018 in D.18-10-052, the Commission approved the 43 projects in the proposed EPIC 3 Investment Plan with minor modifications.

PG&E has an internal governance structure intended to ensure that approved projects within the TD&D Program adhere to the EPIC guiding principles and requirements, as well as the potentially changing marketplace and evolving technologies to ensure PG&E maximizes this program to continue to meet customer needs while maintaining safety, reliability, resiliency, and affordability of the grid.

The following table summarizes the projects' funding status by area and triennial investment plan program cycle as of December 31, 2018.

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5 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.

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

7 In the Tier 3 AL 5015-E filed between triennial EPIC applications, PG&E originally proposed six projects. CPUC Res.E-4863 approved two (Projects 2.34 and 2.36) of the six proposed projects, allowed PG&E's withdrawal of one project (Project 2.31), deferred two projects to a future investment plan (Projects 2.32 and 2.33) and rejected one project (Projects 2.35).

TABLE1: SUMMARY OF PROJECT STATUS AND FUNDING BY PROGRAM CYCLE

EPIC Program Areas	EPIC 1	EPIC 2	EPIC 3	Total
Renewables / DER Resource Integration	**Projects: 3** • 1.01 Energy Storage End Uses • 1.02 Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction • 1.05 Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output ***Committed Funding: $6.0M - $7.3M**	**Projects: 5** • 2.02 Pilot DERMSs • 2.03A Test SI Enhanced Capabilities – PV • 2.03B Test SI Enhanced Capabilities – Vehicle to Home • 2.04 DG monitoring & Voltage Tracking • 2.05 Inertia Response Emulation for DG impact improvement **Committed Funding: $13.7M - $15.6M**	**Projects: 5** • 3.02 Utility Aggregated Resources with Market Participation • 3.03 DERMS and ADMS Advanced Functionality • 3.04 Multi-nodal Distributed Digital Ledger • 3.11 Location-Specific Options for Reliability and/or Resilience Upgrades • 3.42 Electric Load Management for Ridesharing Electrification **Committed Funding: $9.6M – 11.2M**	**Projects: 13** **Committed Funding: $29.3M - $34.1M**
Grid Modernization & Optimization	**Projects: 7** • 1.08 Improve Distribution System Safety & Reliability through New Data Analytics Techniques • 1.09A Test New Remote Monitoring and Control Systems for Existing Transmission & Distribution Assets: Close Proximity Switching • 1.09B/1.10B - Test New Remote Monitoring & Control System for T&D Assets / Demonstrate New Strategies and Tech to Improve the Efficacy of Existing Maintenance and Replacement Programs • 1.09C Test New Remote Monitoring and Control Systems for T&D Assets: Discrete Series Reactors • 1.14 Demonstrate “Next Generation” SmartMeter™ Telecom Network Function • 1.15 Demonstrate New Technologies and Strategies That Support Integrated “Customer-to-Market-to-Grid” Operations of the Future • 1.16 Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages **Committed Funding: $16.1M - $19.7M**	**Projects: 5** • 2.07 Real Time Loading Data for Distribution Operations & Planning • 2.10 Emergency Preparedness Modeling • 2.14 Automatically Map Phasing Information • 2.15 Synchrophasor Applications for Generator Dynamic Model Validation • 2.34 Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors **Committed Funding: $10.4M- $11.8M**	**Projects: 5** • 3.13 Transformer Monitoring via Field Area Network (FAN) • 3.15 Proactive Wires Down Mitigation • 3.20 Data Analytics for Predictive Maintenance • 3.21 Advanced Vegetation Management Insights using Prescriptive Analytics • 3.43 Service Issue Identification Leveraging Momentary Outage Information **Committed Funding: $13.0M - $15.2M**	**Projects: 17** **Committed Funding: $39.5M - $46.7M**

TABLE1: SUMMARY OF PROJECT STATUS AND FUNDING BY PROGRAM CYCLE (CONTINUED)

EPIC Program Areas	EPIC 1	EPIC 2	EPIC 3	Total
Customer Service & Enablement	**Projects: 7** • 1.18 Demonstrate SmartMeter™-Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information • 1.19 Pilot Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform • 1.21 Pilot Methods for Automatic Identification of DERs (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability • 1.22 Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility • 1.23 Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility • 1.24 Demonstrate DSM for T&D Cost Reduction • 1.25 Develop a Tool to Map The Preferred Locations for DC Fast Charging, Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs While Reducing the Impact on PG&E's Distribution Grid **Committed Funding: $8.7M - $10.6M**	**Projects: 5** • 2.19 Enable Distributed Demand-Side Strategies & Technologies • 2.21 Home Area Network (HAN) for Commercial Customers • 2.22 Demand Reduction through Targeted Data Analytics • 2.23 Integrate Demand Side Approaches into Utility Planning • 2.36 Dynamic Rate Design Tool **Committed Funding: $9.3M-$10.5M**	**Projects: 3** • 3.27 Multi-Purpose Meter (MPM) • 3.29 Advanced Customer Bill Scenario Calculator • 3.32 System Harmonics for Power Quality Investigations **Committed Funding: $3.6M - $4.2M**	**Projects: 15** **Committed Funding: $21.6M - $25.3M**
Cross-Cutting/ Foundational	**Projects: 0** **Committed Funding: $0M**	**Projects: 4** • 2.26 Customer & Distribution Automation Open Architecture Devices • 2.27 Next Generation Integrated Smart Grid Network Mgmt. • 2.28 Smart Grid Communications Path Monitoring • 2.29 Mobile Meter Applications **Committed Funding: $6.9M-$7.8M**	**Projects: 1** • 3.41 Drone Enablement and Operational Use **Committed Funding: $2.1M - $2.5M**	**Projects: 5** **Committed Funding: $9.0M - $10.3M**
Summary	**Total Funded Projects: 17** **Total Committed Funding: $30.8M-$37.7M** **Total Project Funding Encumbered: $22.3M** **Total Project Funding Spent to Date: $34.6M*** **Total Administrative Costs Spent to Date: $2.8M**	**Total Funded Projects: 19** **Total Committed Funding: $40.2M-$45.7M** **Total Project Funding Encumbered: $23.2M** **Total Project Funding Spent to Date: $40.8M** **Total Administrative Costs Spent to Date: $3.2M**	**Total Funded Projects: 14** **Total Committed Funding: $28.6M – $33.1M** **Total Project Funding Encumbered: 0** **Total Project Funding Spent to Date: $43.9k** **Total Administrative Costs Spend to Date: $3.8k**	**Total Funded Projects: 50** **Total Committed Funding: $101.5M - $116.4M** **Total Project Funding Encumbered: $45.5M** **Total Project Funding Spent to Date: $75.4M** **Total Administrative Costs Spent to Date: $6.0M**

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

**EPIC Project funding spent to date includes $49k of IT and post-project IP spend.*

2. Introduction and Overview

A. Background on EPIC

Funding for EPIC is authorized in Public Utilities Code (Pub. Util. Code) Section 399.8, which governed the Public Goods Charge (PGC) until expiration on January 1, 2012. The Commission opened an OIR (R.11-10-003) to establish the Electric Program Investment Charge to preserve funding for the public ratepayer benefits associated with the renewables and RD&D activities provided by the electric PGC. The rulemaking included two phases, with Phase 1 to establish the EPIC Program on an interim basis in 2012, and Phase 2 to establish purposes and governance for EPIC to continue from 2013-2020.[8] The EPIC Program Administrators include the CEC and three Electric IOUs: PG&E, SCE, and SDG&E.

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

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

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

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

approved the second triennial investment plan period of 2015-2017 (EPIC 2). On October 25, 2018 in D.18-10-052, the Commission approved the third triennial investment plan period of 2018-2020 (EPIC 3).

The EPIC Program is designed to assist the development of pre-commercialized, new, and emerging clean energy technologies in California, while providing assistance to commercially viable projects. The goal of the EPIC Program is to support projects that help advance new technologies that further safety, reliability and affordability while advancing California's clean energy goals, including Senate Bill 17 Smart Grid Goals and Pub. Util. Code Section 740.1 goals focused on renewables integration and resource conservation, as well as GHG emissions reductions, economic development and low-emission vehicle and transportation support. EPIC supported activities are mapped to the different elements in the electricity-system value chain consisting of: Grid Operations/Market Design, Generation, Transmission, Distribution, and 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 R&D; (2) TD&D; and (3) Market Facilitation which consists of market research, regulatory permitting and streamlining, and workforce development activities. PG&E and the other IOU administrators were designated to administer EPIC funds only in the area of TD&D. The CEC was designated to administer funds in all areas, including a portion of TD&D.

C. EPIC Program Regulatory Process

The Phase 2 decision defines the regulatory process and governance for the EPIC Program. The decision requires EPIC Program Administrators to submit Triennial Investment Plans to cover 3-year cycles for 2012-2014, 2015-2017, and 2018-2020. The investment plans must include details about planned investments, as well as criteria for selecting and evaluating proposals. Each plan must be evaluated and approved by the Commission prior to program implementation. To date, Administrators have filed three Triennial Investment Plans for 2012-2014, 2015-2017 and 2018-2020. On October 25, 2018 in D.18-10-052, the Commission approved the EPIC 3 Investment Plan.

In addition to the Triennial Investment Plans, the Administrators are required to file Annual Reports each year on February 28 through 2020, as well as Final Reports for each project.

D. Coordination

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

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

D.18-10-052 requires the IOUs to prepare and serve a joint application containing a Research Administration Plan (RAP) that identifies the changes they will make to their administrative processes in response to the recommendations made in the independent evaluation of the EPIC Program conducted by Evergreen Economics in 2017. The IOUs have begun to collaborate to develop improvements, and they plan to conduct workshops in February and April 2019 to solicit input from EPIC stakeholders and other peer R&D programs. The joint RAP will be filed by May 1, 2019.

E. Transparent and Public Process

The Program's Administrators hold stakeholder workshops during the planning and implementation of the EPIC Triennial Investment Plans to ensure stakeholder feedback is received and incorporated. These stakeholder workshops to prepare for the Third Triennial Investment Plan were executed at the beginning of 2017 in advance of the EPIC 3 Application. Additionally, Administrators continue to engage with industry stakeholders by participating in and presenting at conferences, as well as hosting workshops/symposiums annually.

In 2018, EPIC Administrators jointly organized an EPIC Symposium on February 7 in Sacramento, California, and a stakeholder workshop on November 9 in Fresno, California. The objective of the all-day symposium was to publicly showcase a variety of EPIC projects, including EE, renewables, and smart grid technologies. PG&E presented two projects: *EPIC 1.02 – Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction* and *EPIC* 2.19 – *Enable Distributed Demand-Side Strategies & Technologies*. The objective of the November workshop was to provide stakeholders with an overview of planned EPIC 3 work, and provide them with an opportunity to inform the scoping of those projects. The focus of the workshop was on projects that align with grid resiliency and projects of particular applicability to Disadvantaged Communities (DAC). PG&E presented three projects: *EPIC 3.15 – Proactive Wires Down Mitigation*, *EPIC 3.21 - Advanced Vegetation Management Insights Using Prescriptive Analytics* and *EPIC 3.29 – Advanced Customer Bill Scenario Calculator*. This symposium and workshop provided a mechanism to engage with industry stakeholders and bring transparency to the EPIC program and associated projects. Public notice for these events is provided to a broad range of stakeholders including technology vendors, DAC, diverse suppliers, researchers, academics and energy consultants. The utilities and the CEC will continue to maintain transparency in the process via webinars and workshops. Furthermore, PG&E's EPIC Program continues to remain accessible to the interested public. PG&E's EPIC website (www.pge.com/epic) includes EPIC Program information and updates, as well as EPIC annual reports and projects' final reports.

3. Budget

A. Authorized Budget

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

TABLE 2: TOTAL AUTHORIZED BUDGET BY PROGRAM CYCLE

Total Authorized Budgets	**PG&E Program Budget** *(TD&D only)*	**PG&E Admin. Budget** *(TD&D only)*	**CEC Program Budget*** *(TD&D, Applied R&D, & Market Facilitation)*	**CEC Admin Budget*** *(TD&D, Applied R&D, & Market Facilitation)*	**CPUC Regulatory Oversight Budget**
EPIC 1: 2012-2014	$43.3 Million	$4.9 Million	$166.2 Million	$18.5 Million	$1.2 Million
EPIC 2: 2015-2017	$45.7 Million	$5.1 Million	$182.9 Million	$20.4 Million	$1.3 Million
EPIC 3: 2018-2020	$49.7 Million	$5.5 Million	$199.1 Million	$22.2 Million	$1.4 Million

**portion remitted by PG&E*

B. Commitments[10]/Encumbrances[11]

The following table outlines the PG&E total financial commitments and encumbrances, as well the remittances made to both the CEC and CPUC beginning from program inception through December 31, 2018.

TABLE 3: TOTAL COMMITMENTS/ENCUMBRANCES BY PROGRAM CYCLE

Commitments/ Encumbrances	PG&E Total Commitments*	PG&E Total Encumbrances	CEC Program Remittance	CEC Admin Remittance	CPUC Remittance
EPIC 1: 2012-2014	$30.8 - $37.7 Million	$22.8 Million	$166.2 Million	$18.5 Million	$1.2 Million
EPIC 2: 2015-2017	$40.2 - $45.7 Million	$18.3 Million	$164.6 Million	$20.4 Million	$1.3 Million
EPIC 3: 2018-2020	$28.6 – 33.1 Million	$0 Million	$0 Million	$8.1 Million	$0.5 Million

**PG&E Total Commitments do not include PG&E Admin costs.*

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

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

C. Dollars Spent on In-House Activities

The following table outlines the PG&E total in-house project expenditures and administrative costs, beginning from program inception through December 31, 2017.

TABLE 4: TOTAL DOLLARS SPENT ON IN-HOUSE ACTIVITIES BY PROGRAM CYCLE

Program Cycle	PG&E In-House TD&D Project Expenditures *	PG&E In-House Program Administrative Costs
EPIC 1: 2012-2014	$11.5 Million	$1.6 Million
EPIC 2: 2015-2017	$18.3 Million	$2.6 Million
EPIC 3: 2018-2020	$0.04 Million	$0.003 Million

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

D. Fund Shifting Above 5 Percent between Program Areas

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

E. Uncommitted/Unencumbered Funds[12]

Projects without committed funding are pending further project and benefits analysis. The range of uncommitted funds is dependent on the range of authorized budget and committed funds as identified in Sections 3a and 3b, respectively. The following table outlines the PG&E uncommitted/unencumbered funding for each program cycle as of December 31, 2018.

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

TABLE 5: TOTAL UNCOMMITTED/UNENCUMBERED FUNDS BY PROGRAM CYCLE

Program Cycle	Uncommitted/Unencumbered Project Funds
EPIC 1: 2012-2014	$5.5 – $12.5 Million
EPIC 2: 2015-2017	$0 – $5.5 Million
EPIC 3: 2018-2020	$16.6* – 21.1 Million

**This amount is 1/3 of the approved $49.7 Program Funds.*

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, 2018. The Project Status Report is based on the format provided in Attachment 6 of D.13-11-025.

C. Project Descriptions and Updates

The project descriptions and updates included below are for EPIC 1, EPIC 2, and EPIC 3 projects. Projects that are on hold have been included in the summary.

Project #1.01 – Energy Storage End Uses

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Grid Operation/Market Design

iii. Objective

- Develop technologies and strategies for efficient and optimized bidding and scheduling of Energy Storage Technologies (EST) in California Independent System Operator (CAISO) markets and demonstrate those strategies using PG&E's existing Sodium Sulfur Battery Energy Storage Systems (NaS BESS).
- This project addresses the following CPUC proceedings:
  - As applicable, operational experiences gained from this project can inform outstanding policy and implementation issues as identified in Energy Storage OIR, R.15-03-011.

iv. Scope

- Develop and deploy technology to enable automated resource response to CAISO market awards.
- Quantify the values that battery resources can capture in CAISO markets.
- Establish financial performance of battery resource participation in CAISO markets.

v. Deliverables

- Demonstrate automated and remote-control application for generic energy storage resources to interface with existing 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 framework/recommendations for accounting standards applicable to energy storage.

vi. Metrics

- 1i – Nameplate capacity (megawatts) of grid-connected energy storage.
- 3a – Maintain/Reduce operations and maintenance costs.
- 6a – CAISO NGR financial settlements.
- 7b – Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Pub. Util. Code § 8360).

- 7c – Dynamic optimization of grid operations and resources, including appropriate consideration for asset management and utilization of related grid operations and resources, with cost-effective full cyber security (Pub. Util. Code § 8360).
- 7l – Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services (Pub. Util. Code § 8360).
- 9c – EPIC project results referenced in regulatory proceedings and policy reports (Business Plan references: CPUC R.10-12-007).

vii. Schedule

- 2.75 years

viii. EPIC Funds Encumbered

- $616,857

ix. EPIC Funds Spent

- $1,833,968

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

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

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

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Distribution; Grid Operation/Market Design

iii. Objective

- Demonstrate the ability of a utility operated energy storage asset to address capacity overloads on the distribution system and improve reliability.
- This project addresses the following California Public Utilities Commission (CPUC) proceedings:
  - This project will count towards the IOU energy procurement targets as set forth in D.10-03-040, the Energy Storage Procurement Framework.
  - As applicable, operational experiences gained from this project can inform outstanding policy and implementation issues as identified in Energy Storage OIR R.15-03-011.

iv. Scope

- Deploy utility operated energy storage asset at a single site.
- Demonstrate peak shaving use case along with other site-specific use cases as suggested by distribution operators.

v. Deliverables

- Identify energy storage site based on project objectives.
- Identify an economic modeling tool to compare the planned traditional utility with alternatives using distributed resources or demand-side investments.
- Construct and integrate energy storage system.
- Test system and analyze results to prove project objectives.

vi. Metrics

- 1c – Avoided procurement and generation costs.
- 7b – Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Pub. Util. Code § 8360).
- 7d – Deployment and integration of cost-effective distributed resources and generation, including renewable resources (Pub. Util. Code § 8360).
- 9c – EPIC project results referenced in regulatory proceedings and policy reports (Business Plan references: Deferring a capacity upgrade has been identified as a key potential value of Energy Storage Technologies (EST) and noted in filings with the CPUC/Assembly Bill (AB) 2514.

vii. Schedule

- 3.5 years

viii. EPIC Funds Encumbered

- $2,686,621

ix. EPIC Funds Spent

- $4,010,510

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- No

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

- Project completed in February 2018.
- Final Report included in 2017 EPIC Annual Report.

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

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

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

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

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

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

xv. Status Update

- Project is currently on hold.

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

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

ii. Assignment to Value Chain
- Grid operations/market design

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

iv. Scope
- N/A

v. Deliverables
- N/A

vi. Metrics
- N/A

vii. Schedule
- N/A

viii. EPIC Funds Encumbered
- N/A

ix. EPIC Funds Spent
- N/A

x. Partners (if applicable)
- N/A

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

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- N/A

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

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

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

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Distribution

iii. Objective

- Demonstration of emerging capabilities in mesoscale modeling to provide more granular and accurate weather forecasting input to 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 related to fire, storms and solar production.
- Not in scope for this project are enhancements to PG&E's RWP, other than improved forecast damage numbers.

v. Deliverables

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

vi. Metrics

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

vii. Schedule

- 3.25 years

viii. EPIC Funds Encumbered

- $535,055

ix. EPIC Funds Spent

- $823,890

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

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

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

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

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

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

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- TBD

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

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

xv. Status Update
- Project is currently on hold.

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

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Grid operations/market design

iii. Objective

- There are 33 General Electric (GE) 7FA gas turbines installed in combined cycle configurations in California, which is considerably more than any other turbine model. GE offers a product marketed as "OpFlex Balance" that uses advanced controls technology to improve ramp rates to as high as 40 megawatts (MW) per minute (or higher in some cases). As of October 2012, none of the 7FAs in California were using this product. This project proposes to demonstrate improved ramp rate capabilities on one 7FA so that it can serve as a model for the rest of the 7FA fleet. It is assumed that there would be cost share with the vendor and the selected plant owner.

iv. Scope

- N/A

v. Deliverables

- N/A

vi. Metrics

- N/A

vii. Schedule

- N/A

viii. EPIC Funds Encumbered

- N/A

ix. EPIC Funds Spent

- N/A

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- N/A

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

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

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

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Transmission; Distribution

iii. Objective

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

iv. Scope

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

v. Deliverables

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

vi. Metrics

- 7c – Dynamic optimization of grid operations and resources; including appropriate consideration for asset management and utilization of related grid operations and resource, with cost-effective full cyber security (Pub. Util. Code § 8360).

- 3a – Maintain/Reduce operations and maintenance costs: With the improved understanding of risk, there could be a better tool for evaluating projects such as asset replacement.

vii. Schedule

- 2.25 years

viii. EPIC Funds Encumbered

- $1,249,505

ix. EPIC Funds Spent

- $2,112,640

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

- Project completed in 2015.
- Final report included in 2015 EPIC Annual Report.

Project #1.09A – Test New Remote Monitoring and Control Systems for Existing Transmission and Distribution Assets: Close Proximity Switching

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

ii. Assignment to Value Chain
- Transmission; Distribution

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

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

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

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

vii. Schedule
- 2.5 years

viii. EPIC Funds Encumbered
- $301,808

ix. EPIC Funds Spent
- $515,268

x. Partners (if applicable)
- N/A

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

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

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

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

Project #1.09B and 1.10B – Test New Remote Monitoring and Control Systems for T&D Assets / Demonstrate New Strategies and Technologies to Improve the Efficacy of Existing Maintenance and Replacement Programs

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Transmission; Distribution

iii. Objective

- The project focus is on development, testing, deployment, and implementation of new technologies, construction methods and techniques, and cost reduction techniques in support of the SCADA monitoring systems used on the Distribution Networks. The monitoring system consists of a complex and extensive set of components used to assess the health and condition of the network transformers on a continuous basis. This research is looking at potential failure points on the monitoring system components and what technologies and improvements can be applied to increase life expectancy of these components and reduce production and maintenance costs for this system and similar systems.

iv. Scope

- Assess new technologies and feasibility of application on the Distribution Networks.
- Primary focus on technologies, components and work methods to extend the life expectancy of monitoring systems equipment and reduce long term maintenance costs.

v. Deliverables

- Modified or improved components identified for use on Distribution Network Monitoring System.
- Improved installation and construction work methods.
- Economic model for maintenance variables based on life expectancy testing of components.
- Changes to components.

vi. Metrics

- 3a – Maintain/Reduce operations and maintenance costs.
- 3b – Maintain/Reduce capital costs.
- 5d – Public safety improvement and hazard exposure reduction.
- 5e – Utility worker safety improvement and hazard exposure reduction.

vii. Schedule

- 3.25 years

viii. EPIC Funds Encumbered

- $484,250

ix. EPIC Funds Spent

- $547,681

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

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

Project #1.09C – Test New Remote Monitoring and Control Systems for T&D Assets: Discrete Series Reactors

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Transmission

iii. Objective

- Gain operating experience with Discrete Series Reactors (DSR) to determine whether such devices would be cost effective and operate reliably and safely on Pacific Gas and Electric Company's (PG&E) transmission system.

iv. Scope

- Install and test 90 DSR units on the Las Positas-Newark 230 kV line.
- Install and test Server at PG&E's San Francisco General Office (SFGO) headquarters, complete with Smart Wire System Manager Software.
- Communication links between the DSRs and server to support the DSR monitoring and control.

v. Deliverables

- Installation, testing and analysis of DSR and server communication links.
- Procure, construct and test the DSRs.
- White paper describing project including go/no go recommendation.
- Final report describing overall project, including finding from the operations and testing of DSR units and a recommendation as to whether or not to install the DSRs elsewhere in the PG&E system.

vi. Metrics

- 3a – Maintain/Reduce operations and maintenance costs.
- 3b – Maintain/Reduce capital costs.
- 5a – Outage number, frequency and duration reductions.
- 5b – Electric system power flow congestion reduction.

vii. Schedule

- 3.25 years

viii. EPIC Funds Encumbered

- $1,449,835

ix. EPIC Funds Spent

- $2,459,732

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

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

Project #1.10A – Demonstrate Automated Asset Notification and Management Systems: Dissolved Gas Analysis

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

ii. Assignment to Value Chain
   - Transmission; Distribution

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

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

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

xv. Status Update
   - Project is currently on hold.

Project #1.10C – Demonstrate Automated Asset Notification and Management Systems: Underground Cable Analysis

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

ii. Assignment to Value Chain
   - Distribution

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

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

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

xv. Status Update
   - Project is currently on hold.

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

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

ii. Assignment to Value Chain
   - Transmission; Distribution

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

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. Status Update

- Project is currently on hold.

Project #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
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

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

xv. Status Update
   - Project is currently on hold.

Project #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
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

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

xv. Status Update

- Project is currently on hold.

Project #1.14 – Demonstrate "Next Generation" SmartMeter™ Telecom Network Functionalities

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Distribution; Grid Operation/Market Design; DSM

iii. Objective

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

iv. Scope

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

v. Deliverables

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

vi. Metrics

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

vii. Schedule

- 3.25 years

viii. EPIC Funds Encumbered

- $3,986,281

ix. EPIC Funds Spent

- $4,133,426

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- Patents filed for –
  - Smart Pole Meter
  - Smart Pole Meter Socket and
  - An algorithm to help identify downed wires

xv. Status Update

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

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

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Distribution; Grid Operation/Market Design; DSM

iii. Objective

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

iv. Scope

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

v. Deliverables

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

vi. Metrics

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

vii. Schedule

- 3.25 years

viii. EPIC Funds Encumbered

- $1,334,030

ix. EPIC Funds Spent

- $4,133,173

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

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

xv. Status Update

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

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

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Distribution

iii. Objective

- Leverage plug-in hybrid vehicle technology emerging in Pacific Gas and Electric Company (PG&E) fleet to generate utility-grade power, supporting distribution circuits during planned or unplanned outage events.

iv. Scope

- Develop nominally 120-kilowatt exportable power capabilities from a plug-in hybrid electric truck. Seek to create the protocols necessary to safely connect the truck to the appropriate grid connection points. The portfolio of fleet vehicles (higher and lower weight classes) may broaden the range of available power ratings demonstrated by the project.

v. Deliverables

- Develop operating requirements for the vehicle.
- Understand engineering challenges with high power export with collaborative supplier development to solve.
- Develop safety and interconnection protocols to connect the vehicle to the grid leveraging existing protocols for temporary local generator set connection.
- Define and document power requirements for different outage/usage scenarios.
- Develop operating protocols (when and how the vehicles will be used).
- Develop unplanned outage protocols.
- Develop the hardware and software (if required) to connect the vehicle to PG&E's system.
- Build vehicles for field testing.

vi. Metrics

- 5a – Outage number, frequency and duration reductions.
- 5e – Utility worker safety improvement and hazard exposure reduction.
- 3a – Maintain/Reduce operations and maintenance costs.
- 4a – GHG emissions reductions (MMTCO2e).

vii. Schedule

- 3.25 years

viii. EPIC Funds Encumbered

- $1,688,840

ix. EPIC Funds Spent

- $4,009,788

x. Partners (if applicable)

- 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

xv. Status Update

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

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

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Transmission; Distribution

iii. Objective

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

iv. Scope

- TBD

v. Deliverables

- TBD

vi. Metrics

- TBD

vii. Schedule

- TBD

viii. EPIC Funds Encumbered

- $0

ix. EPIC Funds Spent

- $0

x. Partners (if applicable)

- TBD

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. Status Update

- Project is currently on hold.

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

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

ii. Assignment to Value Chain
- DSM

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

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

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

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

vii. Schedule
- 2.5 years

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

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

x. Partners (if applicable)
- N/A

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

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

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

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

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

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

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Distribution; Grid Operation/Market Design; DSM

iii. Objective

- The project is to explore and discover effective, new data that can be collected and studied for further benefits. Demonstrate the type of additional data that can be collected and/or processed through the SmartMeter™ platform. Evaluate impact of any increased data traffic on the SmartMeter™ network. Focus on new data collection that makes the SmartMeter™ platform more robust for more customers.

iv. Scope

- Demonstrate the collection of new data from SmartMeter™ devices. Example use cases include:
  - Power Quality Data (C12.19 format).
  - New Data Channels.
  - Mobile data collection methods.
  - Power theft detection methodology using SmartMeter™ data for revenue assurance purposes.

v. Deliverables

- Evaluate new data and analytic methodologies, their associated impact on the SmartMeter™.
- Recommendation of which data warrants consideration for full-scale deployment.
- Evaluation should provide key inputs to a business case for general deployment.

vi. Metrics

- 1h – Customer bill savings (dollars saved).
- 1f – Avoided customer energy use (kilowatt-hours saved).
- 3a – Maintain/Reduce operations and maintenance costs.
- 3b – Maintain/Reduce capital costs.
- 5d – Public safety improvement and hazard exposure reduction.
- 5e – Utility worker safety improvement and hazard exposure reduction.
- 5f – Reduced flicker and other power quality differences.

- 5i. – Increase in the number of nodes in the power system at monitoring points.
- 7f – Deployment of cost-effective smart technologies, including real time, automated, interactive technologies that optimize the physical operation of appliance and consumer devices for metering, communications concerning grid operations and status, and distribution automation.
- 7b – Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid.

vii. Schedule

- 3.25 years

viii. EPIC Funds Encumbered

- $1,054,506

ix. EPIC Funds Spent

- $1,980,499

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

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

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

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Customer Service and Enablement

iii. Objective

- This project will fund continued support of Green Button Connect (GBC). GBC provides a small number of vendors in the competitive market with automated access to recurring, machine-to-machine, programmatic data access to customer-authorized SmartMeter™ data in order to develop new, innovative and creative ways for customers to manage their energy consumption. GBC is a small demonstration, not scalable to support the larger customer base and wider vendor audience. PG&E is planning on implementing a robust, broader scale offering as part of its Customer Data Access (CDA) project.

iv. Scope

- N/A

v. Deliverables

- N/A

vi. Metrics

- N/A

vii. Schedule

- N/A

viii. EPIC Funds Encumbered

- N/A

ix. EPIC Funds Spent

- N/A

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- N/A

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

- Formally notified CPUC on 10-31-13, project may be terminated as refined scope does not appear to meet safety, reliability, affordability guiding principles for priority R&D.

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

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Distribution; DSM

iii. Objective

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

iv. Scope

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

v. Deliverables

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

vi. Metrics

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

vii. Schedule

- 2.5 years

viii. EPIC Funds Encumbered

- $868,495

ix. EPIC Funds Spent

$1,327,782

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for performance

xiv. Treatment of Intellectual Property (if applicable)

- Patent filed for an algorithm which can detect unauthorized PV Interconnections.

xv. Status Update

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

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

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

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

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

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

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

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

vii. Schedule
- 5 years

viii. EPIC Funds Encumbered
- $ 2,756,187

ix. EPIC Funds Spent
- $2,243,025

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. 2018 Status Update

- Project is in the Closeout phase.
- In 2018, completed de-enrollment and final billing for all pilot participants; completed final incentive processing for the pilot
- Submeter testing was done by PG&E and then also by an independent lab retained by Nexant.
- Nexant submitted their independent Evaluation Report which is currently being reviewed by CPUC and the IOUs
- Next steps include finalizing the Nexant independent Evaluation Report and the EPIC Project Final Report.

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

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Grid Ops and Market Design/Distribution/DSM

iii. Objective

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

iv. Scope

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

v. Deliverables

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

vi. Metrics

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

vii. Schedule

- 2.5 years

viii. EPIC Funds Encumbered

- $950,313

ix. EPIC Funds Spent

- $1,323,817

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

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

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

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

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

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

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

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

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

vii. Schedule
- 2 years

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

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

x. Partners (if applicable)
- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

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

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

i. Investment Plan Period

- 1st Triennial (2012-2014)

ii. Assignment to Value Chain

- Distribution; DSM

iii. Objective

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

iv. Scope

- Acquire travel pattern data and grid infrastructure capability data to identify low-cost, high utilization areas in which to integrate DC fast chargers into 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.
- 4a – GHG emissions reductions (MMTCO2e).
- 5c – Forecast accuracy improvement.
- 5d – Public safety improvement and hazard exposure reduction.
- 7b – Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Pub. Util. Code § 8360).
- 7l – Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.

vii. Schedule

- 2.5 years

viii. EPIC Funds Encumbered

- $391,425

ix. EPIC Funds Spent

- $440,769

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

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

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

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

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

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

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. Status Update

- Project is currently on hold.

Project #2.01 – 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; DSM

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
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Project not executed.

Project #2.02 – Pilot Distributed Energy Resource Management Systems (DERMS)

i. Investment Plan Period

- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain

- Grid Operation/Market Design

iii. Objective

- Demonstrate new technology to monitor and control DERs to manage system constraints and evaluate the potential value of DER flexibility to the grid. The DERMS demonstration will drive learning about the people, process, and technology needed to operate the high DER penetration grid of 2025.
- Objective 1: Define DERMS Product Requirements and Characterize PG&E DERMS Needs
- Objective 2: Define Boundaries and Integrations with Internal and External Systems
- Objective 3: Demonstrate Technical Feasibility of Utilizing DERMS to Manage DERs for Distribution Grid Services
- Objective 4: I mplement and Evaluate Economic Optimizations and Market Mechanisms for DER-Provided Distribution Services
- Objective 5: Perform DERMS Deployment Readiness Assessment and Create Deployment Strategy
- This project informs California Public Utilities Commission proceeding, Distribution Resources Plan R.14-08-013 to inform distribution planning by demonstrating DER integration into planning and operations.

iv. Scope

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

v. Deliverables

- The functional integration of a DERMS software minimum viable product and operational demonstration of the identified use cases.
- A report that:
  - Determines the most important characteristics of a full deployment solution including detailed functional and technical requirements.
  - Identifies best practices and required internal capabilities for a full deployment solution.
  - Develops operational processes that can be scaled to a wider system deployment.

- Defines boundaries and integrations with other PG&E systems (e.g., DRMS, DMS, market systems).
- Develops a point of view on the utility role in managing DERs for grid and economic benefits.

vi. Metrics

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

vii. Schedule

- 2.75 years

viii. EPIC Funds Encumbered

- $2,426,740

ix. EPIC Funds Spent

- $6,796,342

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- $419,000

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. 2018 Status Update

- Project completed in January 2019
- The project provided an opportunity for PG&E to define and deploy a DERMS and supporting technology to uncover barriers and specify requirements to prepare for the increasing challenges and opportunities of DERs at scale. The DERMS Demo was a field demonstration of optimal control of a portfolio of 3rd party aggregated behind-the-meter (BTM) solar and energy storage and utility front-of-the-meter (FTM) energy storage to provide distribution capacity and voltage support services while also allowing for participation of these same DERs in the CAISO wholesale market.

- Additionally, the DERMS Demo explored the ability to manage DERs that participate in wholesale markets to also provide distribution and customer services to enable DER value stacking, often referred to as multiple use applications (MUA).
- Final Report included in this 2018 EPIC Annual Report.

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

i. Investment Plan Period

- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain

- Distribution; DSM

iii. Objective

- This project will explore the use and impact of aggregated customer-sited SIs to help inform emerging industry standards, as well as define the operational and communication requirements to support the advancement and deployment of new inverter technologies.
- This project addresses California Public Utilities Commission proceeding, Distribution Resources Plan R.14-08-013, by informing DERs modeling by incorporating SIs. The findings of this report will also support and inform PG&E's position within the Rule 21 open proceeding.

iv. Scope

- Evaluate the technical ability of SIs to influence secondary and primary voltage through field demonstrations in two distinct locations, by adjusting reactive and real power output autonomously.
- Measure customer curtailment from Volt-VAR/Volt-Watt function activation.
- Demonstrate and evaluate the reliability of communications to provide visibility, monitoring and change settings for SI-equipped PV using both a vendor-specific aggregation platform and a vendor-agnostic utility aggregation platform.
- Clarify SI technology requirements to integrate and operate SIs, and characterize challenges to deployment at scale relative to today.
- Through lab testing, understand SI performance under a range of distribution grid conditions.
- Through a vendor-led modeling effort, evaluate the impact of BTM residential PV and PV + Storage with and without SIs and perform an economic analysis of SIs on PG&E's system as compared to traditional distribution grid upgrades.

v. Deliverables

- Identify feeder(s) where SIs will be installed for demonstration.
- Demonstrate the use of residential and commercial SIs on multiple distribution feeders to demonstrate the inverters' local voltage control capabilities and power quality impacts related to high penetration of customer-sited solar PV.
- Develop necessary communications software/hardware/technologies between the utility and two different third-party SI aggregators.

- Design and implement data architectures to support satellite and cellular interaction with remote SIs.
- Quantify and qualify performance of multiple SI models from different manufacturers in lab testing.
- Implement automated Volt-VAR and Volt-Watt curves, with a quantification of ability to perform different grid services.
- Lab-test electric vehicle service equipment (EVSE) performance under a large range of harmonic content, to identify any chance of poor behavior.
- Through a modeling effort, provide an economic assessment of SI functions' effectiveness in deferring certain distribution upgrades associated with high DER penetration.

vi. Metrics

- 3a – Maintain/Reduce operations and maintenance costs.
- 3b – Maintain / Reduce capital costs.
- 3e – Non-energy economic benefits
- 5f – Reduced flicker and other power quality differences
- 7b – Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Pub. Util. Code § 8360)
- 7d – Deployment and integration of cost-effective distributed resources and generation, including renewable resources (Pub. Util. Code § 8360)

vii. Schedule

- 3.5 years

viii. EPIC Funds Encumbered

- $2,797,781

ix. EPIC Funds Spent

- $4,963,351

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. 2018 Status Update

- Project completed in February 2019.
- This project demonstrated the functionality and grid impacts of SIs through a field demonstration, a lab testing, and modeling.
- The field demonstration targeted high voltage issues attributed to high PV penetration as well as an evaluation of a vendor-agnostic aggregation platform that allowed for the remote management of SI-enabled PV assets.
- The demonstration also used PG&E laboratory facilities to evaluate the ability of multiple vendors' SI products to execute Rule 21 SI functions and employed the EPRI to model SI performance and economic analysis on simulated PG&E distribution feeders.
- Final Report included in this 2018 EPIC Annual Report.

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

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

ii. Assignment to Value Chain
- Distribution; DSM

iii. Objective
- Assessment of the use and impact of EV energy flow capabilities as a complement to the SI assessment related to PVs in project 2.03A SIs for PV.

iv. Scope
- Technology demonstration for charging and discharging of the Electric Vehicle (EV) in response to DR or hard islanding events.
- Testing multiple test modes.
- Technology assessment from customer and ratepayer perspectives through a customer survey and a cost-benefit evaluation.

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

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

vii. Schedule
- 2 years

viii. EPIC Funds Encumbered
- $225,158

ix. EPIC Funds Spent
- $534,113

x. Partners (if applicable)
- N/A

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

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

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

- Project completed in February 2018.
- Final Report included in 2017 EPIC Annual Report.

Project #2.04 – DG Monitoring & Voltage Tracking

i. Investment Plan Period

- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain

- Grid Operations/Market Design

iii. Objective

- Utilization of the voltage measurement capabilities of SmartMeter™ devices to monitor DG output and identify voltage fluctuations caused by the intermittent nature of distributed renewable resources.
- Use of data analytics techniques and AMI (and other) data to determine the impact of PV penetration on Rule 2 violations and
- Create rating for the probability that a Rule 2 violation is caused by DG.

iv. Scope

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

v. Deliverables

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

vi. Metrics

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

vii. Schedule

- 2 years

viii. EPIC Funds Encumbered

- $745,762

ix. EPIC Funds Spent

- $1,233,293

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

- Project completed in 2017.
- Final Report included in 2017 EPIC Annual Report.

Project #2.05 – Inertia Response Emulation for DG Impact Improvement

i. Investment Plan Period

- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain

- Grid Operations/Market Design; Transmission

iii. Objective

- Demonstrate the capability to emulate inertia injection and support primary frequency control using energy storage and SI 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 DG on the grid.

iv. Scope

- Develop computer models to evaluate inverter capabilities and demonstrate possible future system needs for new inertia support solutions.
- Analyze and optimize the present technology's energy storage inertial response capabilities via Power-Hardware-In-Loop testing.

v. Deliverables

- Evaluation of the power system's need for reliability support, including identifying threshold conditions.
- Assessment of the capabilities of present energy storage inverters for inertial frequency response functions.
- Provide recommendations for future inverter and interconnection requirements to provide inertial response.

vi. Metrics

- 1a. – Number and total nameplate capacity of DG facilities
- 1b. – Total electricity deliveries from grid-connected DG facilities
- 1i. – Nameplate capacity (MW) of grid-connected energy storage
- 3e. – Non-energy economic benefits (reliability)
- 5a. – Outage number, frequency and duration reductions
- 7b. – Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Pub. Util. Code § 8360)
- 7d. – Deployment and integration of cost-effective distributed resources and generation, including renewable resources (Pub. Util. 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 (Pub. Util. Code § 8360)

vii. Schedule

- 2 years

viii. EPIC Funds Encumbered

- $589,375

ix. EPIC Funds Spent

- $1,291,659

x. Partners (if applicable)

- NREL selected as testing and demonstration provider.

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. 2018 Status Update

- Project completed in February 2019.
- This project explored the capabilities of inverter-based energy resources to provide a set of functions related to system inertia which support the electric system.
- The project demonstrated via transmission system modeling and Power-Hardware-In-Loop testing that advanced inverter control methods can provide active power support that improves the system's frequency response in the face of reduced conventional inertia from synchronous machine generators.
- Inverter control methods were explored including inertia-like response (derivative control) and grid-forming (voltage source) modes for respective benefits in bulk system and isolated distribution system use cases.
- Final Report included in this 2018 EPIC Annual Report.

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; DSM”

iii. Objective

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

iv. Scope

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

v. Deliverables

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

vi. Metrics

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

vii. Schedule

- 2.25 years

viii. EPIC Funds Encumbered

- $0

ix. EPIC Funds Spent

- $0

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- N/A

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

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

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

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

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

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

iv. Scope
- Utilize AMI, SCADA, PV, GIS, weather and other data sources to develop an algorithm to improve the prediction of grid loading.
- Develop a platform to demonstrate the ability to conduct load forecasting at scale and in near real-time

v. Deliverables
- Develop a unique loading algorithm and metrics for assessing forecast stability and confidence.

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

vii. Schedule
- 3.5 years

viii. EPIC Funds Encumbered
- $1,822,317

ix. EPIC Funds Spent
- $2,550,035

x. Partners (if applicable)
- N/A

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

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

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

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. 2018 Status Update

- Project completed in December 2018
- This project developed analytical methods for generating near real-time load forecast information. The project successfully built and demonstrated a platform to ingest and process SmartMeter™, SCADA, PV generation, GIS, and weather data for two of the eight Areas of Responsibility (AOR) within PG&E's service territory.
- Final Report included in this 2018 EPIC Annual Report.

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
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Project not executed

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
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Project not executed

Project #2.10 – Emergency Preparedness Modeling

i. Investment Plan Period

- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain

- Transmission; Distribution

iii. Objective

- Incorporate natural hazard damage model information into one integrated algorithm/tool, which would provide the ability to quickly estimate the impacts of natural hazards on Pacific Gas and Electric Company facilities to enable faster response and restoration.
- Provide the ability to prepare for these hazards by proactively modeling the impacts of potential hazards, to understand system vulnerabilities and restoration resource requirements.
- Incorporate work optimization algorithms to more efficiently allocate crews.
- Utilize artificial intelligence and statistical methods to model productive rates and automatically develop restoration plans.

iv. Scope

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

v. Deliverables

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

vi. Metrics

- 3a – Maintain/Reduce operations and maintenance costs.
- 4a – 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

- 3.5 years

viii. EPIC Funds Encumbered

- $2,656,522

ix. EPIC Funds Spent

- $ 4,206,233

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)

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

xv. 2018 Status Update

- Project completed in February 2019.
- This project developed the RWP system to demonstrate rapid and accurate restoration plan development for emergencies
- The project demonstrated the ability to aggregate equipment damage estimates via damage models, assessments, and outage information systems.
- It also was able to determine time needed for restoration and optimal work resources through a machine learning performance model that predicts accurate work demand and resource performance.
- A mixed integer linear programming (MILP) optimization model that considered multiple stochastic damage scenarios was built to provide resource positioning recommendations that are fast and transparent and more cost-effective and efficient.
- Final Report included in this 2018 EPIC Annual Report.

Project #2.11 – New Mobile Technology & Visualization Applications

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

ii. Assignment to Value Chain
   - Distribution

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

iv. Scope
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Project not executed

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
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Project not executed

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
- N/A

v. Deliverables
- N/A

vi. Metrics
- N/A

vii. Schedule
- N/A

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- N/A

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

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

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

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

xv. 2018 Status Update
- Project not executed

Project #2.14 – Automatically Map Phasing Information

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

ii. Assignment to Value Chain
   - Distribution; DSM

iii. Objective
   - This project aims to explore a variety of pre-commercial analytics and/or hardware options to automatically map 3-phase electrical power information in order to improve the distribution network models.

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

v. Deliverables
   - Develop algorithm or novel process to use AMI data and other sources to determine the assignment of phases to meters and transformers.

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

vii. Schedule
   - 2.75 years

viii. EPIC Funds Encumbered
   - $1,566,518

ix. EPIC Funds Spent
   - $1,929,189

x. Partners (if applicable)
   - PG&E worked with UC Riverside to test an alternate algorithm-based approach which was evaluated against other solutions demonstrated in the project

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

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

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

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

xv. 2018 Status Update

- Project completed in December 2018
- This project successfully developed and demonstrated automated analytical methods for determining meter phasing and meter-to-transformer connectivity using SmartMeter™, SCADA, and GIS data.
- The in-house method developed by PG&E delivered promising results and PG&E is currently working towards further improving the performance of the algorithms, so that an automated solution may be implemented at scale.
- Final Report included in this 2018 EPIC Annual Report

Project #2.15 – Synchrophasor Applications for Generator Dynamic Model Validation

i. Investment Plan Period

- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain

- Transmission

iii. Objective

- This project will demonstrate new synchrophasor analysis applications that can perform generator dynamic model parameter estimation and validation using disturbance data recorded by the synchrophasor system. New synchrophasor applications could perform mandated generator model validation without requiring time- and labor-intensive on-site tests, and could detect sub-synchronous resonance and other conditions which can cause generator outages.

iv. Scope

- Scope is limited to confirming that analysis of Phasor Measurement Unit (PMU) data is better than costly on-site model validation in the target geography. Scope does not include widespread deployment of PMUs.

v. Deliverables

- Install synchrophasors (or "PMUs") on generators or generator tie-lines, and demonstrate new data analysis software applications.
- Evaluate the application's 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 (Pub. Util. Code 8360).

vii. Schedule

- 3 years

viii. EPIC Funds Encumbered

- $620,157

ix. EPIC Funds Spent

- $739,725

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. 2018 Status Update

- Project completed in December 2018.
- The integration of PMUs on generators for dynamic model validation is a new technology and the project did not result in a tool that is production ready. As applications evolve, installation of PMUs at generating stations could potentially allow utilities to enhance their generator model validation processes.
- Final Report included in this 2018 EPIC Annual Report.

Project #2.16 – Enhanced Synchrophasor Analytics & Applications

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

ii. Assignment to Value Chain
   - Transmission

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

iv. Scope
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Project not executed

Project #2.17 – Geomagnetic Disturbance (GMD) Evaluation

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

ii. Assignment to Value Chain
   - Transmission

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

iv. Scope
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Project not executed

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
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Project not executed

Project #2.19 – Enable Distributed Demand-Side Strategies & Technologies

i. Investment Plan Period

- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain

- Distribution; DSM

iii. Objective

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

iv. Scope

- Deploy an aggregation of BTM customer energy storage resources to reduce peak loading or absorb DG on a utility distribution feeder(s).

v. Deliverables

- Demonstrate and test field results for effectiveness of the use of aggregated customer-sited BTM energy storage resources to peak load reduction and/or absorb DG on a utility distribution feeder(s).
- Demonstrate communications with aggregated resources for visualization and control.
- Evaluate cost-effectiveness and reliability of BTM energy storage for addressing capacity constraints.

vi. Metrics

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

vii. Schedule

- 2.75 years

viii. EPIC Funds Encumbered

- $1,678,045

ix. EPIC Funds Spent

- $2,182,049

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

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

xv. 2018 Status Update

- Project completed in February 2018.
- Final Report included in 2017 EPIC Annual Report.

Project #2.20 – Real-Time Energy Usage Feedback to Customers

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

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

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
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Project not executed

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

i. Investment Plan Period

- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain

- DSM

iii. Objective

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

iv. Scope

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

v. Deliverables

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

vi. Metrics

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

vii. Schedule

- 2.25 years

viii. EPIC Funds Encumbered

- $8,451

ix. EPIC Funds Spent

- $223,476

x. Partners (if applicable)

- Rainforest Automation providing development of the cloud service application used by the customers

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

- Project completed in February 2018.
- Final Report included in 2017 EPIC Annual Report.

Project #2.22 – Demand Reduction Through Targeted Data Analytics

i. Investment Plan Period

- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain

- Distribution; DSM

iii. Objective

- Identify strategic customers and target demand reduction in local areas by combining and integrating multiple DSM technologies (e.g., EE, DR, Distributed Energy Storage, and Consumer-oriented Energy Tools).
- Investigate whether Pacific Gas and Electric Company can achieve a sufficient amount of demand reduction through visibility into the customer-side resources and improve the reliability of customer-side resources at the local level in order to reschedule local capacity expansion expenditures.
- This project addresses California Public Utilities Commission proceeding, Distribution Resources Plan R.14-08-013, by supporting the fair and transparent processes for DER deployment and integration.

iv. Scope

- Develop a solution/tool that determines needed customer demand reduction individually and in aggregate at asset level, leveraging interval and SCADA data.
- Develop cross-DER customer targeting to address forecasted capacity challenges at specific assets, for specific days and times of year, leveraging interval data and other customer attributes.

v. Deliverables

- Create a data analytics platform capable of combining and analyzing multi-structured data, linking to a variety of data sources.
- Develop a method for identification, valuation, implementation, and tracking of targeted DERs.
- Create a quantitative screening/rank order tool.
- Develop actionable DER recommendations to customer outreach teams for reaching demand reduction goals.

vi. Metrics

- 3a – Maintain/Reduce capital costs.
- 7b – Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.
- 7e – Development and incorporation of cost-effective DR, demand-side resource, and energy efficient resources.

- 7h – Deployment and integration of cost-effective advanced electricity storage and peak-shaving technologies.

vii. Schedule

- 2.5 years

viii. EPIC Funds Encumbered

- $656,887

ix. EPIC Funds Spent

- $1,725,022

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- N/A

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. 2018 Status Update

- Project completed in February 2019
- This project may result in the enhancement of utility distribution planning tools and processes by facilitating the identification of the lowest cost portfolio capable of deferring, or completely mitigating, asset upgrades. Project tools produced by EPIC 2.22 consider both traditional wires solutions and DER portfolios and allows Distribution Planners to complete advanced scenario analysis.
- Following the development of these new capabilities, EPIC 2.22 tools and platforms were used to support PG&E's first DDOR. EPIC 2.22 was leveraged by PG&E to complete detailed analysis and scenario comparisons at low costs, in a timely fashion, and with a level of analytical rigor that exceed regulatory requirements.
- Final Report included in this 2018 EPIC Annual Report.

Project #2.23 – Integrate Demand Side Approaches Into Utility Planning

i. Investment Plan Period

- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain

- Distribution; DSM

iii. Objective

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

iv. Scope

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

v. Deliverables

- Develop enhanced Customer and DER Load Shapes Catalog in PG&E's LoadSEER Planning Tool.
- Incorporate DER Scenario Projections into LoadSEER.
- Develop interface between LoadSEER and CYME for batch processing integration.

vi. Metrics

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

vii. Schedule

- 2.25 years

viii. EPIC Funds Encumbered

- $1,831,735

ix. EPIC Funds Spent

- $3,102,480

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

- Project completed in 2017.
- Final Report included in 2017 EPIC Annual Report.

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

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

ii. Assignment to Value Chain
   - DSM

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

iv. Scope
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Project not executed

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; DSM

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

iv. Scope
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Project not executed

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; DSM

iii. Objective
- Demonstrate the means by which new customer and distribution devices could interoperate with PG&E's 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., electric distribution equipment, distributed energy resource equipment, RFID reader, smart home devices, etc.) with the AMI network (IPv6) in an effective manner.

v. Deliverables
- Conduct testing that will demonstrate customer and utility open architecture devices/applications that are AMI compatible, secure and interoperable.
- Provide physical and application interfaces, as a proof of concept, which may permit customer, utility and third-party devices to connect to PG&E's AMI network(s).

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

vii. Schedule
- 3.25 years

viii. EPIC Funds Encumbered
- $1,462,438

ix. EPIC Funds Spent
- $ 3,387,422

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)

- Patent filed for AMI network Open Architecture System

xv. 2018 Status Update

- Project completed in February 2019.

- This project successfully demonstrated in laboratory and field tests, the ability to communicate with, monitor, and control PG&E and third-party devices in five use cases.
    - These use cases involved SIs, sensors, SCADA and other distribution intelligent electric devices (IEDs), RFID equipment and Direct Acquisition and Control Telemetry.
    - These use cases were selected for their potential to improve system reliability, reduce costs, or both.
    - This project was successful in demonstrating that PG&E's AMI network can be leveraged for these additional use cases and is suitable for connecting and transmitting data from customer and utility devices.
- Final report included in this 2018 EPIC Annual report.

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; DSM

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 AMI Network management system to holistically monitor, control, and evolve the existing AMI network and infrastructure from a billing-centric platform to a fully operational AMI solutions platform that will meet evolving customer and grid needs.

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

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

vii. Schedule
   - 3 years

viii. EPIC Funds Encumbered
   - $576,433

ix. EPIC Funds Spent
   - $1,133,728

x. Partners (if applicable)
   - N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. 2018 Status Update

- Project completed in August 2018.
- Developed a demonstration grade management platform that successfully identified inventory, configuration, and performance data for all three AMI networks including both networking elements and metering endpoints.
- The project learned the complexity of adding functions needed such as additional Head-End Network Management functions, integration with GIS layers (i.e., data sources like CC&B, MDMS), and integration with various PG&E ticketing systems (Remedy, FAS). Based on this complexity, an enterprise management system will be needed to scale the functions demonstrated through this project.
- Final report included in this 2018 EPIC Annual report.

Project #2.28 – Smart Grid Communications Path Monitoring

i. Investment Plan Period

- 2nd Triennial (2015-2017)

ii. Assignment to Value Chain

- Grid Operation/Market Design

iii. Objective

- Evaluate communication paths for AMI related messages, including methods to clear potential interference, congestion, validate proper authorizations, and grant clearances for sending message over a secured communication path.

iv. Scope

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

v. Deliverables

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

vi. Metrics

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

vii. Schedule

- 1 years

viii. EPIC Funds Encumbered

- $58,518

ix. EPIC Funds Spent

- $251,869

x. Partners (if applicable)

- N/A

xi. Match Funding (if applicable)

- N/A

xii. Match Funding Split (if applicable)

- N/A

xiii. Funding Mechanism (if applicable)

- N/A

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. Status Update

- Project completed in February 2018.
- Final Report included in 2017 EPIC Annual Report.

Project #2.29 – Mobile Meter Applications

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

ii. Assignment to Value Chain
- Grid Operations/Market Design; Distribution; 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 (PEV), DG, mobile storage, etc.).

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

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

vii. Schedule
- 3.5 years

viii. EPIC Funds Encumbered
- $1,709,700

ix. EPIC Funds Spent
- $ 2,516,373

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

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)

- Non-Provisional patent RESOURCE METER SYSTEM AND METHOD (16/143,295) filed for the multi-purpose mobile meter (Next Generation Meter - NGM).

xv. 2018 Status Update

- Project completed in February 2019.
- Conducted functional and acceptance testing on alpha and beta NGM prototypes.
- Demonstrated mobile application of NGM prototype at PG&E
- Refined integration of accelerometer into the NGM
- Designed, implemented, and tested C12.19 and head end applications into NGM
- Final report included in this 2018 EPIC Annual report.

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

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

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

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
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Project not executed

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

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

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

iii. Objective
- Demonstrate how aggregated behind-the-meter energy storage systems that are operated by a third-party dispatcher may address wholesale market needs, while also operating as a customer resource to reduce customers' retail electric bills.

iv. Scope
- N/A

v. Deliverables
- N/A

vi. Metrics
- N/A

vii. Schedule
- N/A

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- N/A

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

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

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

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

xv. Status Update

- Formally Withdrawn by PG&E on 07/31/2017 via PG&E Comments on Draft Res.E-4863.

Project #2.32 – Electric Load Management for Ridesharing Electrification

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

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

iii. Objective
   - Evaluate grid impacts from Electric Vehicle (EV) charging used for ridesharing applications, to assess the ability to manage the resulting load using active demand management.

iv. Scope
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Deferred to a future investment plan by CPUC. Res.E-4863. 08/10/2017.
   - Re-assigned as EPIC 3.42.

Project #2.33 – Service Issue Identification Leveraging Momentary Outage Information

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

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

iii. Objective
- Leverage multiple sources of data, including but not limited to SmartMeter™, time of day, location and weather data, to proactively identify potential problems in the Electric Transmission and Distribution (T&D) system, specifically related to identifying locations with high incidences of momentary outages which may be caused by imminent failures of conductors, insulators, transformers and/or vegetation contact.

iv. Scope
- N/A

v. Deliverables
- N/A

vi. Metrics
- N/A

vii. Schedule
- N/A

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- N/A

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

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

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

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

xv. 2018 Status Update

- Deferred to a future investment plan by CPUC. Res.E-4863. 08/10/2017.
- Re-assigned as EPIC 3.43.

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

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

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

iii. Objective
- Demonstrate distribution sensor products that provide indicators of imminent asset failure and real-time monitoring of PG&E rights-of-way

iv. Scope
- Assess technical feasibility of various sensor products and validate opportunity for business benefits
- Develop solution designs, develop test plans, and conduct testing at ATS
- Conduct field demonstrations of various products and develop post-EPIC roadmaps for integrating capabilities in production

v. Deliverables
- Roadmap for integrating additional sensor technologies in production

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

vii. Schedule
- 2 years

viii. EPIC Funds Encumbered
- $1,201,883

ix. EPIC Funds Spent
- $1,123,468

x. Partners (if applicable)
- N/A

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

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

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

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. 2018 Status Update

- Project is in the Build/Test phase.
- Developed pole-mounted Distribution Reliability Line Monitor (DRLM) product with radio frequency and environmental sensors.
- Conducted field demonstration of DRLM product and assessed the ability of associated algorithm to predict incipient faults for distribution assets.
- Next steps include further assessment, lab testing and field demonstration of products for imminent asset failure detection and real-time monitoring of PG&E rights-of-way.

Project #2.35 – Call Center Staffing Optimization

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

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

iii. Objective
   - Optimize call center staffing by developing a real-time algorithm that integrates with and improves upon existing call center staffing software to potentially predict variability in call volume impacts in near real-time.

iv. Scope
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Rejected by CPUC. Res.E-4863. 08/10/2017.

Project #2.36 – Dynamic Rate Design Tool

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

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

iii. Objective
   - Develop a new rate design tool that will enable complex rate design such as for DER adoption, with a more robust, quicker and powerful rate design approach than the current rate design process. Leveraging big data technologies, the tool will provide rapid optimization, analysis and evaluation of hypothetical new rate structures which will enable PG&E and parties in a rate case to make rate design decisions based on full information and nuanced sensitivity analysis.

iv. Scope
   - Design and build cost of service database
   - Design and build rate design model engine and API
   - Build functionality and ability to run DER scenarios

v. Deliverables
   - Technical architecture specifications
   - Data model and databases
   - Rate design model engine and API

vi. Metrics
   - Time to complete the process of designing, optimizing, and analyzing the impact of a hypothetical rate design

vii. Schedule
   - 1.25 years

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $ 892,113

x. Partners (if applicable)
   - N/A

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

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

xiii. Funding Mechanism (if applicable)

- Pay for Performance

xiv. Treatment of Intellectual Property (if applicable)

- N/A

xv. 2018 Status Update

- Project is in Close-out phase.
- Created technical architecture
- Developed customer, meter and cost of service databases
- Developed customer segmentation, bill determinant, rate schedule, bill calculation and rate solver modules that integrate the steps for rate design
- Developed rate evaluation module including bill impact, bill volatility and energy burden
- Completed E1, TOU and hypothetical DER Rates
- Completed validation and acceptance testing

Project #3.01 – Automated DER Impact & Long-Term Dynamics Evaluation

i. Investment Plan Period
- 3rd Triennial (2018-2020)

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

iii. Objective
- Automate the DER impact and long-term dynamics evaluation processes leveraged in detailed engineering analysis in order to aim to reduce DER study timelines and costs, while also seeking to support distribution engineers to better understand and manage the voltage impacts caused by multiple DERs on a single circuit and on Load Tap Changer (LTC) operations. The automated evaluation modules would produce a report showing device loading, steady state voltage analysis, and voltage flicker analysis. The long-term dynamics module could potentially further identify potential voltage issues that may lead to Electric Rule 2 violations.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.02 – Utility Aggregated Resources With Market Participation

i. Investment Plan Period
- 3rd Triennial (2018-2020)

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

iii. Objective
- Demonstrate multi-technology DER aggregation (e.g., solar, storage) for wholesale market operations with potential to explore multiple uses including distribution support, retail, and/or T&D interfaces for control center operations. Developing this more automated optimization solution may enable realization of additional value from DERs with minimal operator intervention or disruption to operations. This equals more effective utilization of DG assets, which may include enhanced bidding in real-time to enable realization of additional wholesale market value from DERs or enhanced reliability by providing an indication of whether the current state of the grid is configured in a way that allows bidding into the CAISO market.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is in planning phase.

Project #3.03 – Distributed Energy Resource Management System (DERMS) and Advanced Distribution Management System (ADMS) Advanced Functionality

i. Investment Plan Period
- 3rd Triennial (2018-2020)

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

iii. Objective
- To incorporate additional DER technologies and grid management approaches into DERMS and/or ADMS to build upon efforts from the EPIC 2.02 DERMS project to support improvements to safe and reliable grid operations at the T&D market interface, while also enabling the presence of high penetrations of market participating DERs. This would demonstrate the orchestration of a comprehensive DER portfolio and also address the new operational challenges for Distribution Operators (DOs) caused by emerging opportunities for DERs to participate in wholesale markets via the DERP tariff.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is in planning phase.

Project #3.04 – Multi-Nodal Distributed Digital Ledger

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Grid Operations/Market Design; Distribution; Generation; DSM

iii. Objective
- Demonstrate and evaluate a multi-nodal digital distributed ledger (i.e., Blockchain) as an enabling technology that may facilitate greater efficiency, transparency, and security for customers. The project results may illuminate certain blockchain use cases that provide the most benefit to the utility and its customers and provide greater understanding regarding challenges associated with technology scalability, the blockchain interface with the grid, and current business processes and the application of smart contracts and other similar algorithms in a distributed environment.

iv. Scope
- Build blockchain solution for materials traceability by tracking the company's use of steel reels.
- Build blockchain solution for the trading of incremental EV credits in the residential market for LCFS.

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- 18 months

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $1,831

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. 2018 Status Update

- Project is in planning phase.

Project #3.05 – Virtual DER Markets for Capacity and Other Attributes

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

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

iii. Objective
   - To demonstrate the feasibility and the technological and/or economic performance of autonomous distributed economic dispatch in the context of DER markets for capacity and other attributes. There is no technology standard in the industry today for responding to multiple conflicting signals across the Generation-Transmission-Distribution-Customer (GTDC) value chain. The objective of the project is to test flexible demand, generation and storage, and reward local people and businesses for being more flexible with their energy.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.06 – Auto Identification (AutoID) of Behind-the-Meter (BTM) Storage

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

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

iii. Objective
   - To bridge the knowledge gap for storage's charge and discharge behavior in the field, as well as system impacts by analyzing storage charge/discharge patterns.
   - Under current Net Energy Metering Policy, BTM Storage is not required to be on a separate submeter. This could lead to a situation where the utility would not be aware of the presence of storage, which could potentially impact safety and reliability of the distribution network. Additionally, understanding of the "net" storage impact at the feeder-level and secondary circuit level is important as distribution planning engineers begin to include DERs in their load forecasts.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.07 – Utility Scale Storage for Load Balancing

i. Investment Plan Period
- 3rd Triennial (2018-2020)

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

iii. Objective
- To demonstrate phase load balancing by leveraging large, utility-owned batteries. Removing manual work to rebalance loads improves operational efficiency by reduced manual hours spent, improves reliability by optimizing asset utilization across phases with faster adjustment of controls, and improves safety by removing manual labor for managing large loads.

iv. Scope
- TBD.

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.08 – Second-Life Batteries for Grid Needs

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

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

iii. Objective
   - To demonstrate technology that enables second-life energy storage for key utility functions, such as DR and/or frequency regulation, which may lower energy storage costs and support EV business cases with residual value.
   - Technology may also be developed for ensuring that second-life batteries can successfully interface with the grid. Building off PG&E's prior energy storage EPIC pilots, this project may identify significant technical or performance differentiations between a second-life storage system and an installation with new batteries, and

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.09 – Dynamic Near-Term DER Load Forecasting

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Grid Operations/Market Design, Distribution; Generation, Transmission, DSM

iii. Objective
- This project proposes to collect and combine SI data with other data streams (e.g., local weather, customer demographics, and/or customer usage) to create an algorithm that can better predict customer gross and net usage/load, DER generation, back-feed at distribution assets, and impact on system level or local short-term energy supply needs. Beginning in September 2017, California's Rule 21 requires SIs for all new customer-connected generation and storage devices.
- Having better insight into the impact of DERs on generation and distribution system needs, the utility, in coordination with the CAISO, may be able to reduce the generation purchasing buffer required. Further, the utility could better understand and model/predict the impact of DERs on the distribution system. This could reduce operating cost and in turn potentially lower customer bills.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)

- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.10 – Grid of the Future Scenario Engine

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Transmission; Distribution; DSM

iii. Objective
   - To develop a wide-scale distribution and/or transmission grid simulator for analyzing multiple scenarios and potential future stressors to the grid, such as changes in usage behavior, increased DER integration rates and more to facilitate better informed grid planning.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

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

xv. 2018 Status Update
   - Project is currently on hold.

Project #3.11 – Location-Specific Options for Reliability and/or Resilience Upgrades

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Grid Operation/ market design; Distribution; DSM

iii. Objective
- To create the processes and demonstrate the scoping, specification, and deployment of multiple DER technology configurations that could potentially serve as location-specific options for distribution system reliability and/or resilience upgrades.

iv. Scope
- Technology configurations to be evaluated for their ability to provide distribution service reliability and/or resilience may include distributed battery storage, distributed solar and other DG, microgrid controllers, and isolation and protection equipment enabling islanding.
- If a microgrid alternative is identified and selected in the -41- distribution planning process, this project may include a field deployment and evaluation of the selected alternative.
- The relatively immature microgrid market is characterized by a wide range of custom projects with little standardization in technology and design. This project may help identify deployment options and test the efficacy of microgrid-related technologies (e.g., DERs, controllers, communications, and isolation and protective devices) in enhancing reliability and/or resilience in specific locations.

v. Deliverables
- TBD

vi. Metrics
- May include reduced operating costs, reduction in wires down outages and/or improvements in other local reliability metrics with the potential for increased adoption of DERs for energy resilience

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)

- TBD

xi. Match Funding (if applicable)

- TBD

xii. Match Funding Split (if applicable)

- TBD

xiii. Funding Mechanism (if applicable)

- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is in planning phase.

Project #3.12 – Advanced Volt/Var Optimization (VVO) Functionalities

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Grid Operation/ market design; Transmission; Distribution

iii. Objective
   - This project would seek to demonstrate enhanced algorithms to leverage VVO for grid management services.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

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

xv. 2018 Status Update
   - Project is currently on hold.

Project #3.13 – Transformer Monitoring via Field Area Network (FAN)

i. Investment Plan Period

- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain

- Grid Operations/ market design; Distribution

iii. Objective

- This project will seek to demonstrate equipment that can be quickly and safely mounted on the casing of a pole-top distribution transformer to enable monitoring of equipment health. Additionally, it may test new communication devices and processes for delivering sensor data through PG&E's FAN.
- The benefits of a successful solution deployed at full scale based on the learnings of this project may include:
    - Preventative Maintenance / Replacement of Transformers (Reliability, Safety) PG&E has over one million distribution transformers in service, which are replaced at a rate of ~2.5 percent per year. Identifying transformers that are approaching end of life could allow preventative replacement, reducing the chances of unplanned outages and potential safety concerns.
    - Improved Understanding of "Plug and Play" Equipment Installation (Affordability) Developing new methods to attach sensors to field equipment easily, and streamline the process of connecting their outputs to centralized data management systems is an important goal to reduce the cost of installation for new smart grid devices.

iv. Scope

- TBD

v. Deliverables

- TBD

vi. Metrics

- TBD

vii. Schedule

- TBD

viii. EPIC Funds Encumbered

- $0

ix. EPIC Funds Spent

- $0

x. Partners (if applicable)

- TBD

xi. Match Funding (if applicable)

- TBD

xii. Match Funding Split (if applicable)

- TBD

xiii. Funding Mechanism (if applicable)

- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is in planning phase.

Project #3.14 – Maintenance Prioritization for Imminent Asset Risk

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Grid Operation/ market design; Transmission; Distribution

iii. Objective
   - To demonstrate the convergence of asset and operational data with historical maintenance information and proactive identification of potential equipment failures.

iv. Scope
   - N/A

v. Deliverables
   - N/A

vi. Metrics
   - N/A

vii. Schedule
   - N/A

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - N/A

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

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

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

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

xv. 2018 Status Update
   - Project merged with 3.20

Project #3.15 – Proactive Wires Down Mitigation

i. Investment Plan Period

- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain

- Grid Operation/ market design; Distribution

iii. Objective

- To demonstrate technology that could identify a falling conductor in sub-second response time, to enable proactive circuit isolation. If proven successful, the algorithm could be integrated with grid management systems to minimize safety risks in wires down situations.

iv. Scope

- Build, test, and make operationally ready the Rapid Earth Fault Current Limiter (REFCL) technology.

v. Deliverables

- Phase 1: Engineering and Construction
  - Project design
  - Equipment order
  - Test in Proof of Concept RTDS Lab
  - Field and substation work
  - Train and educate all departments affected by this technology
- Phase 2: Field Demonstration & Operation
  - Commissioning & testing
  - Fault location testing

vi. Metrics

- 3a – Maintain/Reduce operations and maintenance costs.
- 4a – GHG Emissions Reductions (MMTCO2e)
- 5a – Outage number, frequency and duration reductions

vii. Schedule

- 2 years

viii. EPIC Funds Encumbered

- $ 0

ix. EPIC Funds Spent

- $18,596

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)

- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is in planning phase.
- Identified equipment supplier and entered into contract negotiations.
- Next steps include ordering equipment.

Project #3.16 – Advanced Condition Monitoring for Remote Diagnostics

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Grid Operation/ market design; Transmission; Distribution

iii. Objective
- To demonstrate advanced real-time sensors for monitoring asset conditions, enabling an increasingly proactive maintenance and grid management operational model. If proven successful, these sensors could help PG&E estimate equipment's remaining service life, and predict when it may fail.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

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

xv. 2018 Status Update
- Project is currently on hold.

Project #3.17 – Generic Universal Distribution Controller (UDC) for Relay, Regulator, Load Tap Changer (LTC), Capacitor, Interrupter Control

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Grid Operation/ market design; Distribution

iii. Objective
- Design and demonstrate a Universal Distribution Controller (UDC) that can act as a generic controller for use in electric distribution line equipment. This approach could potentially standardize controller hardware across operational control functions insuring interoperability and reducing the need for -51- redundant maintenance and management for multiple vendors. It may also permit customization of features through software development control specific to the utility's needs.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.18 – Transformer Health Monitoring

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Transmission; Distribution

iii. Objective
- To develop and demonstrate new algorithms for determining and actively monitoring transformer health and performance based on Synchrophasor or other technology to detect conditions, such as arcing, breaker mis-operation, or total fault energy over time. The project could enable higher accuracy asset monitoring and predictive failure analytics.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

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

xv. 2018 Status Update
- Project is currently on hold.

Project #3.19 – Unified Network Solution

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Grid Operations/ market design; Transmission; Distribution

iii. Objective
- To demonstrate a platform for unified communication among disparate networks both in the field, as well as across the enterprise. This project may improve reliability by ensuring communication service across multiple service platforms and help to reduce reliability risk by ensuring that the systems can rely on each other's backhaul for redundancy.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

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

xv. 2018 Status Update
- Project is currently on hold.

Project #3.20 – Data Analytics for Predictive Maintenance

i. Investment Plan Period

- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain

- Grid Operations/ market design; Distribution; DSM

iii. Objective

- To develop predictive maintenance algorithms for identifying potential asset failures before they occur by using SmartMeter™ voltage data and other utility data sources at service points downstream of equipment. The project would potentially improve system reliability and safety by reducing unplanned outages by proactively identifying and mitigating equipment failure.

iv. Scope

- The project would define a set of failing equipment use cases that have impact on downstream voltage, and develop analytics algorithms to identify the voltage signatures associated with these upcoming failures. Examples of potential equipment use cases include primary side loose neutrals and overloaded or near-failure transformers, and stressed or near-failure cables.

v. Deliverables

- The output of the project would be an analytics process that would correlate and detect pattern signatures that are associated to malfunctioning or failing system assets, a set of heuristics for identifying these signatures, and an evaluation of this technology's efficacy versus traditional condition-based maintenance systems.

vi. Metrics

- TBD

vii. Schedule

- 1.75 years

viii. EPIC Funds Encumbered

- TBD

ix. EPIC Funds Spent

- $23,029

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. 2018 Status Update

- Project is in planning phase.

Project #3.21 – Advanced Vegetation Management Insights Using Prescriptive Analytics

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Grid Operations/ market design; Transmission; Distribution

iii. Objective
- To demonstrate a prescriptive analytics model that predicts tree growth rates and areas at highest risk for vegetation-related outages by leveraging Light Detection and Ranging (LiDAR), other remote sensing data, and historical vegetation-based outages for proactive and targeted mitigation. The model could be used for routine maintenance activities, reliability-focused project planning, or planning and staging in anticipation of strong weather systems impacting the PG&E service system.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is in planning phase.

Project #3.22 – Abnormal State Configuration Risk and Mitigation

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Grid Operations/ market design; Distribution

iii. Objective
   - To demonstrate an algorithm for understanding the comparative risk of abnormal state configurations to proactively prioritize mitigation of these issues. The project would explore the use of system data to analyze risk impact and attempt to demonstrate an algorithmic approach to automate the impact score. This project may also explore the best approaches to integrate this algorithm into utility systems and processes, as well as potentially automate the resolution of these issues.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.23 – Enhanced Distribution Line Equipment Device Settings Management

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Grid Operations/ market design; Distribution

iii. Objective
   - To demonstrate the increased efficiency, quality assurance, and flexibility of technology to manage transmission and substation distribution protection relay device settings to all distribution line equipment relays and controllers.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

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

xv. 2018 Status Update
   - Project is currently on hold.

Project #3.24 – Automatic Power Factor (PF) Management

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Grid Operations/ market design; Distribution; Transmission

iii. Objective
   - To demonstrate a software algorithm to achieve Automatic Power Factor Management to keep power factor within the mandated CAISO guideline.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

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

xv. 2018 Status Update
   - Project is currently on hold.

Project #3.25 – Electric Grid Monitoring (EGM) Meter

i. Investment Plan Period

- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain

- Grid Operations/ market design; Distribution

iii. Objective

- To develop and demonstrate a modular-designed meter with the capability to monitor electric grid operations and report real time outage and restoration, as well as function as a SCADA metering point during the critical and initial 10-30 minutes of a power outage. This may help keep PG&E distribution system operators well-informed of grid outage conditions and assist them in taking appropriate actions to restore customer power quickly.
- The new meter demonstrated in this project could enable potential reduction of equipment costs for replacements due to its modular design. The base mechanical meter would more rarely need replacement, typically leaving just the replacement of the solid-state meter and communication core component as needed.

iv. Scope

- TBD

v. Deliverables

- TBD

vi. Metrics

- TBD

vii. Schedule

- TBD

viii. EPIC Funds Encumbered

- $0

ix. EPIC Funds Spent

- $0

x. Partners (if applicable)

- TBD

xi. Match Funding (if applicable)

- TBD

xii. Match Funding Split (if applicable)

- TBD

xiii. Funding Mechanism (if applicable)

- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.26 – Predictive Data Analytics for Proactive Meter Replacement

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Distribution

iii. Objective
   - To develop and demonstrate a predictive analytics tool for remotely diagnosing meter health, to target and prioritize proactive meter replacements. The project will seek to explore the development and demonstration of an algorithm, software application/tool, and/or system interfaces to predict when a meter has a potentially unsafe condition, identify service connection issues, and/or identify when a meter is failing.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.27 – Multi-Purpose Meter (MPM)

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Grid Operations/market design; Distribution

iii. Objective
   - To develop and demonstrate a meter that can measure energy consumption for multiple customers and/or multiple uses/purposes, in the place of multiple single-use/purpose and/or submeters. The Multi-Purpose Meter (MPM) will include a combination of head-end operations applications, master meter, and individual meters (IDV). This solution will cut down the components inside electric meters and reduce the material costs, meter installation and maintenance costs at the same premise. The combination of power enclosure and MPM box will also be small and take less space inside the building.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $316

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. 2018 Status Update

- Project is in planning phase.

Project #3.28 – Real-Time Load-Based Charging

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Grid Operations/ market design; Distribution; DSM

iii. Objective
   - The project would attempt to develop a smart-charging algorithm based on time, capacity, locations, and other inputs. The algorithm would aim to coordinate EV charging so that specific grid assets are not overly taxed. This project could design controls to coordinate EV charging in a local area in order to facilitate higher EV adoption and charging without the need for distribution system upgrades.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.29 – Advanced Customer Bill Scenario Calculator

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Grid Operations/ market design

iii. Objective
   - To demonstrate an online tool with a streamlined graphical user interface to allow customers to more easily understand how behavioral changes and technology investments may affect their energy bill. The proposed tool is targeted towards the group of more engaged customers. PG&E's customer research shows that the more engaged customers want to understand how technologies may affect their bills. In response to this market need, this tool would allow consumers to engage with their energy usage and conservation options through an interactive and more in-depth manner.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is in planning phase.

Project #3.30 – Connected Device Real-Time Pricing-Based Control

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Grid Operations/ market design; DSM

iii. Objective
   - To demonstrate the technical feasibility, utility benefits, and customer value of real-time pricing services through evaluating how PG&E can send signals to connected devices to control their operation based on pricing signals and/or grid conditions. This project aims to investigate the strategies for potential future dynamic pricing options enabled by recent communication infrastructure solutions that tie real-time locational marginal electricity price to retail real-time pricing transmission at the interval level.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.31 – Real-Time DER Price Signals

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - DSM

iii. Objective
   - To design and demonstrate a locational net benefit rate design structure for DERs in order to valuate DER grid services to incentivize optimal DER siting and dispatch.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

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

xv. 2018 Status Update
   - Project is currently on hold.

Project #3.32 – System Harmonics for Power Quality Investigations

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Grid Operations/market design; Distribution; Transmission

iii. Objective
- To leverage SmartMeter™ data to assist in identifying system harmonics that may cause power quality issues for customers.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

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

xv. 2018 Status Update
- Project is in planning phase.

Project #3.33 – Cyber-Physical Integrated Security

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Grid Operations/market design; Distribution; Transmission

iii. Objective
   - To demonstrate a unified security solution which matches physical access to system access to aid in the blocking of unauthorized access to PG&E's critical infrastructure.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

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

xv. 2018 Status Update
   - Project is currently on hold.

Project #3.34 – Local Wireless Security for Critical Facilities

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Grid Operations/market design; Distribution; Transmission

iii. Objective
- To develop and demonstrate a next-generation wireless security solution which would monitor airwaves around PG&E's electric facilities to detect rogue access points installed within physically secured generation / substation facilities, which could provide bad actors access to the critical infrastructure networks.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

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

xv. 2018 Status Update
- Project is currently on hold.

Project #3.35 – Advance Security of Internet of Things (IoT) Communications

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Grid Operations/market design; Distribution; Transmission

iii. Objective
   - To demonstrate an open architecture standard for secure communications between a utility and customer devices using third party communication channels (e.g., home internet connections, cellular networks, private-built field area networks).

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

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

xv. 2018 Status Update
   - Project is currently on hold.

Project #3.36 – Cybersecurity for Industrial Control Systems (ICS)

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Grid Operations/market design; Transmission

iii. Objective
- This EPIC project is proposed as a joint EPIC Administrator collaborative project that seeks to evaluate potential demonstrations that build on the foundation of machine to machine automated threat response by including adaptive controls & dynamic zoning for ICS. These would help to contain or thwart cyberattacks.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

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

xv. 2018 Status Update
- Project is currently on hold.

Project #3.37 – Augmented Reality

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Grid Operations/market design; Distribution

iii. Objective
- To demonstrate technology for visualizing grid and asset data integrated with the GIS data, superimposed on a device to provide support and guidance for activities, such as asset investigations and maintenance. Augmented reality is a broad technology category which could improve the efficiency and affordability of field operations by providing faster access to key asset information during inspections and maintenance. Just as importantly, this could eventually improve field crew safety by providing hands-free information displays (e.g., through a heads-up display).

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.38 – Voltage Checks

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Grid Operations/market design; Distribution

iii. Objective
- To develop and demonstrate a tool for field workers to perform remote voltage checks and identify low or no-power line situations while on-site without the need to call the central office or manually measure the line. This could potentially enable a field or dispatch employee to identify Service Points and other voltage-checkable equipment in the surrounding area, click on one of the pieces of equipment, and request the current voltage flowing through this equipment to diagnose an issue.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

xiv. Treatment of Intellectual Property (if applicable)

- TBD

xv. 2018 Status Update

- Project is currently on hold.

Project #3.39 – Optimized Dispatch for Restoration Events

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Transmission; Distribution

iii. Objective
- To optimize crew movements and responses during outage dispatch to support restoration operations.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

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

xv. 2018 Status Update
- Project is currently on hold.

Project #3.40 – Advanced Field Reference Tool

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
   - Grid Operations/ market design

iii. Objective
   - To develop a voice guided and/or free-form entry reference for field workers to ask questions and receive guidance based on PG&E's equipment libraries, safety practices, and other critical documentation.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $0

x. Partners (if applicable)
   - TBD

xi. Match Funding (if applicable)
   - TBD

xii. Match Funding Split (if applicable)
   - TBD

xiii. Funding Mechanism (if applicable)
   - TBD

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

xv. 2018 Status Update
   - Project is currently on hold.

Project #3.41 – Drone Enablement and Operational Use

i. Investment Plan Period
- 3rd Triennial (2018-2020)

ii. Assignment to Value Chain
- Grid Operations/ market design; Distribution; Transmission

iii. Objective
- To develop and demonstrate a foundational utility-focused Drone enablement systems and initial use cases to form the foundation for future utility Drone operations. These devices have the potential to revolutionize monitoring, inspection, and real-time awareness of pipeline and powerline infrastructure in normal or outage conditions.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

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

xv. 2018 Status Update
- Project is in planning phase.

Project #3.42 – Electric Load Management for Ridesharing Electrification

i. Investment Plan Period
   - 3rd Triennial (2018-2020)

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

iii. Objective
   - Evaluate grid impacts from Electric Vehicle (EV) charging used for ridesharing applications, to assess the ability to manage the resulting load using active demand management.

iv. Scope
   - TBD

v. Deliverables
   - TBD

vi. Metrics
   - TBD

vii. Schedule
   - TBD

viii. EPIC Funds Encumbered
   - $0

ix. EPIC Funds Spent
   - $111

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
   - Previously defined as EPIC 2.32. Deferred to EPIC 3 by CPUC Res.E-4863 8/10/2017.
   - Project is in planning phase.

Project #3.43 – Service Issue Identification Leveraging Momentary Outage Information

i. Investment Plan Period
- 3rd Triennial (2018-2020)

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

iii. Objective
- Leverage multiple sources of data, including but not limited to SmartMeter™, time of day, location and weather data, to proactively identify potential problems in the Electric Transmission and Distribution (T&D) system, specifically related to identifying locations with high incidences of momentary outages which may be caused by imminent failures of conductors, insulators, transformers and/or vegetation contact.

iv. Scope
- TBD

v. Deliverables
- TBD

vi. Metrics
- TBD

vii. Schedule
- TBD

viii. EPIC Funds Encumbered
- $0

ix. EPIC Funds Spent
- $0

x. Partners (if applicable)
- TBD

xi. Match Funding (if applicable)
- TBD

xii. Match Funding Split (if applicable)
- TBD

xiii. Funding Mechanism (if applicable)
- TBD

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

xv. Status Update

- Previously defined as EPIC 2.33. Deferred to EPIC 3 by CPUC Res.E-4863 8/10/2017.
- Project is in planning phase.

5. Conclusion

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

Through the course of 2018, PG&E's EPIC Program made significant progress and achieved noteworthy successes on many of the projects. Of the 36 projects started across EPIC 1 and EPIC 2, a total of 33 EPIC projects have completed (11 of these 33 projects completed in 2018 and/or before filing the 2018 EPIC Annual Report). PG&E is leveraging the learnings across projects and applying results into practice where applicable, including but not limited to:

- Leveraging the RWP decision support system developed in *EPIC 2.10 – Emergency Preparedness Modeling*. This includes predictive analytics using big data and machine learning algorithms to help provide more certainty in understanding work demand, resource requirements, and positioning of resources for restoration strategy during emergency events. This enhanced capability has the potential to significantly improve the accuracy of determining the Estimated Time for Restoration (ETOR). The RWP system will continue to be refined by leveraging it further in a field demonstration setting, in parallel with the existing process, for the upcoming storm season and benchmarking its output with actual damages as well as actual crew allocation and positioning.
- Leveraging the analytical methods that were developed *in EPIC 2.14 – Automatically Map Phasing Information* for identifying meter phasing. As these methods are refined they will then be applied at scale across the distribution system as part of the IGP. The distribution network model is central to multiple existing control systems, system analyses, and work processes. As the load characteristics of the distribution network evolve, such as with the growth of DERs, it is becoming more important to have accurate and up-to-date network model information to be able to actively manage the distribution system. Automated approaches for obtaining this information can offer a more efficient alternative to the conventional boots-on-the-ground approach.
- Leveraging the enhanced analytic tools and methodologies developed for distribution planning in *EPIC 2.22 – Demand Reduction through Targeted*

Data Analytics that uses detailed customer and DER data to better identify where and when DERs may serve as cost-effective alternatives when compared to traditional wires solutions and defer future distribution or transmission system upgrades. This project built on the important work completed in *EPIC 2.23 – Integrate Demand Side Approaches into Utility Planning*, which delivered new load shape profiles, enhanced load forecasting tool and overall analytical process that allows PG&E to more accurately and consistently integrate DER impact to the distribution system load profile. With these enhancements, PG&E can evaluate if DER growth could defer or even in some instances eliminate the need for future network upgrades. The capabilities of *EPIC 2.22* have already been leveraged to respond to requirements set forth in the CPUC's Distribution Resources Plan (DRP) proceeding, specifically in the 2018 DDOR.

In addition to some of the post EPIC project level achievements listed above, since the inception of the EPIC Program, PG&E has established and maintained strong program management practices to provide oversight of the EPIC Program and ensure the maximum value of the projects to its customer base. PG&E continues to build on our administrative best practices in response to the evaluation. Our improvements are detailed out in our RAP filing. In addition to oversight, the Program Management Office provides:

- Communications with interested vendors and diverse suppliers through channels such as referrals and industry events (e.g., Grid Edge Executive Council, Silicon Valley Leadership Group, DistribuTECH, etc.);
- Collaboration through Industry Engagement, such as with the DOE, and other utilities;
- Coordination with the other IOUs and CEC through regularly scheduled administrator meetings and collaboration;
- Benchmarking and new technology solution vetting;
- Collaboration with research entities, such as the EPRI & NREL;
- Administrator-coordinated execution of industry-wide EPIC workshops and symposiums;

- Other EPIC Program support, such as providing comments and/or Letters of Support to select CEC Grant Funding Opportunities (GFO); and
- Coordination with DAC.

PG&E's EPIC portfolio of active projects continues to address challenges of the changing grid landscape and the threat of climate change, including enabling an increase in DER adoption by customers, the need to modernize the grid to ensure continued safe, reliable, and resilient operation, and the need to continue improving affordability such as through advancing how to leverage data. These achievements from the EPIC projects, and their future path forward for those technologies that are proven ready to scale, help pave the way for the grid of the future, advancing California policy objectives, and ultimately, improving the safety, reliability, resiliency, and affordability of the electric grid.

B. Next Steps for EPIC Investment Plan

PG&E, in conjunction with the other EPIC Administrators, will continue to host annual stakeholder workshops and symposiums, as well as workshops specifically for DAC. These industry events will focus on the sharing of progress, results, and future plans as well as understanding stakeholder needs and incorporating stakeholder input into the scoping of EPIC projects. PG&E will also continue to promote the EPIC Program through participation in both internal and external public forums and other industry events.

PG&E and the other IOUs received the CPUC decision and approval of the third triennial investment plan period of 2018-2020 (EPIC 3) on October 25, 2018. PG&E is excited to embark on the new technology demonstrations contained within that filing that can help meet emerging grid needs and California policy objectives, as well as continued advancement in how we execute the program, which will be further detailed in the RAP.

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

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

- Changes in the marketplace that may have made the project obsolete (or relatively less important to pursue);

- Different technologies have emerged that could produce better insights for the industry and PG&E customers, making some of the original proposed projects no longer the best use of available program funds;
- The technology may prove to not yet be ready for commercialization and/or not yet ready nor capable to support the later stages of the original project objective; and
- The vendor interest may drop due to the small-scale demonstration size of the project or the vendor may revise their business model such that it is no longer aligned with the projects' objectives.

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

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

PACIFIC GAS AND ELECTRIC COMPANY

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PROJECT STATUS REPORT

(SEE ATTACHED SPREADSHEET)

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Row #	Investment Program Period	Program Administrator	Project Name	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to Date: Contract/Grant Amount ($)	Funds Expended to Date: In House Expenditures ($)	Funds Expended to Date: Total Spent to Date ($)	Administrative and Overhead Costs to Be Incurred for Each Project	Leveraged Funds	Partners	Match Funding
	A	*B*	*C*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
For Report DOC	i. Investment Plan Period		Project Name	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
1	1st Triennial (2012-2014)	PG&E	1.01 – Energy Storage End Uses	$ 616,857	$1,660,000 - $2,030,000	$ 778,040	$ 1,055,928	$ 1,833,968	$ -	Leveraged battery assets that was funded by Energy Regulators Regional Association (ERRA). Leveraged $163K, as well as software and expertise from PG&E's hydro generation group.	N/A	N/A
2	1st Triennial (2012-2014)	PG&E	1.02 – Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction	$ 2,686,621	$3,610,000 - $4,412,000	$ 2,758,654	$ 1,251,855	$ 4,010,510	$ -	No	N/A	No
3	1st Triennial (2012-2014)	PG&E	1.03 – Demonstrate Priority Scenarios from the Energy Storage Framework	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
4	1st Triennial (2012-2014)	PG&E	1.04 – Expand Test Lab and Pilot Facilities for New Energy Storage Systems	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
5	1st Triennial (2012-2014)	PG&E	1.05 – Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output	$ 535,055	$720,000 - $880,000	$ 511,681	$ 312,209	$ 823,890	$ -	N/A	N/A	N/A
6	1st Triennial (2012-2014)	PG&E	1.06 – Demonstrate Communication Systems Allowing the CAISO to Utilize Available Renewable Generation Flexibility	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
7	1st Triennial (2012-2014)	PG&E	1.07 – Demonstrate Systems to Ramp Existing Gas-Fired Generation More Quickly to Adapt to Changes in Variable Energy Resources Output	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A

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	A	*B*	*C*	*R*	*S*	*T*	*U*	*V*	*W*
For Report DOC	i. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
1	1st Triennial (2012-2014)	PG&E	1.01 – Energy Storage End Uses	N/A	Pay for performance	N/A	Sole Source: •Power Settlements Consulting (sole vendor that could provide solution without modification or required hardware). • Trimark Associates (enhancements were made to their equipment for this EPIC project, as they were the original vendor under the capital project for the Yerba Buena and Vaca batteries).	N/A	N/A
2	1st Triennial (2012-2014)	PG&E	1.02 – Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction	N/A	Pay for Performance	N/A	Competitive Bid	11	Cupertino Electric
3	1st Triennial (2012-2014)	PG&E	1.03 – Demonstrate Priority Scenarios from the Energy Storage Framework	TBD	TBD	TBD	TBD	TBD	TBD
4	1st Triennial (2012-2014)	PG&E	1.04 – Expand Test Lab and Pilot Facilities for New Energy Storage Systems	N/A	N/A	N/A	N/A	N/A	N/A
5	1st Triennial (2012-2014)	PG&E	1.05 – Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output	N/A	Pay for performance	N/A	Competitive Bid & Sole Source • 1st award to create raw, gridded weather forecast data: competitive. • 2nd award to develop map of variables from data: completive. • 3rd award: Sole source to Clean Power Research due to obtain PV estimation for inclusion in solar irradiance use case.	• 1st award: 6 • 2nd award: 6	• 1st award: Weather Decision Technologies • 2nd award: Vertum Partners
6	1st Triennial (2012-2014)	PG&E	1.06 – Demonstrate Communication Systems Allowing the CAISO to Utilize Available Renewable Generation Flexibility	N/A	N/A	N/A	TBD	TBD	TBD
7	1st Triennial (2012-2014)	PG&E	1.07 – Demonstrate Systems to Ramp Existing Gas-Fired Generation More Quickly to Adapt to Changes in Variable Energy Resources Output	N/A	N/A	N/A	N/A	N/A	N/A

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	A	*B*	*C*	*X*	*Y*	*Z*	*AA*
For Report DOC	i. Investment Plan Period		Project Name				
1	1st Triennial (2012-2014)	PG&E	1.01 – Energy Storage End Uses	N/A	N/A	Column applicable to CEC only	Yes. •Power Settlements Consulting - California-based • Trimark Associates - California-based
2	1st Triennial (2012-2014)	PG&E	1.02 – Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction	1	N/A	Column applicable to CEC only	Yes - California-based.
3	1st Triennial (2012-2014)	PG&E	1.03 – Demonstrate Priority Scenarios from the Energy Storage Framework	TBD	TBD	Column applicable to CEC only	TBD
4	1st Triennial (2012-2014)	PG&E	1.04 – Expand Test Lab and Pilot Facilities for New Energy Storage Systems	N/A	N/A	Column applicable to CEC only	N/A
5	1st Triennial (2012-2014)	PG&E	1.05 – Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output	• 1st award: 1 • 2nd award: 1	N/A	Column applicable to CEC only	• Weather Decision Technologies: No • Vertum Partners: Yes - California-based • Clean Power Research: Yes - California-based
6	1st Triennial (2012-2014)	PG&E	1.06 – Demonstrate Communication Systems Allowing the CAISO to Utilize Available Renewable Generation Flexibility	TBD	TBD	Column applicable to CEC only	TBD
7	1st Triennial (2012-2014)	PG&E	1.07 – Demonstrate Systems to Ramp Existing Gas-Fired Generation More Quickly to Adapt to Changes in Variable Energy Resources Output	N/A	N/A	Column applicable to CEC only	N/A

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	A	*B*	*C*	*AB*	*AC*	*AD*
For Report DOC	i. Investment Plan Period		Project Name		vi. Metrics	xv. 2018 Status Update
1	1st Triennial (2012-2014)	PG&E	1.01 – Energy Storage End Uses	Column applicable to CEC only	• 1i - Nameplate capacity (megawatts) of grid-connected energy storage. • 3a - Maintain/Reduce operations and maintenance costs. • 6a - CAISO NGR financial settlements. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code (Pub. Util. Code) § 8360). • 7c - Dynamic optimization of grid operations and resources, including appropriate consideration for asset management and utilization of related grid operations and resources, with cost-effective full cyber security (Pub. Util. Code § 8360). • 7l - Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services (Pub. Util. Code § 8360). • 9c - EPIC project results referenced in regulatory proceedings and policy reports (Business Plan references: CPUC R.10-12-007).	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
2	1st Triennial (2012-2014)	PG&E	1.02 – Demonstrate the Use of Distributed Energy Storage for T&D Cost Reduction	Column applicable to CEC only	• 1c - Avoided procurement and generation costs. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code (Pub. Util. Code) § 8360). • 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources (Pub. Util. Code § 8360). • 9c - EPIC project results referenced in regulatory proceedings and policy reports (Business Plan references: Deferring a capacity upgrade has been identified as a key potential value of Energy Storage Technologies (ESTs) and noted in filings with the CPUC/Assembly Bill 2514.	• Project completed in February 2018 • Final Report included in this 2017 EPIC Annual Report
3	1st Triennial (2012-2014)	PG&E	1.03 – Demonstrate Priority Scenarios from the Energy Storage Framework	Column applicable to CEC only	TBD	• Project is currently on hold.
4	1st Triennial (2012-2014)	PG&E	1.04 – Expand Test Lab and Pilot Facilities for New Energy Storage Systems	Column applicable to CEC only	N/A	• Formally Withdrawn. CPUC A.12-11-003, 10/15/2013.
5	1st Triennial (2012-2014)	PG&E	1.05 – Demonstrate New Resource Forecast Methods to Better Predict Variable Resource Output	Column applicable to CEC only	• 3a - Maintain/Reduce operations and maintenance costs. • 4a - GHG emissions reductions (MMTCO2e). • 5c - Forecast accuracy improvement. • 5e - Utility worker safety improvement and hazard exposure reduction.	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
6	1st Triennial (2012-2014)	PG&E	1.06 – Demonstrate Communication Systems Allowing the CAISO to Utilize Available Renewable Generation Flexibility	Column applicable to CEC only	N/A	• Project is currently on hold.
7	1st Triennial (2012-2014)	PG&E	1.07 – Demonstrate Systems to Ramp Existing Gas-Fired Generation More Quickly to Adapt to Changes in Variable Energy Resources Output	Column applicable to CEC only	N/A	• Formally Withdrawn. CPUC A.12-11-003, 10/15/2013.

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	A	*B*	*C*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
For Report DOC	i. Investment Plan Period		Project Name	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
8	1st Triennial (2012-2014)	PG&E	1.08 – Improve Distribution System Safety and Reliability through New Data Analytics Techniques	$ 1,249,505	$1,900,000 - $2,320,000	$ 1,791,805	$ 320,835	$ 2,112,640	$ -	N/A	N/A	N/A
9	1st Triennial (2012-2014)	PG&E	1.09A – Test New Remote Monitoring and Control Systems for Existing Transmission and Distribution Assets: Close Proximity Switching	$ 301,808	$464,000 - $567,000	$ 382,094	$ 133,174	$ 515,268	$ -	N/A	N/A	N/A
10	1st Triennial (2012-2014)	PG&E	1.09B and 1.10B – Test New Remote Monitoring and Control Systems for T&D Assets / Demonstrate New Strategies and Technologies to Improve the Efficacy of Existing Maintenance and Replacement Programs	$ 484,250	$450,000 - $550,000	$ 543,414	$ 4,267	$ 547,681	$ -	N/A	N/A	N/A
11	1st Triennial (2012-2014)	PG&E	1.09C – Test New Remote Monitoring and Control Systems for T&D Assets: Discrete Series Reactors	$ 1,449,835	$2,2100,000 - $2,710,000	$ 1,545,895	$ 913,838	$ 2,459,732	$ -	N/A	N/A	N/A
12	1st Triennial (2012-2014)	PG&E	1.10A – Demonstrate Automated Asset Notification and Management Systems: Dissolved Gas Analysis	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
13	1st Triennial (2012-2014)	PG&E	1.10C – Demonstrate Automated Asset Notification and Management Systems: Underground Cable Analysis	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
14	1st Triennial (2012-2014)	PG&E	1.11 – Demonstrate Self-Correcting Tools to Improve System Records and Operations	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
15	1st Triennial (2012-2014)	PG&E	1.12 – Demonstrate New Technologies that Improve Wildlife Safety and Protect Assets from Weather-Related Degradation	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
16	1st Triennial (2012-2014)	PG&E	1.13 – Demonstrate New Communication Systems to Improve Substation Automation and Interoperability	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD

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	A	*B*	*C*	*R*	*S*	*T*	*U*	*V*	*W*
For Report DOC	i. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
8	1st Triennial (2012-2014)	PG&E	1.08 – Improve Distribution System Safety and Reliability through New Data Analytics Techniques	N/A	Pay for performance	N/A	Competitive Bid	• 11 total bidders • 7 passed initial screen	Space Time Insight
9	1st Triennial (2012-2014)	PG&E	1.09A – Test New Remote Monitoring and Control Systems for Existing Transmission and Distribution Assets: Close Proximity Switching	N/A	Pay for Performance	N/A	Competitive Bid	4	Two vendors chosen from RFP: • Inertia Switch • Trayer Issued Direct Award for Remote Solutions. They not respond to RFP, but shortly after competitive bid process completed, they announced independent creation of similar product.
10	1st Triennial (2012-2014)	PG&E	1.09B and 1.10B – Test New Remote Monitoring and Control Systems for T&D Assets / Demonstrate New Strategies and Technologies to Improve the Efficacy of Existing Maintenance and Replacement Programs	N/A	Pay for performance	N/A	Competitive Bid	Phase I: 5 bids Phase 2: 8 bids	Phase 1: Black and Veach Phase 2: Exponent
11	1st Triennial (2012-2014)	PG&E	1.09C – Test New Remote Monitoring and Control Systems for T&D Assets: Discrete Series Reactors	N/A	Pay for Performance	N/A	Sole Source - Smart Wires, Inc. selected as they are the developer and sole supplier of DSR devices.	N/A	N/A
12	1st Triennial (2012-2014)	PG&E	1.10A – Demonstrate Automated Asset Notification and Management Systems: Dissolved Gas Analysis	TBD	TBD	TBD	TBD	TBD	TBD
13	1st Triennial (2012-2014)	PG&E	1.10C – Demonstrate Automated Asset Notification and Management Systems: Underground Cable Analysis	TBD	TBD	TBD	TBD	TBD	TBD
14	1st Triennial (2012-2014)	PG&E	1.11 – Demonstrate Self-Correcting Tools to Improve System Records and Operations	TBD	TBD	TBD	TBD	TBD	TBD
15	1st Triennial (2012-2014)	PG&E	1.12 – Demonstrate New Technologies that Improve Wildlife Safety and Protect Assets from Weather-Related Degradation	TBD	TBD	TBD	TBD	TBD	TBD
16	1st Triennial (2012-2014)	PG&E	1.13 – Demonstrate New Communication Systems to Improve Substation Automation and Interoperability	TBD	TBD	TBD	TBD	TBD	TBD

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	A	*B*	*C*	*X*	*Y*	*Z*	*AA*
For Report DOC	i. Investment Plan Period		Project Name				
8	1st Triennial (2012-2014)	PG&E	1.08 – Improve Distribution System Safety and Reliability through New Data Analytics Techniques	1	N/A	Column applicable to CEC only	Yes - California-based
9	1st Triennial (2012-2014)	PG&E	1.09A – Test New Remote Monitoring and Control Systems for Existing Transmission and Distribution Assets: Close Proximity Switching	The two RFP vendors tied for first.	N/A	Column applicable to CEC only	No
10	1st Triennial (2012-2014)	PG&E	1.09B and 1.10B – Test New Remote Monitoring and Control Systems for T&D Assets / Demonstrate New Strategies and Technologies to Improve the Efficacy of Existing Maintenance and Replacement Programs	Phase 1: 1 Phase 2: 1	N/A	Column applicable to CEC only	No
11	1st Triennial (2012-2014)	PG&E	1.09C – Test New Remote Monitoring and Control Systems for T&D Assets: Discrete Series Reactors	N/A	N/A	Column applicable to CEC only	No
12	1st Triennial (2012-2014)	PG&E	1.10A – Demonstrate Automated Asset Notification and Management Systems: Dissolved Gas Analysis	TBD	TBD	Column applicable to CEC only	TBD
13	1st Triennial (2012-2014)	PG&E	1.10C – Demonstrate Automated Asset Notification and Management Systems: Underground Cable Analysis	TBD	TBD	Column applicable to CEC only	TBD
14	1st Triennial (2012-2014)	PG&E	1.11 – Demonstrate Self-Correcting Tools to Improve System Records and Operations	TBD	TBD	Column applicable to CEC only	TBD
15	1st Triennial (2012-2014)	PG&E	1.12 – Demonstrate New Technologies that Improve Wildlife Safety and Protect Assets from Weather-Related Degradation	TBD	TBD	Column applicable to CEC only	TBD
16	1st Triennial (2012-2014)	PG&E	1.13 – Demonstrate New Communication Systems to Improve Substation Automation and Interoperability	TBD	TBD	Column applicable to CEC only	TBD

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Row #	Investment Program Period	Program Administrator	Project Name	How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals	Applicable Metrics	2018 Update
	A	*B*	*C*	*AB*	*AC*	*AD*
For Report DOC	i. Investment Plan Period		Project Name		vi. Metrics	xv. 2018 Status Update
8	1st Triennial (2012-2014)	PG&E	1.08 – Improve Distribution System Safety and Reliability through New Data Analytics Techniques	Column applicable to CEC only	• 7c - Dynamic optimization of grid operations and resources; including appropriate consideration for asset management and utilization of related grid operations and resource, with cost-effective full cyber security (Public Utilities Code §8360). • 3a - Maintain/Reduce operations and maintenance costs: With the improved understanding of risk, there could be a better tool for evaluating projects such as asset replacement.	• Project completed in 2015. • Final report included in previous 2015 EPIC Annual Report.
9	1st Triennial (2012-2014)	PG&E	1.09A – Test New Remote Monitoring and Control Systems for Existing Transmission and Distribution Assets: Close Proximity Switching	Column applicable to CEC only	• 5a - Outage number, frequency and duration reductions. • 5e - Utility worker safety improvement and hazard exposure reduction.	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
10	1st Triennial (2012-2014)	PG&E	1.09B and 1.10B – Test New Remote Monitoring and Control Systems for T&D Assets / Demonstrate New Strategies and Technologies to Improve the Efficacy of Existing Maintenance and Replacement Programs	Column applicable to CEC only	• 3a - Maintain/Reduce operations and maintenance costs. • 3b - Maintain/Reduce capital costs. • 5d - Public safety improvement and hazard exposure reduction. • 5e - Utility worker safety improvement and hazard exposure reduction.	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
11	1st Triennial (2012-2014)	PG&E	1.09C – Test New Remote Monitoring and Control Systems for T&D Assets: Discrete Series Reactors	Column applicable to CEC only	• 3a - Maintain/Reduce operations and maintenance costs. • 3b - Maintain/Reduce capital costs. • 5a - Outage number, frequency and duration reductions. • 5b - Electric system power flow congestion reduction.	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
12	1st Triennial (2012-2014)	PG&E	1.10A – Demonstrate Automated Asset Notification and Management Systems: Dissolved Gas Analysis	Column applicable to CEC only	TBD	• Project is currently on hold.
13	1st Triennial (2012-2014)	PG&E	1.10C – Demonstrate Automated Asset Notification and Management Systems: Underground Cable Analysis	Column applicable to CEC only	TBD	• Project is currently on hold.
14	1st Triennial (2012-2014)	PG&E	1.11 – Demonstrate Self-Correcting Tools to Improve System Records and Operations	Column applicable to CEC only	TBD	• Project is currently on hold.
15	1st Triennial (2012-2014)	PG&E	1.12 – Demonstrate New Technologies that Improve Wildlife Safety and Protect Assets from Weather-Related Degradation	Column applicable to CEC only	TBD	• Project is currently on hold.
16	1st Triennial (2012-2014)	PG&E	1.13 – Demonstrate New Communication Systems to Improve Substation Automation and Interoperability	Column applicable to CEC only	TBD	• Project is currently on hold.

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Row #	Investment Program Period	Program Administrator	Project Name	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to Date: Contract/Grant Amount ($)	Funds Expended to Date: In House Expenditures ($)	Funds Expended to Date: Total Spent to Date ($)	Administrative and Overhead Costs to Be Incurred for Each Project	Leveraged Funds	Partners	Match Funding
	A	B	C	I	J	K	L	M	N	O	P	Q
For Report DOC	i. Investment Plan Period		Project Name	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
17	1st Triennial (2012-2014)	PG&E	1.14 – Demonstrate "Next Generation" SmartMeter™ Telecom Network Functionalities (includes 1.14.17 Smart Pole Meter)	$ 3,986,281	$3,780,000 - $4,550,000	$ 3,321,005	$ 812,422	$ 4,133,426	$ -	No	N/A	N/A
18	1st Triennial (2012-2014)	PG&E	1.15 – Demonstrate New Technologies and Strategies That Support Integrated "Customer-to-Market-to-Grid" Operations of the Future	$ 1,334,030	$3,780,000 - $4,620,000	$ 1,592,302	$ 2,540,871	$ 4,133,173	$ -	N/A	N/A	N/A
19	1st Triennial (2012-2014)	PG&E	1.16 – Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages	$ 1,688,840	$3,600,000 - $4,400,000	$ 2,448,165	$ 1,561,622	$ 4,009,788	$ 125	Department of Energy (DOE) provided test services using National Renewable Energy Lab (NREL) facilities. Approximate cost share to date: $120,000.	DOE/NREL; Edison Electric Institute engaged for elec. utility industry staging events; Portland General Electric closely collaborating for industry-level requirements	N/A
20	1st Triennial (2012-2014)	PG&E	1.17 – Leverage EPIC Funds by Participating in Multi-Utility, Industry Wide RD&D Programs Such as EPRI	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	N/A
21	1st Triennial (2012-2014)	PG&E	1.18 – Demonstrate SmartMeter™-Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information	$ 1,399,248	$1,080,000 - $1,320,000	$ 1,231,131	$ 65,711	$ 1,296,842	$ -	N/A	N/A	N/A
22	1st Triennial (2012-2014)	PG&E	1.19 – Pilot Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	$ 1,054,506	$1,780,000 - $2,180,000	$ 831,015	$ 1,149,484	$ 1,980,499	$ -	Leveraging existing AMI network investments.	N/A	N/A

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Row #	Investment Program Period	Program Administrator	Project Name	Match Funding Split	Funding Mechanism	Intellectual Property	Identification of the Method Used to Grant Awards.	If Competitively Selected, Provide the Number of Bidders Passing the Initial Pass/Fail Screening for Project	If Competitively Selected, Provide the Name of Selected Bidder.
	A	*B*	*C*	*R*	*S*	*T*	*U*	*V*	*W*
For Report DOC	i. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
17	1st Triennial (2012-2014)	PG&E	1.14 – Demonstrate "Next Generation" SmartMeter™ Telecom Network Functionalities (includes 1.14.17 Smart Pole Meter)	N/A	Pay for Performance	• Provisional patent filed for Smart Pole Meter and Meter Socket • Full patent filed for development of Wire Down Algorithm.	Sole Source - Silver Springs Network selected as they solutions provider for PG&E's AMI electric network. It is necessary to work with SSN to ensure that devices and applications can communicate across the AMI network.	N/A	N/A
18	1st Triennial (2012-2014)	PG&E	1.15 – Demonstrate New Technologies and Strategies That Support Integrated "Customer-to-Market-to-Grid" Operations of the Future	N/A	Pay For Performance	New Intellectual Property (IP) has been created through co-development with the vendor. PG&E retains ownership rights to the IP and will provide free unlimited use rights to CA IOUs per the CPUC decision	Competitive Bid	3	BitStew
19	1st Triennial (2012-2014)	PG&E	1.16 – Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages	N/A	Pay for performance	N/A	• Phase 1 (Mule Phase): 2 Direct Awards - Efficient Drivetrains, Inc. (EDI) and Electric Vehicle International (EVI) selected due to short-term availability of prototype driveline and capability of generating utility-grade export power on F550 - diesel/gasoline configuration • Phase 2 (Alpha Phase): Based on results of Mule phase, moved forward with EDI, which was designed to help formulate specs for Phase 3 • Phase 3 (Beta Phase): Competitive solicitation. 10 potential bidders. Received 2 final bids.	2 (Phase 3 - Beta Phase)	Efficient Drivetrains, Inc. (EDI) (Phase 3 - Beta Phase)
20	1st Triennial (2012-2014)	PG&E	1.17 – Leverage EPIC Funds by Participating in Multi-Utility, Industry Wide RD&D Programs Such as EPRI	N/A	TBD	TBD	TBD	TBD	TBD
21	1st Triennial (2012-2014)	PG&E	1.18 – Demonstrate SmartMeter™-Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information	N/A	Pay for performance	N/A	Sole Source - Silver Springs Network, as they are the solutions provider for PG&E's AMI electric network. It is necessary to work with SSN to ensure that devices and applications can communicate across the AMI network.	N/A	N/A
22	1st Triennial (2012-2014)	PG&E	1.19 – Pilot Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	N/A	Pay for Performance	N/A	Competitive Bid	3	BitStew & Primestone

Row #	Investment Program Period	Program Administrator	Project Name	If Competitively Selected, Provide the Rank of the Selected Bidder in the Selection Process.	If Competitively Selected, Explain Why the Bidder Was Not the Highest Scoring Bidder, Explain Why a Lower Scoring Bidder Was Selected.	If Interagency or Sole Source Agreement, Specify Date of Notification to the Joint Legislative Budget Committee (JLBC) Was Notified and Date of JLBC Authorization.	Does Award Recipient Identify as California-Based Entity, Small Business, Businesses Owned by Women, Minorities, or Disabled Veterans? Information Requested for Technology Vendor Procurements Only (i.e., Not PMs, Consulting Services, Etc.)
	A	*B*	*C*	*X*	*Y*	*Z*	*AA*
For Report DOC	i. Investment Plan Period		Project Name				
17	1st Triennial (2012-2014)	PG&E	1.14 – Demonstrate "Next Generation" SmartMeter™ Telecom Network Functionalities (includes 1.14.17 Smart Pole Meter)	N/A	N/A	Column applicable to CEC only	No
18	1st Triennial (2012-2014)	PG&E	1.15 – Demonstrate New Technologies and Strategies That Support Integrated "Customer-to-Market-to-Grid" Operations of the Future	1	N/A	Column applicable to CEC only	No
19	1st Triennial (2012-2014)	PG&E	1.16 – Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages	1 (Phase 3 - Beta Phase)	N/A	Column applicable to CEC only	N/A
20	1st Triennial (2012-2014)	PG&E	1.17 – Leverage EPIC Funds by Participating in Multi-Utility, Industry Wide RD&D Programs Such as EPRI	TBD	TBD	Column applicable to CEC only	TBD
21	1st Triennial (2012-2014)	PG&E	1.18 – Demonstrate SmartMeter™-Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information	N/A	N/A	Column applicable to CEC only	No
22	1st Triennial (2012-2014)	PG&E	1.19 – Pilot Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	Tie for first	N/A	Column applicable to CEC only	No

Row #	Investment Program Period	Program Administrator	Project Name	How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals	Applicable Metrics	2018 Update
	A	*B*	*C*	*AB*	*AC*	*AD*
For Report DOC	i. Investment Plan Period		Project Name		vi. Metrics	xv. 2018 Status Update
17	1st Triennial (2012-2014)	PG&E	1.14 – Demonstrate "Next Generation" SmartMeter™ Telecom Network Functionalities (includes 1.14.17 Smart Pole Meter)	Column applicable to CEC only	• 7f - Deployment of cost-effective smart technologies, including real time, automated, interactive technologies that optimize the physical operation of appliance and consumer devices for metering, communications concerning grid operations and status, and distribution automation (Public Utilities Code (Pub. Util. Code) §8360). • 7k - Develop standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid (Pub. Util. Code §8360). • Note: Each technology demonstrated may have additional specific benefits to name. For instance, the following could apply: improved communication for power restoration, improved control of streetlights, etc.	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
18	1st Triennial (2012-2014)	PG&E	1.15 – Demonstrate New Technologies and Strategies That Support Integrated "Customer-to-Market-to-Grid" Operations of the Future	Column applicable to CEC only	• 5a - Outage number, frequency and duration reductions. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360). • 3a - Maintain/Reduce operations and maintenance costs.	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
19	1st Triennial (2012-2014)	PG&E	1.16 – Demonstrate Electric Vehicle as a Resource to Improve Grid Power Quality and Reduce Customer Outages	Column applicable to CEC only	• 5a - Outage number, frequency and duration reductions. • 5e - Utility worker safety improvement and hazard exposure reduction. • 3a - Maintain/Reduce operations and maintenance costs. • 4a – Greenhouse Gas emissions reductions (MMTCO2e).	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
20	1st Triennial (2012-2014)	PG&E	1.17 – Leverage EPIC Funds by Participating in Multi-Utility, Industry Wide RD&D Programs Such as EPRI	Column applicable to CEC only	TBD	• Project is currently on hold.
21	1st Triennial (2012-2014)	PG&E	1.18 – Demonstrate SmartMeter™-Enabled Data Analytics to Provide Customers With Appliance-Level Energy Use Information	Column applicable to CEC only	• 1f - Avoided customer energy use. • 1h - Customer bill savings (dollars saved).	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
22	1st Triennial (2012-2014)	PG&E	1.19 – Pilot Enhanced Data Techniques and Capabilities via the SmartMeter™ Platform	Column applicable to CEC only	• 1h - Customer bill savings (dollars saved). • 1f - Avoided customer energy use (kilowatt-hours saved). • 3a - Maintain/Reduce operations and maintenance costs. • 3b - Maintain/Reduce capital costs. • 5d - Public safety improvement and hazard exposure reduction. • 5e - Utility worker safety improvement and hazard exposure reduction. • 5f - Reduced flicker and other power quality differences. • 5i. Increase in the number of nodes in the power system at monitoring points. • 7f - Deployment of cost-effective smart technologies, including real time, automated, interactive technologies that optimize the physical operation of appliance and consumer devices for metering, communications concerning grid operations and status, and distribution automation. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid.	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.

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	A	*B*	*C*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
For Report DOC	i. Investment Plan Period		Project Name	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
23	1st Triennial (2012-2014)	PG&E	1.20 – Demonstrate the Benefits of Providing the Competitive, Open Market With Automated Access to Customer-Authorized SmartMeter™ Data to Drive Innovation.	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
24	1st Triennial (2012-2014)	PG&E	1.21 – Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability	$ 868,495	$1,200,000 - $1,460,000	$ 890,314	$ 437,467	$ 1,327,782	$ -	N/A	N/A	N/A
25	1st Triennial (2012-2014)	PG&E	1.22 – Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility	$ 2,756,187	$1,730,000 - $2,120,000	$ 1,988,486	$ 254,539	$ 2,243,025	$ -	N/A	N/A	N/A
26	1st Triennial (2012-2014)	PG&E	1.23 – Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility	$ 950,313	$1,200,000 - $1,460,000	$ 872,927	$ 450,890	$ 1,323,817	$ -	N/A	N/A	N/A
27	1st Triennial (2012-2014)	PG&E	1.24 – Demonstrate Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	$ 1,196,477	$1,327,000 - $1,621,000	$ 1,262,770	$ 77,583	$ 1,340,353	$ -	N/A	N/A	N/A
28	1st Triennial (2012-2014)	PG&E	1.25 – Develop a Tool to Map the Preferred Locations for DC Fast Charging, Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs, While Reducing the Impact on PG&E's Distribution Grid	$ 391,425	$400,000 - $490,000	$ 308,151	$ 132,618	$ 440,769	$ -	N/A	N/A	N/A
29	1st Triennial (2012-2014)	PG&E	1.26 – Pilot Measurement and Telemetry Strategies and Technologies That Enable the Cost-Effective Integration of Mass Market Demand Response (DR) Resources Into the CAISO Wholesale Market	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD

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Row #	Investment Program Period	Program Administrator	Project Name	Match Funding Split	Funding Mechanism	Intellectual Property	Identification of the Method Used to Grant Awards.	If Competitively Selected, Provide the Number of Bidders Passing the Initial Pass/Fail Screening for Project	If Competitively Selected, Provide the Name of Selected Bidder.
	A	*B*	*C*	*R*	*S*	*T*	*U*	*V*	*W*
For Report DOC	i. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
23	1st Triennial (2012-2014)	PG&E	1.20 – Demonstrate the Benefits of Providing the Competitive, Open Market With Automated Access to Customer-Authorized SmartMeter™ Data to Drive Innovation.	N/A	N/A	N/A	N/A	N/A	N/A
24	1st Triennial (2012-2014)	PG&E	1.21 – Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability	N/A	Pay for performance	Provisional patent filed for development of Unauthorized Interconnection Detection Algorithm.	Sole Source - Nexant selected due to expertise in PG&E's CC&B database, PV generation data analysis and AMI network.	N/A	N/A
25	1st Triennial (2012-2014)	PG&E	1.22 – Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility	N/A	Pay for Performance	N/A	Competitive Bid	15	Nexant, Inc.
26	1st Triennial (2012-2014)	PG&E	1.23 – Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility	N/A	Pay for performance	N/A	• Sole Source - - Opower - PG&E's customer facing web portal, My Energy. Given the project is integrated PV generation interval data into My Energy, it was necessary to work with them. - Clean Power Research - Purchased subscription to estimated generation data.	N/A	N/A
27	1st Triennial (2012-2014)	PG&E	1.24 – Demonstrate Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	N/A	Pay for performance	N/A	Sole sourced - Enetics is a consulting firm that performed a study that assessed the available technologies that would best address the need of the project and determined Enetics provides that solution. They were also willing to make enhancements to their device to further meet the need of PG&E and were the lowest cost and immediately available.	N/A	N/A
28	1st Triennial (2012-2014)	PG&E	1.25 – Develop a Tool to Map the Preferred Locations for DC Fast Charging, Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs, While Reducing the Impact on PG&E's Distribution Grid	N/A	Pay for Performance	N/A	Competitive Bid	4	Energy and Environmental Economics, Inc. (E3)
29	1st Triennial (2012-2014)	PG&E	1.26 – Pilot Measurement and Telemetry Strategies and Technologies That Enable the Cost-Effective Integration of Mass Market Demand Response (DR) Resources Into the CAISO Wholesale Market	TBD	TBD	TBD	TBD	TBD	TBD

Row #	Investment Program Period	Program Administrator	Project Name	If Competitively Selected, Provide the Rank of the Selected Bidder in the Selection Process.	If Competitively Selected, Explain Why the Bidder Was Not the Highest Scoring Bidder, Explain Why a Lower Scoring Bidder Was Selected.	If Interagency or Sole Source Agreement, Specify Date of Notification to the Joint Legislative Budget Committee (JLBC) Was Notified and Date of JLBC Authorization.	Does Award Recipient Identify as California-Based Entity, Small Business, Businesses Owned by Women, Minorities, or Disabled Veterans? Information Requested for Technology Vendor Procurements Only (i.e., Not PMs, Consulting Services, Etc.)
	A	*B*	*C*	*X*	*Y*	*Z*	*AA*
For Report DOC	i. Investment Plan Period		Project Name				
23	1st Triennial (2012-2014)	PG&E	1.20 – Demonstrate the Benefits of Providing the Competitive, Open Market With Automated Access to Customer-Authorized SmartMeter™ Data to Drive Innovation.	N/A	N/A	Column applicable to CEC only	N/A
24	1st Triennial (2012-2014)	PG&E	1.21 – Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability	N/A	N/A	Column applicable to CEC only	No
25	1st Triennial (2012-2014)	PG&E	1.22 – Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility	1	N/A	Column applicable to CEC only	No
26	1st Triennial (2012-2014)	PG&E	1.23 – Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility	N/A	N/A	Column applicable to CEC only	Opower - No Clean Power Research - Yes: California-based
27	1st Triennial (2012-2014)	PG&E	1.24 – Demonstrate Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	N/A	N/A	Column applicable to CEC only	No
28	1st Triennial (2012-2014)	PG&E	1.25 – Develop a Tool to Map the Preferred Locations for DC Fast Charging, Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs, While Reducing the Impact on PG&E's Distribution Grid	1	N/A - E3 was the highest scoring vendor.	Column applicable to CEC only	Yes - California-based, small business, and Minority Based Enterprise (MBE).
29	1st Triennial (2012-2014)	PG&E	1.26 – Pilot Measurement and Telemetry Strategies and Technologies That Enable the Cost-Effective Integration of Mass Market Demand Response (DR) Resources Into the CAISO Wholesale Market	TBD	TBD	Column applicable to CEC only	TBD

Row #	Investment Program Period	Program Administrator	Project Name	How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals	Applicable Metrics	2018 Update
	A	*B*	*C*	*AB*	*AC*	*AD*
For Report DOC	i. Investment Plan Period		Project Name		vi. Metrics	xv. 2018 Status Update
23	1st Triennial (2012-2014)	PG&E	1.20 – Demonstrate the Benefits of Providing the Competitive, Open Market With Automated Access to Customer-Authorized SmartMeter™ Data to Drive Innovation.	Column applicable to CEC only	N/A	• Formally notified CPUC on 10-31-13, project may be terminated as refined scope does not appear to meet safety, reliability, affordability guiding principles for priority Research and Development.
24	1st Triennial (2012-2014)	PG&E	1.21 – Pilot Methods for Automatic Identification of Distributed Energy Resources (Such as Solar PV) as They Interconnect to the Grid to Improve Safety & Reliability	Column applicable to CEC only	• 5d - Public safety improvement and hazard exposure reduction. • 5f - Reduced flicker and other power quality differences. • 5c - Forecast accuracy improvement.	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
25	1st Triennial (2012-2014)	PG&E	1.22 – Demonstrate Subtractive Billing With Submetering for EVs to Increase Customer Billing Flexibility	Column applicable to CEC only	• 4a - GHG emissions reductions (MMTCO2e). • 1h - Customer bill savings (megawatt hours saved).	• Project is in the Closeout phase. • In 2018, completed de-enrollment and final billing for all pilot participants; completed final incentive processing for the pilot • Submeter testing was done by PG&E and then also by an independent lab retained by Nexant. • Nexant submitted their independent Evaluation Report which is currently being reviewed by CPUC and the IOUs • Next steps include finalizing the Nexant independent Evaluation Report and the EPIC Project Final Report.
26	1st Triennial (2012-2014)	PG&E	1.23 – Demonstrate Additive Billing With Submetering for PVs to Increase Customer Billing Flexibility	Column applicable to CEC only	• 5c - Forecast accuracy improvements. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360).	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
27	1st Triennial (2012-2014)	PG&E	1.24 – Demonstrate Demand-Side Management (DSM) for Transmission and Distribution (T&D) Cost Reduction	Column applicable to CEC only	• 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360).	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
28	1st Triennial (2012-2014)	PG&E	1.25 – Develop a Tool to Map the Preferred Locations for DC Fast Charging, Based on Traffic Patterns and PG&E's Distribution System, to Address EV Drivers' Needs, While Reducing the Impact on PG&E's Distribution Grid	Column applicable to CEC only	• 3a - Maintain/Reduce capital costs. • 3d - Number of operations of various existing equipment types before and after adoption of a new smart grid component, as an indicator of possible equipment life extensions from reduced wear and tear. • 4a - Greenhouse Gas emissions reductions (MMTCO2e). • 5c - Forecast accuracy improvement. • 5d - Public safety improvement and hazard exposure reduction. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code § 8360). • 7l - Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.	• Project completed in 2016. • Final Report was included in 2016 EPIC Annual Report.
29	1st Triennial (2012-2014)	PG&E	1.26 – Pilot Measurement and Telemetry Strategies and Technologies That Enable the Cost-Effective Integration of Mass Market Demand Response (DR) Resources Into the CAISO Wholesale Market	Column applicable to CEC only	TBD	• Project is currently on hold.

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	A	*B*	*C*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
For Report DOC	i. Investment Plan Period		Project Name	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
30	2nd Triennial (2015-2017)	PG&E	2.01 – Evaluate Storage on the Distribution Grid	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
31	2nd Triennial (2015-2017)	PG&E	2.02 – Pilot Distributed Energy Resource Management Systems (DERMS)	$ 2,426,740	$6,000,000 - $7,320,000	$ 3,069,228	$ 3,727,114	$ 6,796,342	$ 18,215	N/A	N/A	$419,000
32	2nd Triennial (2015-2017)	PG&E	2.03A – Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	$ 2,797,781	$4,767,300 - $5,826,700	$ 2,488,206	$ 2,475,146	$ 4,963,351	$26,670	This project is leveraging funds from the PG&E Smart Grid Volt/Var Optimization (VVO) pilot given they are completing the testing of the functionality of the smart inverter technologies. The results of the testing will impact this project's opportunity to launch.	N/A	N/A
33	2nd Triennial (2015-2017)	PG&E	2.03B – Test Smart Inverter Enhanced Capabilities - Vehicle to Home	$ 225,158	$414,000 - $506,000	$ 260,177	$ 273,936	$ 534,113	$ -	N/A	N/A	N/A
34	2nd Triennial (2015-2017)	PG&E	2.04 – DG Monitoring & Voltage Tracking	$ 745,762	$1,110,000 - $1,360,000	$ 816,364	$ 416,929	$ 1,233,293	$ 7,583	N/A	N/A	N/A

Row #	Investment Program Period	Program Administrator	Project Name	Match Funding Split	Funding Mechanism	Intellectual Property	Identification of the Method Used to Grant Awards.	If Competitively Selected, Provide the Number of Bidders Passing the Initial Pass/Fail Screening for Project	If Competitively Selected, Provide the Name of Selected Bidder.
	A	*B*	*C*	*R*	*S*	*T*	*U*	*V*	*W*
For Report DOC	i. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
30	2nd Triennial (2015-2017)	PG&E	2.01 – Evaluate Storage on the Distribution Grid	N/A	N/A	N/A	N/A	N/A	N/A
31	2nd Triennial (2015-2017)	PG&E	2.02 – Pilot Distributed Energy Resource Management Systems (DERMS)	N/A	Pay for performance	N/A	Competitive Bid	5	GE Alstom
32	2nd Triennial (2015-2017)	PG&E	2.03A – Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	N/A	Pay for Performance	N/A	Sole Source - SolarCity selected due to their large residential market share and large amount of customers on impacted distribution circuits that is most relevant to test their technologies.	N/A	N/A
33	2nd Triennial (2015-2017)	PG&E	2.03B – Test Smart Inverter Enhanced Capabilities - Vehicle to Home	N/A	Pay for Performance	N/A - No current evidence of Intellectual Property development	Quick Bid	4	Navigant
34	2nd Triennial (2015-2017)	PG&E	2.04 – DG Monitoring & Voltage Tracking	N/A	Pay for Performance	N/A	Competitive Bid	12	Nexant, Inc.

Row #	Investment Program Period	Program Administrator	Project Name	If Competitively Selected, Provide the Rank of the Selected Bidder in the Selection Process.	If Competitively Selected, Explain Why the Bidder Was Not the Highest Scoring Bidder, Explain Why a Lower Scoring Bidder Was Selected.	If Interagency or Sole Source Agreement, Specify Date of Notification to the Joint Legislative Budget Committee (JLBC) Was Notified and Date of JLBC Authorization.	Does Award Recipient Identify as California-Based Entity, Small Business, Businesses Owned by Women, Minorities, or Disabled Veterans? Information Requested for Technology Vendor Procurements Only (i.e., Not PMs, Consulting Services, Etc.)
	A	*B*	*C*	*X*	*Y*	*Z*	*AA*
For Report DOC	i. Investment Plan Period		Project Name				
30	2nd Triennial (2015-2017)	PG&E	2.01 – Evaluate Storage on the Distribution Grid	N/A	N/A	Column applicable to CEC only	N/A
31	2nd Triennial (2015-2017)	PG&E	2.02 – Pilot Distributed Energy Resource Management Systems (DERMS)	1	N/A	Column applicable to CEC only	No
32	2nd Triennial (2015-2017)	PG&E	2.03A – Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	N/A	N/A	Column applicable to CEC only	N/A
33	2nd Triennial (2015-2017)	PG&E	2.03B – Test Smart Inverter Enhanced Capabilities - Vehicle to Home	1	N/A	Column applicable to CEC only	No
34	2nd Triennial (2015-2017)	PG&E	2.04 – DG Monitoring & Voltage Tracking	1	N/A	Column applicable to CEC only	No

Row #	Investment Program Period	Program Administrator	Project Name	How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals	Applicable Metrics	2018 Update
	A	*B*	*C*	*AB*	*AC*	*AD*
For Report DOC	i. Investment Plan Period		Project Name		vi. Metrics	xv. 2018 Status Update
30	2nd Triennial (2015-2017)	PG&E	2.01 – Evaluate Storage on the Distribution Grid	Column applicable to CEC only	N/A	• Project not executed.
31	2nd Triennial (2015-2017)	PG&E	2.02 – Pilot Distributed Energy Resource Management Systems (DERMS)	Column applicable to CEC only	• 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code (Pub. Util. Code) § 8360). • 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources (Pub. Util. Code § 8360).	• Project completed in January 2019 • The project provided an opportunity for PG&E to define and deploy a DERMS and supporting technology to uncover barriers and specify requirements to prepare for the increasing challenges and opportunities of DERs at scale. The DERMS Demo was a field demonstration of optimal control of a portfolio of 3rd party aggregated behind-the-meter (BTM) solar and energy storage and utility front-of-the-meter (FTM) energy storage to provide distribution capacity and voltage support services while also allowing for participation of these same DERs in the CAISO wholesale market. • Additionally, the DERMS Demo explored the ability to manage DERs that participate in wholesale markets to also provide distribution and customer services to enable DER value stacking, often referred to as multiple use applications (MUA). • Final Report included in this 2018 EPIC Annual Report.
32	2nd Triennial (2015-2017)	PG&E	2.03A – Test Smart Inverter Enhanced Capabilities - Photovoltaics (PV)	Column applicable to CEC only	• 3a – Maintain/Reduce operations and maintenance costs. • 3b - Maintain / Reduce capital costs. • 3e – Non-energy economic benefits • 5f – Reduced flicker and other power quality differences • 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)	• Project completed in February 2019. • This project demonstrated the functionality and grid impacts of Smart Inverters (SI) through a field demonstration, a lab testing, and modeling. • The field demonstration targeted high voltage issues attributed to high PV penetration as well as an evaluation of a vendor-agnostic aggregation platform that allowed for the remote management of SI-enabled PV assets. • The demonstration also used PG&E laboratory facilities to evaluate the ability of multiple vendors' SI products to execute Rule 21 SI functions and employed the Electric Power Research Institute (EPRI) to model SI performance and economic analysis on simulated PG&E distribution feeders. • Final Report included in this 2018 EPIC Annual Report.
33	2nd Triennial (2015-2017)	PG&E	2.03B – Test Smart Inverter Enhanced Capabilities - Vehicle to Home	Column applicable to CEC only	• 3a - Maintain/Reduce operations and maintenance costs. • 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources.	• Project completed in Februaray 2018 • The project demonstrated that a bi-directional EV and charger can support critical household loads through an outage. However, the project also determined that, in addition to the technology not being commercially available, it is not cost effective for customers to adopt. This was supported by the project's customer survey results which indicate the current cost estimate is roughly 4 times higher than an optimal price for consumers. Therefore, even though the project use cases were technically proven-- they are not currently feasible due to technology cost, limited market value, and other restrictions between actors (e.g. EV battery warranty coverage). • Final Report included in this 2017 EPIC Annual Report
34	2nd Triennial (2015-2017)	PG&E	2.04 – DG Monitoring & Voltage Tracking	Column applicable to CEC only	• 3a - Maintain/Reduce operations and maintenance costs. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360). • 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources.	•• Project completed in 2017. • This project demonstrated an algorithmic process for analyzing new data sources (including SmartMeter™ devices and databases of solar irradiance) to predict the likelihood that a Rule 2 voltage violation was caused by distributed solar generation. Solar energy is by nature intermittent, and ebbs and surges of generation can change the voltage for neighboring, downstream customers. This functionality, if integrated into a larger grid analytics platform, might improve decision making for power quality engineers responding to customer issues. • Final Report included in this 2017 EPIC Annual Report.

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	A	*B*	*C*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
For Report DOC	i. Investment Plan Period		Project Name	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
35	2nd Triennial (2015-2017)	PG&E	2.05 – Inertia Response Emulation for DG Impact Improvement	$ 589,375	$1,450,000 - $1,780,000	$ 587,426	$ 704,233	$ 1,291,659	$0	N/A	National Renewable Energy Laboratory selected as testing and demonstration provider.	N/A
36	2nd Triennial (2015-2017)	PG&E	2.06 – Intelligent Universal Transformer (IUT)	$ -	$ -	$ -	$ -	$ -	$0	N/A	N/A	N/A
37	2nd Triennial (2015-2017)	PG&E	2.07 – Real-Time Loading Data for Distribution Operations and Planning	$ 1,822,317	$2,420,000 - $2,958,000	$ 1,618,782	$ 931,253	$ 2,550,035	$ 10,592	N/A	N/A	N/A
38	2nd Triennial (2015-2017)	PG&E	2.08 – "Smart" Monitoring and Analysis Tools	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
39	2nd Triennial (2015-2017)	PG&E	2.09 – Distributed Series Impedance (DSI) Phase 2	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
40	2nd Triennial (2015-2017)	PG&E	2.10 – Emergency Preparedness Modeling	$ 2,656,522	$3,993,000 - $4,881,000	$ 2,858,079	$ 1,348,154	$ 4,206,233	$ 1,538	N/A	N/A	N/A
41	2nd Triennial (2015-2017)	PG&E	2.11 – New Mobile Technology & Visualization Applications	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
42	2nd Triennial (2015-2017)	PG&E	2.12 - New Emergency Management Mobile Applications	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
43	2nd Triennial (2015-2017)	PG&E	2.13 – Digital Substation/Substation Automation	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
44	2nd Triennial (2015-2017)	PG&E	2.14 – Automatically Map Phasing Information	$ 1,566,518	$1,660,000 - $2,030,000	$ 1,505,888	$ 423,301	$ 1,929,189	$ 17,575	N/A	PG&E is working with University of California, Riverside to test an alternate algorithm based approach which will be evaluated against other solutions demonstrated in project	N/A

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	A	*B*	*C*	*R*	*S*	*T*	*U*	*V*	*W*
For Report DOC	i. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
35	2nd Triennial (2015-2017)	PG&E	2.05 – Inertia Response Emulation for DG Impact Improvement	N/A	Pay for performance	N/A	Quick Bid	4	NREL
36	2nd Triennial (2015-2017)	PG&E	2.06 – Intelligent Universal Transformer (IUT)	N/A	N/A	N/A	N/A	N/A	N/A
37	2nd Triennial (2015-2017)	PG&E	2.07 – Real-Time Loading Data for Distribution Operations and Planning	N/A	Pay for Performance	N/A	Competitive Bid	12	Trove Predictive Data
38	2nd Triennial (2015-2017)	PG&E	2.08 – "Smart" Monitoring and Analysis Tools	N/A	N/A	N/A	N/A	N/A	N/A
39	2nd Triennial (2015-2017)	PG&E	2.09 – Distributed Series Impedance (DSI) Phase 2	N/A	N/A	N/A	N/A	N/A	N/A
40	2nd Triennial (2015-2017)	PG&E	2.10 – Emergency Preparedness Modeling	N/A	Pay for Performance	PG&E will receive perpetual, transferable sublicenses to all Work Product to use for current and future PG&E business.	Competitive Bid	3	IBM
41	2nd Triennial (2015-2017)	PG&E	2.11 – New Mobile Technology & Visualization Applications	N/A	N/A	N/A	N/A	N/A	N/A
42	2nd Triennial (2015-2017)	PG&E	2.12 - New Emergency Management Mobile Applications	N/A	N/A	N/A	N/A	N/A	N/A
43	2nd Triennial (2015-2017)	PG&E	2.13 – Digital Substation/Substation Automation	N/A	N/A	N/A	N/A	N/A	N/A
44	2nd Triennial (2015-2017)	PG&E	2.14 – Automatically Map Phasing Information	N/A	Pay for performance	N/A	• Sole Source - - Silver Springs Network selected as they are the solutions provider for PG&E's AMI electric network. It is necessary to work with SSN to ensure that devices and applications can communicate across the AMI network. - Navigant selected due to industry expertise and familiarity with PG&E-specific systems - Consulting branch of UC Riverside selected per industry expertise	N/A	N/A

Row #	Investment Program Period	Program Administrator	Project Name	If Competitively Selected, Provide the Rank of the Selected Bidder in the Selection Process.	If Competitively Selected, Explain Why the Bidder Was Not the Highest Scoring Bidder, Explain Why a Lower Scoring Bidder Was Selected.	If Interagency or Sole Source Agreement, Specify Date of Notification to the Joint Legislative Budget Committee (JLBC) Was Notified and Date of JLBC Authorization.	Does Award Recipient Identify as California-Based Entity, Small Business, Businesses Owned by Women, Minorities, or Disabled Veterans? Information Requested for Technology Vendor Procurements Only (i.e., Not PMs, Consulting Services, Etc.)
	A	*B*	*C*	*X*	*Y*	*Z*	*AA*
For Report DOC	i. Investment Plan Period		Project Name				
35	2nd Triennial (2015-2017)	PG&E	2.05 – Inertia Response Emulation for DG Impact Improvement	1	N/A	Column applicable to CEC only	No
36	2nd Triennial (2015-2017)	PG&E	2.06 – Intelligent Universal Transformer (IUT)	TBD	TBD	Column applicable to CEC only	N/A
37	2nd Triennial (2015-2017)	PG&E	2.07 – Real-Time Loading Data for Distribution Operations and Planning	1	N/A	Column applicable to CEC only	No
38	2nd Triennial (2015-2017)	PG&E	2.08 – "Smart" Monitoring and Analysis Tools	N/A	N/A	Column applicable to CEC only	N/A
39	2nd Triennial (2015-2017)	PG&E	2.09 – Distributed Series Impedance (DSI) Phase 2	N/A	N/A	Column applicable to CEC only	N/A
40	2nd Triennial (2015-2017)	PG&E	2.10 – Emergency Preparedness Modeling	1	N/A	Column applicable to CEC only	No
41	2nd Triennial (2015-2017)	PG&E	2.11 – New Mobile Technology & Visualization Applications	N/A	N/A	Column applicable to CEC only	N/A
42	2nd Triennial (2015-2017)	PG&E	2.12 - New Emergency Management Mobile Applications	N/A	N/A	Column applicable to CEC only	N/A
43	2nd Triennial (2015-2017)	PG&E	2.13 – Digital Substation/Substation Automation	N/A	N/A	Column applicable to CEC only	N/A
44	2nd Triennial (2015-2017)	PG&E	2.14 – Automatically Map Phasing Information	N/A	N/A	Column applicable to CEC only	N/A

Row #	Investment Program Period	Program Administrator	Project Name	How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals	Applicable Metrics	2018 Update
	A	*B*	*C*	*AB*	*AC*	*AD*
For Report DOC	i. Investment Plan Period		Project Name		vi. Metrics	xv. 2018 Status Update
35	2nd Triennial (2015-2017)	PG&E	2.05 – Inertia Response Emulation for DG Impact Improvement	Column applicable to CEC only	• 1a. Number and total nameplate capacity of distributed generation facilities • 1b. Total electricity deliveries from grid-connected distributed generation facilities • 1i. Nameplate capacity (MW) of grid-connected energy storage • 3e. Non-energy economic benefits (reliability) • 5a. Outage number, frequency and duration reductions • 7b. Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (PU Code § 8360) • 7d. Deployment and integration of cost-effective distributed resources and generation, including renewable resources (PU Code § 8360) • 7h. Deployment and integration of cost-effective advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air-conditioning (PU Code § 8360)	• Project completed in February 2019. • This project explored the capabilities of inverter-based energy resources to provide a set of functions related to system inertia which support the electric system. • The project demonstrated via transmission system modeling and Power-Hardware-In-Loop testing that advanced inverter control methods can provide active power support that improves the system's frequency response in the face of reduced conventional inertia from synchronous machine generators. • Inverter control methods were explored including inertia-like response (derivative control) and grid-forming (voltage source) modes for respective benefits in bulk system and isolated distribution system use cases. • Final Report included in this 2018 EPIC Annual Report.
36	2nd Triennial (2015-2017)	PG&E	2.06 – Intelligent Universal Transformer (IUT)	Column applicable to CEC only	• 3a - Maintain/Reduce operations and maintenance costs. • 3b - Maintain/Reduce capital costs. • 5d - Public safety improvement and hazard exposure reduction. • 7k - Develop standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid. • 7l - Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.	• Project put on hold after determining the product (IUT) was not mature enough for a technology demonstration through EPIC.
37	2nd Triennial (2015-2017)	PG&E	2.07 – Real-Time Loading Data for Distribution Operations and Planning	Column applicable to CEC only	• 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.	• Project completed in December 2018 • This project developed analytical methods for generating near real-time load forecast information. The project successfully built and demonstrated a platform to ingest and process SmartMeter™, Supervisory Control and Data Acquisition (SCADA), photovoltaic system (PV) generation, Geographic Information System (GIS) and weather data for two of the eight Areas of Responsibility (AOR) within PG&E's service territory. • Final Report included in this 2018 EPIC Annual Report.
38	2nd Triennial (2015-2017)	PG&E	2.08 – "Smart" Monitoring and Analysis Tools	Column applicable to CEC only	N/A	• Project not executed.
39	2nd Triennial (2015-2017)	PG&E	2.09 – Distributed Series Impedance (DSI) Phase 2	Column applicable to CEC only	N/A	• Project not executed.
40	2nd Triennial (2015-2017)	PG&E	2.10 – Emergency Preparedness Modeling	Column applicable to CEC only	• 3a - Maintain/Reduce operations and maintenance costs. • 4a - Greenhouse Gas emissions reductions (MMTCO2e). • 5a - Outage number, frequency and duration reductions. • 5d - Public safety improvement and hazard exposure reduction. • 5e - Utility worker safety improvement and hazard exposure reduction. • 5c - Forecast accuracy improvement.	• Project completed in February 2019. • This project developed the Restoration Work Plan (RWP) system to demonstrate rapid and accurate restoration plan development for emergencies • The project demonstrated the ability to aggregate equipment damage estimates via damage models, assessments, and outage information systems. • It also was able to determine time needed for restoration and optimal work resources through a machine learning performance model that predicts accurate work demand and resource performance. • A mixed integer linear programming (MILP) optimization model that considered multiple stochastic damage scenarios was built to provide resource positioning recommendations that are fast and transparent and more cost-effective and efficient. • Final Report included in this 2018 EPIC Annual Report.
41	2nd Triennial (2015-2017)	PG&E	2.11 – New Mobile Technology & Visualization Applications	Column applicable to CEC only	N/A	• Project not executed.
42	2nd Triennial (2015-2017)	PG&E	2.12 - New Emergency Management Mobile Applications	Column applicable to CEC only	N/A	• Project not executed.
43	2nd Triennial (2015-2017)	PG&E	2.13 – Digital Substation/Substation Automation	Column applicable to CEC only	N/A	• Project not executed.
44	2nd Triennial (2015-2017)	PG&E	2.14 – Automatically Map Phasing Information	Column applicable to CEC only	• 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid.	• Project completed in December 2018 • This project successfully developed and demonstrated automated analytical methods for determining meter phasing and meter-to-transformer connectivity using SmartMeter™, Supervisory Control and Data Acquisition (SCADA) and Geographic Information System (GIS) data. • The in-house method developed by PG&E delivered promising results and PG&E is currently working towards further improving the performance of the algorithms, so that an automated solution may be implemented at scale. • Final Report included in this 2018 EPIC Annual Report

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	A	*B*	*C*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
For Report DOC	i. Investment Plan Period		Project Name	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
45	2nd Triennial (2015-2017)	PG&E	2.15 – Synchrophasor Applications for Generator Dynamic Model Validation	$ 620,157	$654,000 - $799,000	$ 559,481	$ 180,244	$ 739,725	$ 800	N/A	N/A	N/A
46	2nd Triennial (2015-2017)	PG&E	2.16 – Enhanced Synchrophasor Analytics & Applications	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
47	2nd Triennial (2015-2017)	PG&E	2.17 – Geomagnetic Disturbance (GMD) Evaluation	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
48	2nd Triennial (2015-2017)	PG&E	2.18 – Optical Instrument Transformers and Sensors for Protection and Control Systems	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
49	2nd Triennial (2015-2017)	PG&E	2.19 – Enable Distributed Demand-Side Strategies & Technologies	$ 1,678,045	$2,615,000 - $3,197,000	$ 1,471,957	$ 710,092	$ 2,182,049	$ 31,151	N/A	N/A	N/A
50	2nd Triennial (2015-2017)	PG&E	2.20 – Real-Time Energy Usage Feedback to Customers	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
51	2nd Triennial (2015-2017)	PG&E	2.21 – Home Area Network (HAN) for Commercial Customers	$ 8,451	$180,000 - $220,000	$ 22,302	$ 201,174	$ 223,476	$ 3,193	N/A	Rainforest Automation providing development of the cloud service application used by the customers	N/A
52	2nd Triennial (2015-2017)	PG&E	2.22 – Demand Reduction through Targeted Data Analytics	$ 656,887	$1,734,000 - $2,120,000	$ 733,780	$ 991,242	$ 1,725,022	$ 14,902	N/A	N/A	N/A
53	2nd Triennial (2015-2017)	PG&E	2.23 – Integrate Demand Side Approaches Into Utility Planning	$ 1,831,735	$2,831,000 - $3,461,000	$ 1,798,098	$ 1,304,382	$ 3,102,480	$ 8,188	N/A	N/A	N/A

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	A	*B*	*C*	*R*	*S*	*T*	*U*	*V*	*W*
For Report DOC	i. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
45	2nd Triennial (2015-2017)	PG&E	2.15 – Synchrophasor Applications for Generator Dynamic Model Validation	N/A	Pay for performance	N/A	• Sole Source - - MathWorks was selected as the software tool because they are the only commercial vendor of this type of parameter estimation tool required for the project. - Schweitzer Engineering Labs was selected as the PMU vendor because they are the only vendor to offer a module to measure generator rotor angle which was necessary for the modeling effort.	N/A	N/A
46	2nd Triennial (2015-2017)	PG&E	2.16 – Enhanced Synchrophasor Analytics & Applications	N/A	N/A	N/A	N/A	N/A	N/A
47	2nd Triennial (2015-2017)	PG&E	2.17 – Geomagnetic Disturbance (GMD) Evaluation	N/A	N/A	N/A	N/A	N/A	N/A
48	2nd Triennial (2015-2017)	PG&E	2.18 – Optical Instrument Transformers and Sensors for Protection and Control Systems	N/A	N/A	N/A	N/A	N/A	N/A
49	2nd Triennial (2015-2017)	PG&E	2.19 – Enable Distributed Demand-Side Strategies & Technologies	N/A	Pay for Performance	N/A	Competitive Bid	10	Solar City (for residential customers); Green Charge Networks (for commercial customers)
50	2nd Triennial (2015-2017)	PG&E	2.20 – Real-Time Energy Usage Feedback to Customers	N/A	N/A	N/A	N/A	N/A	N/A
51	2nd Triennial (2015-2017)	PG&E	2.21 – Home Area Network (HAN) for Commercial Customers	N/A	Pay for Performance	N/A - No current evidence of Intellectual Property development	Sole Source to Rainforest Automation for purchase of energy monitoring devices that connect to the SmartMeter™.	N/A	N/A
52	2nd Triennial (2015-2017)	PG&E	2.22 – Demand Reduction through Targeted Data Analytics	N/A	N/A	N/A	Sole Source to Teradata to reduce unnecessary IT redundancy by leveraging existing data platform and data connections rather than re-create them.	N/A	N/A
53	2nd Triennial (2015-2017)	PG&E	2.23 – Integrate Demand Side Approaches Into Utility Planning	N/A	Pay for Performance	N/A	Sole Source to Integral Analytics (IA) given they are the developer/vendor for LoadSEER, which is the tool that is being modified to achieve the goals of this project.	N/A	N/A

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Row #	Investment Program Period	Program Administrator	Project Name	If Competitively Selected, Provide the Rank of the Selected Bidder in the Selection Process.	If Competitively Selected, Explain Why the Bidder Was Not the Highest Scoring Bidder, Explain Why a Lower Scoring Bidder Was Selected.	If Interagency or Sole Source Agreement, Specify Date of Notification to the Joint Legislative Budget Committee (JLBC) Was Notified and Date of JLBC Authorization.	Does Award Recipient Identify as California-Based Entity, Small Business, Businesses Owned by Women, Minorities, or Disabled Veterans? Information Requested for Technology Vendor Procurements Only (i.e., Not PMs, Consulting Services, Etc.)
	A	*B*	*C*	*X*	*Y*	*Z*	*AA*
For Report DOC	i. Investment Plan Period		Project Name				
45	2nd Triennial (2015-2017)	PG&E	2.15 – Synchrophasor Applications for Generator Dynamic Model Validation	N/A	N/A	Column applicable to CEC only	No
46	2nd Triennial (2015-2017)	PG&E	2.16 – Enhanced Synchrophasor Analytics & Applications	N/A	N/A	Column applicable to CEC only	N/A
47	2nd Triennial (2015-2017)	PG&E	2.17 – Geomagnetic Disturbance (GMD) Evaluation	N/A	N/A	Column applicable to CEC only	N/A
48	2nd Triennial (2015-2017)	PG&E	2.18 – Optical Instrument Transformers and Sensors for Protection and Control Systems	N/A	N/A	Column applicable to CEC only	N/A
49	2nd Triennial (2015-2017)	PG&E	2.19 – Enable Distributed Demand-Side Strategies & Technologies	1	N/A	Column applicable to CEC only	No
50	2nd Triennial (2015-2017)	PG&E	2.20 – Real-Time Energy Usage Feedback to Customers	N/A	N/A	Column applicable to CEC only	N/A
51	2nd Triennial (2015-2017)	PG&E	2.21 – Home Area Network (HAN) for Commercial Customers	N/A	N/A	Column applicable to CEC only	N/A
52	2nd Triennial (2015-2017)	PG&E	2.22 – Demand Reduction through Targeted Data Analytics	N/A	N/A	Column applicable to CEC only	N/A
53	2nd Triennial (2015-2017)	PG&E	2.23 – Integrate Demand Side Approaches Into Utility Planning	N/A	N/A	Column applicable to CEC only	No

Row #	Investment Program Period	Program Administrator	Project Name	How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals	Applicable Metrics	2018 Update
	A	*B*	*C*	*AB*	*AC*	*AD*
For Report DOC	i. Investment Plan Period		Project Name		vi. Metrics	xv. 2018 Status Update
45	2nd Triennial (2015-2017)	PG&E	2.15 – Synchrophasor Applications for Generator Dynamic Model Validation	Column applicable to CEC only	• 3a - Maintain/Reduce operations and maintenance costs. • 5a - Outage number, frequency and duration reductions. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid (Public Utilities Code 8360).	• Project completed in December 2018. • The integration of PMUs on generators for dynamic model validation is a new technology and the project did not result in a tool that is production ready. As applications evolve, installation of PMUs at generating stations could potentially allow utilities to enhance their generator model validation processes. • Final Report included in this 2018 EPIC Annual Report.
46	2nd Triennial (2015-2017)	PG&E	2.16 – Enhanced Synchrophasor Analytics & Applications	Column applicable to CEC only	N/A	• Project not executed.
47	2nd Triennial (2015-2017)	PG&E	2.17 – Geomagnetic Disturbance (GMD) Evaluation	Column applicable to CEC only	N/A	• Project not executed.
48	2nd Triennial (2015-2017)	PG&E	2.18 – Optical Instrument Transformers and Sensors for Protection and Control Systems	Column applicable to CEC only	N/A	• Project not executed.
49	2nd Triennial (2015-2017)	PG&E	2.19 – Enable Distributed Demand-Side Strategies & Technologies	Column applicable to CEC only	• 1c - Avoided procurement and generation costs. • 1i - Nameplate Capacity of Grid-Connected Storage. • 3f - Improvements in system operation efficiencies stemming from increased utility dispatchability of customer demand side management. • 5b - Electric system power flow congestion reduction. • 5d - Public safety improvement and hazard exposure reduction. • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid. • 7d - Deployment and integration of cost-effective distributed resources and generation, including renewable resources.	• Project completed in February 2018 • Final Report included in this 2017 EPIC Annual Report
50	2nd Triennial (2015-2017)	PG&E	2.20 – Real-Time Energy Usage Feedback to Customers	Column applicable to CEC only	N/A	• Project not executed.
51	2nd Triennial (2015-2017)	PG&E	2.21 – Home Area Network (HAN) for Commercial Customers	Column applicable to CEC only	• 1e - Peak load reduction (megawatts) from summer and winter programs. • 1f - Avoided customer energy use (kilowatt hours saved). • 1h - Customer bill savings (dollars saved). • 3a - Maintain / Reduce operations and maintenance costs. • 4a - GHG emissions reductions (MMTCO2e). • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Public Utilities Code § 8360).	• Project completed in February 2018 • Final Report included in 2017 EPIC Annual Report
52	2nd Triennial (2015-2017)	PG&E	2.22 – Demand Reduction through Targeted Data Analytics	Column applicable to CEC only	• 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.	2018 Status Update • Project completed in February 2019 • This project may result in the enhancement of utility distribution planning tools and processes by facilitating the identification of the lowest cost portfolio capable of deferring, or completely mitigating, asset upgrades. Project tools produced by EPIC 2.22 consider both traditional wires solutions and DER portfolios and allows Distribution Planners to complete advanced scenario analysis. • Following the development of these new capabilities, EPIC 2.22 tools and platforms were used to support PG&E's first Distribution Deferral Opportunity Report (DDOR). EPIC 2.22 was leveraged by PG&E to complete detailed analysis and scenario comparisons at low costs, in a timely fashion, and with a level of analytical rigor that exceed regulatory requirements. • Final Report included in this 2018 EPIC Annual Report.
53	2nd Triennial (2015-2017)	PG&E	2.23 – Integrate Demand Side Approaches Into Utility Planning	Column applicable to CEC only	• 1c - Avoided procurement and generation costs. • 3f - Improvements in system operation efficiencies stemming from increased utility dispatchability of customer demand side management. • 5c - Forecast accuracy improvement. • 7e - Development and incorporation of cost-effective demand response, demand side resources, and energy-efficient resources (Public Utilities Code § 8360).	• Project completed in 2017. • Final Report included in this 2017 EPIC Annual Report.

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	A	*B*	*C*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
For Report DOC	i. Investment Plan Period		Project Name	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
54	2nd Triennial (2015-2017)	PG&E	2.24 – Appliance Level Bill Disaggregation for Non-Residential Customers	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
55	2nd Triennial (2015-2017)	PG&E	2.25 – Enhanced Smart Grid Communications	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
56	2nd Triennial (2015-2017)	PG&E	2.26 – Customer & Distribution Automation Open Architecture Devices	$ 1,462,438	$3,015,000 - $3,685,000	$ 1,096,118	$ 2,291,303	$ 3,387,422	$ 109,170	N/A	N/A	N/A
57	2nd Triennial (2015-2017)	PG&E	2.27 – Next Generation Integrated Smart Grid Network Management	$ 576,433	$1,008,000 - $1,232,000	$ 564,219	$ 569,510	$ 1,133,728	$ 6,363	N/A	N/A	N/A
58	2nd Triennial (2015-2017)	PG&E	2.28 – Smart Grid Communications Path Monitoring	$ 58,518	$227,000 - $277,000	$ 63,687	$ 188,182	$ 251,869	$ 7,236	N/A	N/A	N/A
59	2nd Triennial (2015-2017)	PG&E	2.29 – Mobile Meter Applications	$ 1,709,700	$2,610,000 - $3,190,000	$ 1,610,558	$ 905,815	$ 2,516,373	$ 56,768	In-kind services for resource time from Lawrence Livermore National Lab (LLNL) on technical specification calls	Lawrence Livermore National Lab providing technical support for product development	N/A
60	2nd Triennial (2015-2017)	PG&E	2.30 – Leverage EPIC Funds to Participate in Industry-Wide RD&D Programs	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
61	2nd Triennial (2015-2017)	PG&E	2.31 – Aggregated Behind-The-Meter Storage Market / Retail Optimization	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
62	2nd Triennial (2015-2017)	PG&E	2.32 – Electric Load Management for Ridesharing Electrification	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
63	2nd Triennial (2015-2017)	PG&E	2.33 – Service Issue Identification Leveraging Momentary Outage Information	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
64	2nd Triennial (2015-2017)	PG&E	2.34 – Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors	$ 1,201,883	$1,655,000 - $2,023,000	$ 901,327	$ 222,141	$ 1,123,468	$ 7,529	N/A	N/A	N/A

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	A	*B*	*C*	*R*	*S*	*T*	*U*	*V*	*W*
For Report DOC	i. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
54	2nd Triennial (2015-2017)	PG&E	2.24 – Appliance Level Bill Disaggregation for Non-Residential Customers	N/A	N/A	N/A	N/A	N/A	N/A
55	2nd Triennial (2015-2017)	PG&E	2.25 – Enhanced Smart Grid Communications	N/A	N/A	N/A	N/A	N/A	N/A
56	2nd Triennial (2015-2017)	PG&E	2.26 – Customer & Distribution Automation Open Architecture Devices	N/A	N/A	• Patent filed for AMI network Open Architecture System	Compeitive Bid	N/A	Errigal Inc.
57	2nd Triennial (2015-2017)	PG&E	2.27 – Next Generation Integrated Smart Grid Network Management	N/A	Pay for Performance	N/A	Competitive Bid	8	Errigal Inc.
58	2nd Triennial (2015-2017)	PG&E	2.28 – Smart Grid Communications Path Monitoring	N/A	N/A	N/A	N/A	N/A	N/A
59	2nd Triennial (2015-2017)	PG&E	2.29 – Mobile Meter Applications	N/A	Pay for Performance	Intellectual Property potential being explored	Competitive Bid	8	Ofer Communications
60	2nd Triennial (2015-2017)	PG&E	2.30 – Leverage EPIC Funds to Participate in Industry-Wide RD&D Programs	N/A	N/A	N/A	N/A	N/A	N/A
61	2nd Triennial (2015-2017)	PG&E	2.31 – Aggregated Behind-The-Meter Storage Market / Retail Optimization	N/A	N/A	N/A	N/A	N/A	N/A
62	2nd Triennial (2015-2017)	PG&E	2.32 – Electric Load Management for Ridesharing Electrification	N/A	N/A	N/A	N/A	N/A	N/A
63	2nd Triennial (2015-2017)	PG&E	2.33 – Service Issue Identification Leveraging Momentary Outage Information	N/A	N/A	N/A	N/A	N/A	N/A
64	2nd Triennial (2015-2017)	PG&E	2.34 – Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors	N/A	N/A	N/A	N/A	N/A	N/A

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	A	*B*	*C*	*X*	*Y*	*Z*	*AA*
For Report DOC	i. Investment Plan Period		Project Name				
54	2nd Triennial (2015-2017)	PG&E	2.24 – Appliance Level Bill Disaggregation for Non-Residential Customers	N/A	N/A	Column applicable to CEC only	N/A
55	2nd Triennial (2015-2017)	PG&E	2.25 – Enhanced Smart Grid Communications	N/A	N/A	Column applicable to CEC only	N/A
56	2nd Triennial (2015-2017)	PG&E	2.26 – Customer & Distribution Automation Open Architecture Devices	2	Supplier selected had best prices for Use Cases that were selected for award.	Column applicable to CEC only	No
57	2nd Triennial (2015-2017)	PG&E	2.27 – Next Generation Integrated Smart Grid Network Management	1	N/A	Column applicable to CEC only	Yes
58	2nd Triennial (2015-2017)	PG&E	2.28 – Smart Grid Communications Path Monitoring	N/A	N/A	Column applicable to CEC only	N/A
59	2nd Triennial (2015-2017)	PG&E	2.29 – Mobile Meter Applications	1	N/A	Column applicable to CEC only	No
60	2nd Triennial (2015-2017)	PG&E	2.30 – Leverage EPIC Funds to Participate in Industry-Wide RD&D Programs	N/A	N/A	Column applicable to CEC only	N/A
61	2nd Triennial (2015-2017)	PG&E	2.31 – Aggregated Behind-The-Meter Storage Market / Retail Optimization	N/A	N/A	Column applicable to CEC only	N/A
62	2nd Triennial (2015-2017)	PG&E	2.32 – Electric Load Management for Ridesharing Electrification	N/A	N/A	Column applicable to CEC only	N/A
63	2nd Triennial (2015-2017)	PG&E	2.33 – Service Issue Identification Leveraging Momentary Outage Information	N/A	N/A	Column applicable to CEC only	N/A
64	2nd Triennial (2015-2017)	PG&E	2.34 – Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors	N/A	N/A	Column applicable to CEC only	N/A

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	A	*B*	*C*	*AB*	*AC*	*AD*
For Report DOC	i. Investment Plan Period		Project Name		vi. Metrics	xv. 2018 Status Update
54	2nd Triennial (2015-2017)	PG&E	2.24 – Appliance Level Bill Disaggregation for Non-Residential Customers	Column applicable to CEC only	N/A	• Project not executed.
55	2nd Triennial (2015-2017)	PG&E	2.25 – Enhanced Smart Grid Communications	Column applicable to CEC only	N/A	• Project not executed.
56	2nd Triennial (2015-2017)	PG&E	2.26 – Customer & Distribution Automation Open Architecture Devices	Column applicable to CEC only	• 3f - Improvements in system operation efficiencies stemming from increased utility dispatchability of customer demand side management. • 5i - Increase in the number of nodes in the power system at monitoring points. • 7j - Provide consumers with timely information and control options.	• Project completed in February 2019. • This project successfully demonstrated in laboratory and field tests, the ability to communicate with, monitor, and control PG&E and third-party devices in five use cases. • These use cases involved Smart Inverters, sensors, SCADA and other distribution intelligent electric devices (IEDs), RFID equipment and Direct Acquisition and Control Telemetry. • These use cases were selected for their potential to improve system reliability, reduce costs, or both. • This project was successful in demonstrating that PG&E's AMI network can be leveraged for these additional use cases and is suitable for connecting and transmitting data from customer and utility devices. • Final report included in this 2018 EPIC Annual report.
57	2nd Triennial (2015-2017)	PG&E	2.27 – Next Generation Integrated Smart Grid Network Management	Column applicable to CEC only	• 3a - Maintain/Reduce operations and maintenance costs. • 5a - Outage number, frequency and duration reductions. • 5d - Public safety improvement and hazard exposure reduction. • 5e - Utility worker safety improvement and hazard exposure reduction.	• Project completed in August 2018. • Developed a demonstration grade management platform that successfully identified inventory, configuration, and performance data for all three AMI networks including both networking elements and metering endpoints. • The project learned the complexity of adding functions needed such as additional Head-End Network Management functions, integration with GIS layers (i.e., data sources like CC&B, MDMS), and integration with various PG&E ticketing systems (Remedy, FAS). Based on this complexity, an enterprise management system will be needed to scale the functions demonstrated through this project. • Final report included in this 2018 EPIC Annual report.
58	2nd Triennial (2015-2017)	PG&E	2.28 – Smart Grid Communications Path Monitoring	Column applicable to CEC only	• 1h - Customer bill savings (dollars saved). • 3e - Non-energy economic benefits – reduction operational hours to fix estimated bills due to RF Interference.	• Project completed in February 2018 • Final Report included in 2017 EPIC Annual Report
59	2nd Triennial (2015-2017)	PG&E	2.29 – Mobile Meter Applications	Column applicable to CEC only	• 3a - Maintain/Reduce operations and maintenance costs (Affordability). • 7b - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid (Reliability). • 7j - Provide consumers with timely information and control options (Customer).	• Project completed in February 2019. • Conducted functional and acceptance testing on alpha and beta NGM prototypes. • Demonstrated mobile application of NGM prototype at PG&E • Refined integration of accelerometer into the NGM • Designed, implemented, and tested C12.19 and head end applications into NGM • Final report included in this 2018 EPIC Annual report.
60	2nd Triennial (2015-2017)	PG&E	2.30 – Leverage EPIC Funds to Participate in Industry-Wide RD&D Programs	Column applicable to CEC only	N/A	• Project not executed.
61	2nd Triennial (2015-2017)	PG&E	2.31 – Aggregated Behind-The-Meter Storage Market / Retail Optimization	Column applicable to CEC only	N/A	• Formally Withdrawn by PG&E on 07/31/2017 via PG&E Comments on Draft Resolution E-4863
62	2nd Triennial (2015-2017)	PG&E	2.32 – Electric Load Management for Ridesharing Electrification	Column applicable to CEC only	N/A	• Deferred to a future investment plan by CPUC. Resolution E-4863. 08/10/2017. • Re-assigned as EPIC 3.42.
63	2nd Triennial (2015-2017)	PG&E	2.33 – Service Issue Identification Leveraging Momentary Outage Information	Column applicable to CEC only	N/A	• Deferred to a future investment plan by CPUC. Resolution E-4863. 08/10/2017 • Re-assigned as EPIC 3.43.
64	2nd Triennial (2015-2017)	PG&E	2.34 – Predictive Risk Identification with Radio Frequency (RF) Added to Line Sensors	Column applicable to CEC only	• 3a - Maintain / Reduce operations and maintenance costs • 5a - Outage number, frequency and duration reductions • 5d - Public safety improvement and hazard exposure reduction	• Project is in the Build/Test phase. • Developed pole-mounted Distribution Reliability Line Monitor (DRLM) product with radio frequency and environmental sensors. • Conducted field demonstration of DRLM product and assessed the ability of associated algorithm to predict incipient faults for distribution assets. • Next steps include further assessment, lab testing and field demonstration of products for imminent asset failure detection and real-time monitoring of PG&E rights-of-way.

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	A	*B*	*C*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
For Report DOC	i. Investment Plan Period		Project Name	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
65	2nd Triennial (2015-2017)	PG&E	2.35 – Call Center Staffing Optimization	$ -	$ -	$ -	$ -	$ -	$ -	N/A	N/A	N/A
66	2nd Triennial (2015-2017)	PG&E	2.36 – Dynamic Rate Design Tool	$ 585,440	$1,913,000 - $2,338,000	$ 460,493	$ 431,621	$ 892,113	$ -	N/A	N/A	N/A
67	3rd Triennial (2018-2020)	PG&E	3.01 – Automated DER Impact & Long-Term Dynamics EvaluationAutomated DER impact	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
68	3rd Triennial (2018-2020)	PG&E	3.02 – Utility Aggregated Resources with Market Participation	$ -	$593,000 - $694,400	$ -	$ -	$ -	$ -	TBD	TBD	TBD
69	3rd Triennial (2018-2020)	PG&E	3.03 – Distributed Energy Resource Management System (DERMS) and Advanced Distribution Management System (ADMS) Advanced Functionality	$ -	$3,330,000 - $3,898,000	$ -	$ -	$ -	$ -	TBD	TBD	TBD
70	3rd Triennial (2018-2020)	PG&E	3.04 – Multi-Nodal Distributed Digital Ledger	$ -	$2,430,000 - $2,845,000		$ 1,831	$ 1,831	$ -	TBD	TBD	TBD
71	3rd Triennial (2018-2020)	PG&E	3.05 – Virtual DER Markets for Capacity and Other Attributes	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
72	3rd Triennial (2018-2020)	PG&E	3.06 – Auto Identification (AutoID) of Behind-the-Meter (BTM) Storage	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD

Row #	Investment Program Period	Program Administrator	Project Name	Match Funding Split	Funding Mechanism	Intellectual Property	Identification of the Method Used to Grant Awards.	If Competitively Selected, Provide the Number of Bidders Passing the Initial Pass/Fail Screening for Project	If Competitively Selected, Provide the Name of Selected Bidder.
	A	*B*	*C*	*R*	*S*	*T*	*U*	*V*	*W*
For Report DOC	i. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
65	2nd Triennial (2015-2017)	PG&E	2.35 – Call Center Staffing Optimization	N/A	N/A	N/A	N/A	N/A	N/A
66	2nd Triennial (2015-2017)	PG&E	2.36 – Dynamic Rate Design Tool	N/A	Pay for Performance	N/A	N/A	N/A	N/A
67	3rd Triennial (2018-2020)	PG&E	3.01 – Automated DER Impact & Long-Term Dynamics EvaluationAutomated DER impact	TBD	TBD	TBD	TBD	TBD	TBD
68	3rd Triennial (2018-2020)	PG&E	3.02 – Utility Aggregated Resources with Market Participation	TBD	TBD	TBD	TBD	TBD	TBD
69	3rd Triennial (2018-2020)	PG&E	3.03 – Distributed Energy Resource Management System (DERMS) and Advanced Distribution Management System (ADMS) Advanced Functionality	TBD	TBD	TBD	TBD	TBD	TBD
70	3rd Triennial (2018-2020)	PG&E	3.04 – Multi-Nodal Distributed Digital Ledger	TBD	TBD	TBD	TBD	TBD	TBD
71	3rd Triennial (2018-2020)	PG&E	3.05 – Virtual DER Markets for Capacity and Other Attributes	TBD	TBD	TBD	TBD	TBD	TBD
72	3rd Triennial (2018-2020)	PG&E	3.06 – Auto Identification (AutoID) of Behind-the-Meter (BTM) Storage	TBD	TBD	TBD	TBD	TBD	TBD

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	A	*B*	*C*	*X*	*Y*	*Z*	*AA*
For Report DOC	i. Investment Plan Period		Project Name				
65	2nd Triennial (2015-2017)	PG&E	2.35 – Call Center Staffing Optimization	N/A	N/A	Column applicable to CEC only	N/A
66	2nd Triennial (2015-2017)	PG&E	2.36 – Dynamic Rate Design Tool	N/A	N/A	Column applicable to CEC only	N/A
67	3rd Triennial (2018-2020)	PG&E	3.01 – Automated DER Impact & Long-Term Dynamics EvaluationAutomated DER impact	TBD	TBD	Column applicable to CEC only	
68	3rd Triennial (2018-2020)	PG&E	3.02 – Utility Aggregated Resources with Market Participation	TBD	TBD	Column applicable to CEC only	
69	3rd Triennial (2018-2020)	PG&E	3.03 – Distributed Energy Resource Management System (DERMS) and Advanced Distribution Management System (ADMS) Advanced Functionality	TBD	TBD	Column applicable to CEC only	
70	3rd Triennial (2018-2020)	PG&E	3.04 – Multi-Nodal Distributed Digital Ledger	TBD	TBD	Column applicable to CEC only	
71	3rd Triennial (2018-2020)	PG&E	3.05 – Virtual DER Markets for Capacity and Other Attributes	TBD	TBD	Column applicable to CEC only	
72	3rd Triennial (2018-2020)	PG&E	3.06 – Auto Identification (AutoID) of Behind-the-Meter (BTM) Storage	TBD	TBD	Column applicable to CEC only	

Row #	Investment Program Period	Program Administrator	Project Name	How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals	Applicable Metrics	2018 Update
	A	*B*	*C*	*AB*	*AC*	*AD*
For Report DOC	i. Investment Plan Period		Project Name		vi. Metrics	xv. 2018 Status Update
65	2nd Triennial (2015-2017)	PG&E	2.35 – Call Center Staffing Optimization	Column applicable to CEC only	N/A	• Rejected by CPUC. Resolution E-4863. 08/10/2017
66	2nd Triennial (2015-2017)	PG&E	2.36 – Dynamic Rate Design Tool	Column applicable to CEC only	• Time to complete the process of designing, optimizing, and analyzing the impact of a hypothetical rate design	• Project is in Close-out phase. • Created technical architecture • Developed customer, meter and cost of service databases • Developed customer segmentation, bill determinant, rate schedule, bill calculation and rate solver modules that integrate the steps for rate design • Developed rate evaluation module including bill impact, bill volatility and energy burden • Completed E1, TOU and hypothetical DER Rates • Completed validation and acceptance testing
67	3rd Triennial (2018-2020)	PG&E	3.01 – Automated DER Impact & Long-Term Dynamics EvaluationAutomated DER impact	Column applicable to CEC only	TBD	• Project is currently on hold.
68	3rd Triennial (2018-2020)	PG&E	3.02 – Utility Aggregated Resources with Market Participation	Column applicable to CEC only	TBD	• Project is in planning phase
69	3rd Triennial (2018-2020)	PG&E	3.03 – Distributed Energy Resource Management System (DERMS) and Advanced Distribution Management System (ADMS) Advanced Functionality	Column applicable to CEC only	TBD	• Project is in planning phase
70	3rd Triennial (2018-2020)	PG&E	3.04 – Multi-Nodal Distributed Digital Ledger	Column applicable to CEC only	TBD	• Project is in planning phase
71	3rd Triennial (2018-2020)	PG&E	3.05 – Virtual DER Markets for Capacity and Other Attributes	Column applicable to CEC only	TBD	• Project is currently on hold.
72	3rd Triennial (2018-2020)	PG&E	3.06 – Auto Identification (AutoID) of Behind-the-Meter (BTM) Storage	Column applicable to CEC only	TBD	• Project is currently on hold.

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Row #	Investment Program Period	Program Administrator	Project Name	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to Date: Contract/Grant Amount ($)	Funds Expended to Date: In House Expenditures ($)	Funds Expended to Date: Total Spent to Date ($)	Administrative and Overhead Costs to Be Incurred for Each Project	Leveraged Funds	Partners	Match Funding
	A	*B*	*C*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
For Report DOC	i. Investment Plan Period		Project Name	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
73	3rd Triennial (2018-2020)	PG&E	3.07 – Utility Scale Storage for Load Balancing	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
74	3rd Triennial (2018-2020)	PG&E	3.08 – Second-Life Batteries for Grid Needs	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
75	3rd Triennial (2018-2020)	PG&E	3.09 – Dynamic Near-Term DER Load Forecasting	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
76	3rd Triennial (2018-2020)	PG&E	3.10– Grid of the Future Scenario Engine	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
77	3rd Triennial (2018-2020)	PG&E	3.11 – Location-Specific Options for Reliability and/or Resilience Upgrades	$ -	$1,823,000 - $2,134,000	$ -	$ -	$ -	$ -	TBD	TBD	TBD
78	3rd Triennial (2018-2020)	PG&E	3.12 – Advanced Volt/Var Optimization (VVO) Functionalities	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
79	3rd Triennial (2018-2020)	PG&E	3.13 – Transformer Monitoring via Field Area Network (FAN)	$ -	$1,137,000 - $1,331,000	$ -	$ -	$ -	$ -	TBD	TBD	TBD
80	3rd Triennial (2018-2020)	PG&E	3.14 – Maintenance Prioritization for Imminent Asset Risk	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD

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Row #	Investment Program Period	Program Administrator	Project Name	Match Funding Split	Funding Mechanism	Intellectual Property	Identification of the Method Used to Grant Awards.	If Competitively Selected, Provide the Number of Bidders Passing the Initial Pass/Fail Screening for Project	If Competitively Selected, Provide the Name of Selected Bidder.
	A	*B*	*C*	*R*	*S*	*T*	*U*	*V*	*W*
For Report DOC	i. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
73	3rd Triennial (2018-2020)	PG&E	3.07 – Utility Scale Storage for Load Balancing	TBD	TBD	TBD	TBD	TBD	TBD
74	3rd Triennial (2018-2020)	PG&E	3.08 – Second-Life Batteries for Grid Needs	TBD	TBD	TBD	TBD	TBD	TBD
75	3rd Triennial (2018-2020)	PG&E	3.09 – Dynamic Near-Term DER Load Forecasting	TBD	TBD	TBD	TBD	TBD	TBD
76	3rd Triennial (2018-2020)	PG&E	3.10– Grid of the Future Scenario Engine	TBD	TBD	TBD	TBD	TBD	TBD
77	3rd Triennial (2018-2020)	PG&E	3.11 – Location-Specific Options for Reliability and/or Resilience Upgrades	TBD	TBD	TBD	TBD	TBD	TBD
78	3rd Triennial (2018-2020)	PG&E	3.12 – Advanced Volt/Var Optimization (VVO) Functionalities	TBD	TBD	TBD	TBD	TBD	TBD
79	3rd Triennial (2018-2020)	PG&E	3.13 – Transformer Monitoring via Field Area Network (FAN)	TBD	TBD	TBD	TBD	TBD	TBD
80	3rd Triennial (2018-2020)	PG&E	3.14 – Maintenance Prioritization for Imminent Asset Risk	TBD	TBD	TBD	TBD	TBD	TBD

Row #	Investment Program Period	Program Administrator	Project Name	If Competitively Selected, Provide the Rank of the Selected Bidder in the Selection Process.	If Competitively Selected, Explain Why the Bidder Was Not the Highest Scoring Bidder, Explain Why a Lower Scoring Bidder Was Selected.	If Interagency or Sole Source Agreement, Specify Date of Notification to the Joint Legislative Budget Committee (JLBC) Was Notified and Date of JLBC Authorization.	Does Award Recipient Identify as California-Based Entity, Small Business, Businesses Owned by Women, Minorities, or Disabled Veterans? Information Requested for Technology Vendor Procurements Only (i.e., Not PMs, Consulting Services, Etc.)
	A	*B*	*C*	*X*	*Y*	*Z*	*AA*
For Report DOC	i. Investment Plan Period		Project Name				
73	3rd Triennial (2018-2020)	PG&E	3.07 – Utility Scale Storage for Load Balancing	TBD	TBD	Column applicable to CEC only	
74	3rd Triennial (2018-2020)	PG&E	3.08 – Second-Life Batteries for Grid Needs	TBD	TBD	Column applicable to CEC only	
75	3rd Triennial (2018-2020)	PG&E	3.09 – Dynamic Near-Term DER Load Forecasting	TBD	TBD	Column applicable to CEC only	
76	3rd Triennial (2018-2020)	PG&E	3.10– Grid of the Future Scenario Engine	TBD	TBD	Column applicable to CEC only	
77	3rd Triennial (2018-2020)	PG&E	3.11 – Location-Specific Options for Reliability and/or Resilience Upgrades	TBD	TBD	Column applicable to CEC only	
78	3rd Triennial (2018-2020)	PG&E	3.12 – Advanced Volt/Var Optimization (VVO) Functionalities	TBD	TBD	Column applicable to CEC only	
79	3rd Triennial (2018-2020)	PG&E	3.13 – Transformer Monitoring via Field Area Network (FAN)	TBD	TBD	Column applicable to CEC only	
80	3rd Triennial (2018-2020)	PG&E	3.14 – Maintenance Prioritization for Imminent Asset Risk	TBD	TBD	Column applicable to CEC only	

Row #	Investment Program Period	Program Administrator	Project Name	How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals	Applicable Metrics	2018 Update
	A	*B*	*C*	*AB*	*AC*	*AD*
For Report DOC	i. Investment Plan Period		Project Name		vi. Metrics	xv. 2018 Status Update
73	3rd Triennial (2018-2020)	PG&E	3.07 – Utility Scale Storage for Load Balancing	Column applicable to CEC only	TBD	• Project is currently on hold.
74	3rd Triennial (2018-2020)	PG&E	3.08 – Second-Life Batteries for Grid Needs	Column applicable to CEC only	TBD	• Project is currently on hold.
75	3rd Triennial (2018-2020)	PG&E	3.09 – Dynamic Near-Term DER Load Forecasting	Column applicable to CEC only	TBD	• Project is currently on hold.
76	3rd Triennial (2018-2020)	PG&E	3.10– Grid of the Future Scenario Engine	Column applicable to CEC only	TBD	• Project is currently on hold.
77	3rd Triennial (2018-2020)	PG&E	3.11 – Location-Specific Options for Reliability and/or Resilience Upgrades	Column applicable to CEC only	May include reduced operating costs, reduction in wires down outages and/or improvements in other local reliability metrics with the potential for increased adoption of DERs for energy resilience	• Project is in planning phase
78	3rd Triennial (2018-2020)	PG&E	3.12 – Advanced Volt/Var Optimization (VVO) Functionalities	Column applicable to CEC only	TBD	• Project is currently on hold.
79	3rd Triennial (2018-2020)	PG&E	3.13 – Transformer Monitoring via Field Area Network (FAN)	Column applicable to CEC only	TBD	• Project is in planning phase.
80	3rd Triennial (2018-2020)	PG&E	3.14 – Maintenance Prioritization for Imminent Asset Risk	Column applicable to CEC only	N/A	• Project merged with 3.20

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	A	*B*	*C*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
For Report DOC	i. Investment Plan Period		Project Name	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
81	3rd Triennial (2018-2020)	PG&E	3.15 – Proactive Wires Down Mitigation	$ -	$7,105,000 - $8,317,000	$ -	$ 18,596	$ 18,596	$ -	TBD	TBD	TBD
82	3rd Triennial (2018-2020)	PG&E	3.16 – Advanced Condition Monitoring for Remote Diagnostics	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
83	3rd Triennial (2018-2020)	PG&E	3.17 – Generic Universal Distribution Controller (UDC) for Relay, Regulator, Load Tap Changer (LTC), Capacitor, Interrupter Control	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
84	3rd Triennial (2018-2020)	PG&E	3.18 – Transformer Health Monitoring	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
85	3rd Triennial (2018-2020)	PG&E	3.19 – Unified Network Solution	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
86	3rd Triennial (2018-2020)	PG&E	3.20 – Data Analytics for Predictive Maintenance	$ -	$1,756,000 - $2,056,000	$ -	$ 23,029	$ 23,029	$ -	TBD	TBD	TBD
87	3rd Triennial (2018-2020)	PG&E	3.21 – Advanced Vegetation Management Insights Using Prescriptive Analytics	$ -	$2,443,000 - $2,860,000	$ -	$ -	$ -	$ -	TBD	TBD	TBD
88	3rd Triennial (2018-2020)	PG&E	3.22 – Abnormal State Configuration Risk and Mitigation	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
89	3rd Triennial (2018-2020)	PG&E	3.23 – Enhanced Distribution Line Equipment Device Settings Management	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
90	3rd Triennial (2018-2020)	PG&E	3.24 – Automatic Power Factor (PF) Management	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
91	3rd Triennial (2018-2020)	PG&E	3.25 – Electric Grid Monitoring (EGM) Meter	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD

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	A	*B*	*C*	*R*	*S*	*T*	*U*	*V*	*W*
For Report DOC	i. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
81	3rd Triennial (2018-2020)	PG&E	3.15 – Proactive Wires Down Mitigation	TBD	TBD	TBD	TBD	TBD	TBD
82	3rd Triennial (2018-2020)	PG&E	3.16 – Advanced Condition Monitoring for Remote Diagnostics	TBD	TBD	TBD	TBD	TBD	TBD
83	3rd Triennial (2018-2020)	PG&E	3.17 – Generic Universal Distribution Controller (UDC) for Relay, Regulator, Load Tap Changer (LTC), Capacitor, Interrupter Control	TBD	TBD	TBD	TBD	TBD	TBD
84	3rd Triennial (2018-2020)	PG&E	3.18 – Transformer Health Monitoring	TBD	TBD	TBD	TBD	TBD	TBD
85	3rd Triennial (2018-2020)	PG&E	3.19 – Unified Network Solution	TBD	TBD	TBD	TBD	TBD	TBD
86	3rd Triennial (2018-2020)	PG&E	3.20 – Data Analytics for Predictive Maintenance	TBD	TBD	TBD	TBD	TBD	TBD
87	3rd Triennial (2018-2020)	PG&E	3.21 – Advanced Vegetation Management Insights Using Prescriptive Analytics	TBD	TBD	TBD	TBD	TBD	TBD
88	3rd Triennial (2018-2020)	PG&E	3.22 – Abnormal State Configuration Risk and Mitigation	TBD	TBD	TBD	TBD	TBD	TBD
89	3rd Triennial (2018-2020)	PG&E	3.23 – Enhanced Distribution Line Equipment Device Settings Management	TBD	TBD	TBD	TBD	TBD	TBD
90	3rd Triennial (2018-2020)	PG&E	3.24 – Automatic Power Factor (PF) Management	TBD	TBD	TBD	TBD	TBD	TBD
91	3rd Triennial (2018-2020)	PG&E	3.25 – Electric Grid Monitoring (EGM) Meter	TBD	TBD	TBD	TBD	TBD	TBD

Row #	Investment Program Period	Program Administrator	Project Name	If Competitively Selected, Provide the Rank of the Selected Bidder in the Selection Process.	If Competitively Selected, Explain Why the Bidder Was Not the Highest Scoring Bidder, Explain Why a Lower Scoring Bidder Was Selected.	If Interagency or Sole Source Agreement, Specify Date of Notification to the Joint Legislative Budget Committee (JLBC) Was Notified and Date of JLBC Authorization.	Does Award Recipient Identify as California-Based Entity, Small Business, Businesses Owned by Women, Minorities, or Disabled Veterans? Information Requested for Technology Vendor Procurements Only (i.e., Not PMs, Consulting Services, Etc.)
	A	*B*	*C*	*X*	*Y*	*Z*	*AA*
For Report DOC	i. Investment Plan Period		Project Name				
81	3rd Triennial (2018-2020)	PG&E	3.15 – Proactive Wires Down Mitigation	TBD	TBD	Column applicable to CEC only	
82	3rd Triennial (2018-2020)	PG&E	3.16 – Advanced Condition Monitoring for Remote Diagnostics	TBD	TBD	Column applicable to CEC only	
83	3rd Triennial (2018-2020)	PG&E	3.17 – Generic Universal Distribution Controller (UDC) for Relay, Regulator, Load Tap Changer (LTC), Capacitor, Interrupter Control	TBD	TBD	Column applicable to CEC only	
84	3rd Triennial (2018-2020)	PG&E	3.18 – Transformer Health Monitoring	TBD	TBD	Column applicable to CEC only	
85	3rd Triennial (2018-2020)	PG&E	3.19 – Unified Network Solution	TBD	TBD	Column applicable to CEC only	
86	3rd Triennial (2018-2020)	PG&E	3.20 – Data Analytics for Predictive Maintenance	TBD	TBD	Column applicable to CEC only	
87	3rd Triennial (2018-2020)	PG&E	3.21 – Advanced Vegetation Management Insights Using Prescriptive Analytics	TBD	TBD	Column applicable to CEC only	
88	3rd Triennial (2018-2020)	PG&E	3.22 – Abnormal State Configuration Risk and Mitigation	TBD	TBD	Column applicable to CEC only	
89	3rd Triennial (2018-2020)	PG&E	3.23 – Enhanced Distribution Line Equipment Device Settings Management	TBD	TBD	Column applicable to CEC only	
90	3rd Triennial (2018-2020)	PG&E	3.24 – Automatic Power Factor (PF) Management	TBD	TBD	Column applicable to CEC only	
91	3rd Triennial (2018-2020)	PG&E	3.25 – Electric Grid Monitoring (EGM) Meter	TBD	TBD	Column applicable to CEC only	

Row #	Investment Program Period	Program Administrator	Project Name	How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals	Applicable Metrics	2018 Update
	A	*B*	*C*	*AB*	*AC*	*AD*
For Report DOC	i. Investment Plan Period		Project Name		vi. Metrics	xv. 2018 Status Update
81	3rd Triennial (2018-2020)	PG&E	3.15 – Proactive Wires Down Mitigation	Column applicable to CEC only	• 3a – Maintain/Reduce operations and maintenance costs. • 4a – GHG Emissions Reductions (MMTCO2e) • 5a – Outage number, frequency and duration reductions	• Project is in the Planning phase. • Identified equipment supplier and entered into contract negotiations. • Next steps include ordering equipment and identify the scope, cost, and specifications for distribution work.
82	3rd Triennial (2018-2020)	PG&E	3.16 – Advanced Condition Monitoring for Remote Diagnostics	Column applicable to CEC only	TBD	• Project is currently on hold.
83	3rd Triennial (2018-2020)	PG&E	3.17 – Generic Universal Distribution Controller (UDC) for Relay, Regulator, Load Tap Changer (LTC), Capacitor, Interrupter Control	Column applicable to CEC only	TBD	• Project is currently on hold.
84	3rd Triennial (2018-2020)	PG&E	3.18 – Transformer Health Monitoring	Column applicable to CEC only	TBD	• Project is currently on hold.
85	3rd Triennial (2018-2020)	PG&E	3.19 – Unified Network Solution	Column applicable to CEC only	TBD	• Project is currently on hold.
86	3rd Triennial (2018-2020)	PG&E	3.20 – Data Analytics for Predictive Maintenance	Column applicable to CEC only	TBD	• Project is in planning phase
87	3rd Triennial (2018-2020)	PG&E	3.21 – Advanced Vegetation Management Insights Using Prescriptive Analytics	Column applicable to CEC only	TBD	• Project is in planning phase
88	3rd Triennial (2018-2020)	PG&E	3.22 – Abnormal State Configuration Risk and Mitigation	Column applicable to CEC only	TBD	• Project is currently on hold.
89	3rd Triennial (2018-2020)	PG&E	3.23 – Enhanced Distribution Line Equipment Device Settings Management	Column applicable to CEC only	TBD	• Project is currently on hold.
90	3rd Triennial (2018-2020)	PG&E	3.24 – Automatic Power Factor (PF) Management	Column applicable to CEC only	TBD	• Project is currently on hold.
91	3rd Triennial (2018-2020)	PG&E	3.25 – Electric Grid Monitoring (EGM) Meter	Column applicable to CEC only	TBD	• Project is currently on hold.

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	A	*B*	*C*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
For Report DOC	i. Investment Plan Period		Project Name	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
92	3rd Triennial (2018-2020)	PG&E	3.26 – Predictive Data Analytics for Proactive Meter Replacement	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
93	3rd Triennial (2018-2020)	PG&E	3.27 – Multi-Purpose Meter (MPM)	$ -	$1,863,000 - $2,181,000	$ 316	$ -	$ 316	$ -	TBD	TBD	TBD
94	3rd Triennial (2018-2020)	PG&E	3.28 – Real-Time Load-Based Charging	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
95	3rd Triennial (2018-2020)	PG&E	3.29 – Advanced Customer Bill Scenario Calculator	$ -	$1,000,000 - $1,170,000	$ -	$ -	$ -	$ -	TBD	TBD	TBD
96	3rd Triennial (2018-2020)	PG&E	3.30 – Connected Device Real-Time Pricing-Based Control	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
97	3rd Triennial (2018-2020)	PG&E	3.31 – Real-Time DER Price Signals	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
98	3rd Triennial (2018-2020)	PG&E	3.32 – System Harmonics for Power Quality Investigations	$ -	$721,000 - $844,000	$ -	$ -	$ -	$ -	TBD	TBD	TBD

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	A	*B*	*C*	*R*	*S*	*T*	*U*	*V*	*W*
For Report DOC	i. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
92	3rd Triennial (2018-2020)	PG&E	3.26 – Predictive Data Analytics for Proactive Meter Replacement	TBD	TBD	TBD	TBD	TBD	TBD
93	3rd Triennial (2018-2020)	PG&E	3.27 – Multi-Purpose Meter (MPM)	TBD	TBD	TBD	TBD	TBD	TBD
94	3rd Triennial (2018-2020)	PG&E	3.28 – Real-Time Load-Based Charging	TBD	TBD	TBD	TBD	TBD	TBD
95	3rd Triennial (2018-2020)	PG&E	3.29 – Advanced Customer Bill Scenario Calculator	TBD	TBD	TBD	TBD	TBD	TBD
96	3rd Triennial (2018-2020)	PG&E	3.30 – Connected Device Real-Time Pricing-Based Control	TBD	TBD	TBD	TBD	TBD	TBD
97	3rd Triennial (2018-2020)	PG&E	3.31 – Real-Time DER Price Signals	TBD	TBD	TBD	TBD	TBD	TBD
98	3rd Triennial (2018-2020)	PG&E	3.32 – System Harmonics for Power Quality Investigations	TBD	TBD	TBD	TBD	TBD	TBD

Row #	Investment Program Period	Program Administrator	Project Name	If Competitively Selected, Provide the Rank of the Selected Bidder in the Selection Process.	If Competitively Selected, Explain Why the Bidder Was Not the Highest Scoring Bidder, Explain Why a Lower Scoring Bidder Was Selected.	If Interagency or Sole Source Agreement, Specify Date of Notification to the Joint Legislative Budget Committee (JLBC) Was Notified and Date of JLBC Authorization.	Does Award Recipient Identify as California-Based Entity, Small Business, Businesses Owned by Women, Minorities, or Disabled Veterans? Information Requested for Technology Vendor Procurements Only (i.e., Not PMs, Consulting Services, Etc.)
	A	*B*	*C*	*X*	*Y*	*Z*	*AA*
For Report DOC	i. Investment Plan Period		Project Name				
92	3rd Triennial (2018-2020)	PG&E	3.26 – Predictive Data Analytics for Proactive Meter Replacement	TBD	TBD	Column applicable to CEC only	
93	3rd Triennial (2018-2020)	PG&E	3.27 – Multi-Purpose Meter (MPM)	TBD	TBD	Column applicable to CEC only	
94	3rd Triennial (2018-2020)	PG&E	3.28 – Real-Time Load-Based Charging	TBD	TBD	Column applicable to CEC only	
95	3rd Triennial (2018-2020)	PG&E	3.29 – Advanced Customer Bill Scenario Calculator	TBD	TBD	Column applicable to CEC only	
96	3rd Triennial (2018-2020)	PG&E	3.30 – Connected Device Real-Time Pricing-Based Control	TBD	TBD	Column applicable to CEC only	
97	3rd Triennial (2018-2020)	PG&E	3.31 – Real-Time DER Price Signals	TBD	TBD	Column applicable to CEC only	
98	3rd Triennial (2018-2020)	PG&E	3.32 – System Harmonics for Power Quality Investigations	TBD	TBD	Column applicable to CEC only	

Row #	Investment Program Period	Program Administrator	Project Name	How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals	Applicable Metrics	2018 Update
	A	*B*	*C*	*AB*	*AC*	*AD*
For Report DOC	i. Investment Plan Period		Project Name		vi. Metrics	xv. 2018 Status Update
92	3rd Triennial (2018-2020)	PG&E	3.26 – Predictive Data Analytics for Proactive Meter Replacement	Column applicable to CEC only	TBD	• Project is currently on hold.
93	3rd Triennial (2018-2020)	PG&E	3.27 – Multi-Purpose Meter (MPM)	Column applicable to CEC only	TBD	• Project is in planning phase.
94	3rd Triennial (2018-2020)	PG&E	3.28 – Real-Time Load-Based Charging	Column applicable to CEC only	TBD	• Project is currently on hold.
95	3rd Triennial (2018-2020)	PG&E	3.29 – Advanced Customer Bill Scenario Calculator	Column applicable to CEC only	TBD	• Project is in planning phase.
96	3rd Triennial (2018-2020)	PG&E	3.30 – Connected Device Real-Time Pricing-Based Control	Column applicable to CEC only	TBD	• Project is currently on hold.
97	3rd Triennial (2018-2020)	PG&E	3.31 – Real-Time DER Price Signals	Column applicable to CEC only	TBD	• Project is currently on hold.
98	3rd Triennial (2018-2020)	PG&E	3.32 – System Harmonics for Power Quality Investigations	Column applicable to CEC only	TBD	• Project is in planning phase.

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Row #	Investment Program Period	Program Administrator	Project Name	Encumbered Funding Amount ($)	Committed Funding Amount ($)	Funds Expended to Date: Contract/Grant Amount ($)	Funds Expended to Date: In House Expenditures ($)	Funds Expended to Date: Total Spent to Date ($)	Administrative and Overhead Costs to Be Incurred for Each Project	Leveraged Funds	Partners	Match Funding
	A	*B*	*C*	*I*	*J*	*K*	*L*	*M*	*N*	*O*	*P*	*Q*
For Report DOC	i. Investment Plan Period		Project Name	viii. EPIC Funds Encumbered				ix. EPIC Funds Spent			x. Partners (if applicable)	xi. Match Funding (if applicable)
99	3rd Triennial (2018-2020)	PG&E	3.33 – Cyber-Physical Integrated Security	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
100	3rd Triennial (2018-2020)	PG&E	3.34 – Local Wireless Security for Critical Facilities	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
101	3rd Triennial (2018-2020)	PG&E	3.35 - Advanced Security for IoT	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
102	3rd Triennial (2018-2020)	PG&E	3.36 – Cybersecurity for Industrial Control Systems (ICS)	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
103	3rd Triennial (2018-2020)	PG&E	3.37 – Augmented Reality	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
104	3rd Triennial (2018-2020)	PG&E	3.38 – Voltage Checks	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
105	3rd Triennial (2018-2020)	PG&E	3.39 – Optimized Dispatch for Restoration Events	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
106	3rd Triennial (2018-2020)	PG&E	3.40 – Advanced Field Reference Tool	$ -	$ -	$ -	$ -	$ -	$ -	TBD	TBD	TBD
107	3rd Triennial (2018-2020)	PG&E	3.41 – Drone Enablement and Operational Use	$ -	$2,118,000 - $2,479,000	$ -	$ -	$ -	$ -	TBD	TBD	TBD
108	3rd Triennial (2018-2020)	PG&E	3.42 – Electric Load Management for Ridesharing Electrification	$ -	$1,445,000 - $1,691,000	$ -	$ 111	$ 111	$ 111	TBD	TBD	TBD
109	3rd Triennial (2018-2020)	PG&E	3.43 – Service Issue Identification Leveraging Momentary Outage Information	$ -	$582,000 - $681,000	$ -	$ -	$ -	$ -	TBD	TBD	TBD

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Row #	Investment Program Period	Program Administrator	Project Name	Match Funding Split	Funding Mechanism	Intellectual Property	Identification of the Method Used to Grant Awards.	If Competitively Selected, Provide the Number of Bidders Passing the Initial Pass/Fail Screening for Project	If Competitively Selected, Provide the Name of Selected Bidder.
	A	*B*	*C*	*R*	*S*	*T*	*U*	*V*	*W*
For Report DOC	i. Investment Plan Period		Project Name	xii. Match Funding Split (if applicable)	xiii. Funding Mechanism (if applicable)	xiv. Treatment of Intellectual Property (if applicable)			
99	3rd Triennial (2018-2020)	PG&E	3.33 – Cyber-Physical Integrated Security	TBD	TBD	TBD	TBD	TBD	TBD
100	3rd Triennial (2018-2020)	PG&E	3.34 – Local Wireless Security for Critical Facilities	TBD	TBD	TBD	TBD	TBD	TBD
101	3rd Triennial (2018-2020)	PG&E	3.35 - Advanced Security for IoT	TBD	TBD	TBD	TBD	TBD	TBD
102	3rd Triennial (2018-2020)	PG&E	3.36 – Cybersecurity for Industrial Control Systems (ICS)	TBD	TBD	TBD	TBD	TBD	TBD
103	3rd Triennial (2018-2020)	PG&E	3.37 – Augmented Reality	TBD	TBD	TBD	TBD	TBD	TBD
104	3rd Triennial (2018-2020)	PG&E	3.38 – Voltage Checks	TBD	TBD	TBD	TBD	TBD	TBD
105	3rd Triennial (2018-2020)	PG&E	3.39 – Optimized Dispatch for Restoration Events	TBD	TBD	TBD	TBD	TBD	TBD
106	3rd Triennial (2018-2020)	PG&E	3.40 – Advanced Field Reference Tool	TBD	TBD	TBD	TBD	TBD	TBD
107	3rd Triennial (2018-2020)	PG&E	3.41 – Drone Enablement and Operational Use	TBD	TBD	TBD	TBD	TBD	TBD
108	3rd Triennial (2018-2020)	PG&E	3.42 – Electric Load Management for Ridesharing Electrification	TBD	TBD	TBD	TBD	TBD	TBD
109	3rd Triennial (2018-2020)	PG&E	3.43 – Service Issue Identification Leveraging Momentary Outage Information	TBD	TBD	TBD	TBD	TBD	TBD

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Row #	Investment Program Period	Program Administrator	Project Name	If Competitively Selected, Provide the Rank of the Selected Bidder in the Selection Process.	If Competitively Selected, Explain Why the Bidder Was Not the Highest Scoring Bidder, Explain Why a Lower Scoring Bidder Was Selected.	If Interagency or Sole Source Agreement, Specify Date of Notification to the Joint Legislative Budget Committee (JLBC) Was Notified and Date of JLBC Authorization.	Does Award Recipient Identify as California-Based Entity, Small Business, Businesses Owned by Women, Minorities, or Disabled Veterans? Information Requested for Technology Vendor Procurements Only (i.e., Not PMs, Consulting Services, Etc.)
	A	*B*	*C*	*X*	*Y*	*Z*	*AA*
For Report DOC	i. Investment Plan Period		Project Name				
99	3rd Triennial (2018-2020)	PG&E	3.33 – Cyber-Physical Integrated Security	TBD	TBD	Column applicable to CEC only	
100	3rd Triennial (2018-2020)	PG&E	3.34 – Local Wireless Security for Critical Facilities	TBD	TBD	Column applicable to CEC only	
101	3rd Triennial (2018-2020)	PG&E	3.35 - Advanced Security for IoT	TBD	TBD	Column applicable to CEC only	
102	3rd Triennial (2018-2020)	PG&E	3.36 – Cybersecurity for Industrial Control Systems (ICS)	TBD	TBD	Column applicable to CEC only	
103	3rd Triennial (2018-2020)	PG&E	3.37 – Augmented Reality	TBD	TBD	Column applicable to CEC only	
104	3rd Triennial (2018-2020)	PG&E	3.38 – Voltage Checks	TBD	TBD	Column applicable to CEC only	
105	3rd Triennial (2018-2020)	PG&E	3.39 – Optimized Dispatch for Restoration Events	TBD	TBD	Column applicable to CEC only	
106	3rd Triennial (2018-2020)	PG&E	3.40 – Advanced Field Reference Tool	TBD	TBD	Column applicable to CEC only	
107	3rd Triennial (2018-2020)	PG&E	3.41 – Drone Enablement and Operational Use	TBD	TBD	Column applicable to CEC only	
108	3rd Triennial (2018-2020)	PG&E	3.42 – Electric Load Management for Ridesharing Electrification	TBD	TBD	Column applicable to CEC only	
109	3rd Triennial (2018-2020)	PG&E	3.43 – Service Issue Identification Leveraging Momentary Outage Information	TBD	TBD	Column applicable to CEC only	

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Row #	Investment Program Period	Program Administrator	Project Name	How the Project Leads to Technological Advancement or Breakthroughs to Overcome Barriers to Achieving the State's Statutory Energy Goals	Applicable Metrics	2018 Update
	A	*B*	*C*	*AB*	*AC*	*AD*
For Report DOC	i. Investment Plan Period		Project Name		vi. Metrics	xv. 2018 Status Update
99	3rd Triennial (2018-2020)	PG&E	3.33 – Cyber-Physical Integrated Security	Column applicable to CEC only	TBD	• Project is currently on hold.
100	3rd Triennial (2018-2020)	PG&E	3.34 – Local Wireless Security for Critical Facilities	Column applicable to CEC only	TBD	• Project is currently on hold.
101	3rd Triennial (2018-2020)	PG&E	3.35 - Advanced Security for IoT	Column applicable to CEC only	TBD	• Project is currently on hold.
102	3rd Triennial (2018-2020)	PG&E	3.36 – Cybersecurity for Industrial Control Systems (ICS)	Column applicable to CEC only	TBD	• Project is currently on hold.
103	3rd Triennial (2018-2020)	PG&E	3.37 – Augmented Reality	Column applicable to CEC only	TBD	• Project is currently on hold.
104	3rd Triennial (2018-2020)	PG&E	3.38 – Voltage Checks	Column applicable to CEC only	TBD	• Project is currently on hold.
105	3rd Triennial (2018-2020)	PG&E	3.39 – Optimized Dispatch for Restoration Events	Column applicable to CEC only	TBD	• Project is currently on hold.
106	3rd Triennial (2018-2020)	PG&E	3.40 – Advanced Field Reference Tool	Column applicable to CEC only	TBD	• Project is currently on hold.
107	3rd Triennial (2018-2020)	PG&E	3.41 – Drone Enablement and Operational Use	Column applicable to CEC only	TBD	• Project is n planning phase.
108	3rd Triennial (2018-2020)	PG&E	3.42 – Electric Load Management for Ridesharing Electrification	Column applicable to CEC only	TBD	• Previously defined as EPIC 2.32. Deferred to EPIC 3 by CPUC Resolution E-4863 8/10/2017. • Project is in planning phase.
109	3rd Triennial (2018-2020)	PG&E	3.43 – Service Issue Identification Leveraging Momentary Outage Information	Column applicable to CEC only	TBD	• Previously defined as EPIC 2.33. Deferred to EPIC 3 by CPUC Resolution E-4863 8/10/2017. • Project is in planning phase.