BEFORE THE PUBLIC UTILITIES COMMISSION OF THE

STATE OF CALIFORNIA

Application of Southern California Edison Company (U 338-E) for Approval of Its 2015-2017 Triennial Investment Plan for the Electric Program Investment Charge	))))	A.14-05-005 (Filed May 1, 2014)

AMENDMENT TO APPLICATION OF SOUTHERN CALIFORNIA EDISON COMPANY (SCE) (U 338-E) FOR APPROVAL OF ITS 2015-2017 TRIENNIAL INVESTMENT PLAN FOR THE ELECTRIC PROGRAM INVESTMENT CHARGE

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Dated: **May 8, 2014**

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I.

INTRODUCTION

Southern California Edison Company (SCE) respectfully submits this amendment to its application requesting approval of its 2015-2017 triennial Investment Plan for the Electric Program Investment Charge (EPIC). The application that SCE submitted contained voluminous attachments. In the mechanical process of submitting the documents for filing and service, the attached material was inadvertenly not included. SCE apologizes for any inconvenience.

Respectfully submitted,

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/s/ Kris G. Vyas
By: Kris G. Vyas

Attorneys for
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Dated: May 8, 2014

Investment Plan for the Electric Program Investment Charge (EPIC) Program.

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Southern California Edison

EPIC Triennial Investment Plan

MAY 1, 2014

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1. Background and Executive Summary

On December 15, 2011, the California Public Utilities Commission (Commission) adopted Decision (D.)11-12-035, establishing the Electric Program Investment Charge (EPIC)[1] to replace the expiring Public Goods Charge (PGC). Pursuant to D.11-12-035, the investor-owned utilities (IOUs) were required to impose the collection of EPIC "on all distribution customers in the same manner as the expiring" PGC as of January 1, 2012.[2]

On May 24, 2012, the Commission adopted the EPIC, Phase II Decision[3], which established the parameters of the EPIC program.[4] EPIC aims to fund applied research and development, technology demonstrations and deployments and market facilitation programs for the benefit of Investor Owned Utilities' (IOU) ratepayers.[5] The EPIC Program Administrators are Pacific Gas & Electric Company (PG&E), Southern California Edison Company, San Diego Gas & Electric Company (SDG&E) and the California Energy Commission (CEC). Approximately 80% of the total EPIC funding is administered by the CEC and approximately 20% is administered by the IOUs. Additionally, 0.5% of the EPIC budget funds Commission oversight of the program.[6] The annual total budget is $162 million per year[7] and the IOUs are required to collect the EPIC from customers over the years 2013-2020.[8] The IOUs are only allowed to administer technology demonstrations and deployments.[9]

Per the requirements of D.12-05-37, on November 1, 2012, SCE filed its first triennial, EPIC Investment Plan Application (A.)12-11-004, covering 3 years 2012-2014.[10] SCE's 2012-2014 investment plan proposed that SCE's share of EPIC funds be used to foster SCE's Advanced Technology organization's existing smart grid efforts; these efforts should prove to be of substantial benefit to SCE's customers over the long term. In addition, SCE possesses expertise, experience and proven success in the smart grid arena.[11] In the fall of 2013, the

[1] D.11-12-035, at OP 2.
[2] *Id.*, at OP 2-3.
[3] D.12-05-037.
[4] SCE has filed a legal appeal of EPIC, which is pending before the California Appellate Court.
[5] D.12-05-037, at OP 1.
[6] *Id.,* at OP 5.
[7] Id., at OP 7.
[8] *Id.*, at OP 7.
[9] *Id*., at OP 7.
[10] *Id*., at OP 11.
[11] More information about SCE's smart grid efforts is available in SCE's Application for Approval of its Smart Grid Deployment Plan, Application (A.) 11-07-001 and SCE's Annual Report on the Status of Smart Grid Investments, available at: http://www.cpuc.ca.gov/NR/rdonlyres/2881F099-0028-4152-B19B-E9A6C0FC5CA1/0/SCESmartGridAnnualReport_100113.pdf.

State Legislature passed Senate Bill (SB) 96. This Bill added Section 25711.7[12] to the Public Resources Code and denied the CEC's request for an additional $50 million from IOU ratepayers to fund solar projects for new home construction. SCE and the other EPIC Administrators received final approval of the 2012-2014 Investment Plan Applications from the Commission[13] on November 19, 2013.

The Commission's EPIC Phase II Decision mandates that the EPIC Program Administrators file coordinated triennial investment plans by May 1, 2014.[14] This second triennial investment plan for 2015-2017 carefully builds on SCE's first triennial plan, while also proposing new efforts to help enhance SCE's electric grid. This Investment Plan represents a transparent and collaborative effort between SCE and the other program administrators, with valuable input provided from stakeholders during the process of developing the 2015-2017 Investment Plan.

The EPIC Administrators are required to hold stakeholder workshops at least twice per year, during the development of the administrators' respective investment plans and during the execution of those plans.[15] These stakeholders may include the legislature, government agencies, utilities, the California Independent System Operator (CAISO), consumer groups, environmental organizations, agricultural organizations, academic experts, the business community, the energy efficiency community, and clean energy or other industry associations.[16] In compliance with these requirements for stakeholder engagements, the EPIC Administrators held a joint webinar on February 21, 2014. The EPIC Administrators also held a Northern California stakeholder workshop at the CEC's facility in Sacramento on March 17, 2014, and held a Southern California stakeholder workshop at SCE's Advanced Technology facility on March 21, 2014. At the joint Administrator webinar, as well as at the Northern California and Southern California workshops, SCE encouraged stakeholders to access SCE's EPIC webpage[17] and provide comments[18] on the investment plan process.

SCE's investment plan maps the planned investments to the electricity system value chain,

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[12] Section 25711.7 was added to Pub. Resources Code by Stats. 2013, Ch. 365, Sec. 22 (SB 96 (2013)) and became effective on September 26, 2013.
[13] D.13-11-025.
[14] D.12-05-037, at p. 31.
[15] *Id.*, at OP 15.
[16] *Id.*, at OP 15.
[17] SCE's EPIC webpage can be accessed at: https://www.sce.com/wps/portal/home/regulatory/epic/!ut/p/b1/lZFPb4JAEMU_jUeyA8vfI5oWsVhjqRH2QmAdcI0uiFvT9tMXiFeLzmkmO2_2vfwIlwlhMr-KKleilvmxn5md6W7gz8MYQjdaUwin03Blv5oU3oxuIe0W4E75MOi9AF7mixWEwWevp2t4j32fAthkSxhhXKpG7Ul64ZjxWiqUKkM5gVs_gRarr2Ou6vZnAtgI3ouavMIdXkQlh4mLHUkdq6RF4eka6p6pmZRbmms7qCEANw2P8gL5zfI_nkYiD5ZHQo_FTjsPzt1PZpTET4YaOWg-fXDxAHlxOJ-Z3_HrOX0rkjwOsFMb7XK2rHqQaq8JWdYkGZ6a0-bkHsrI_nCBWs31N8LtH1WzdBo!/dl4/d5/L2dBISEvZ0FBIS9nQSEh/
[18] SCE's EPIC public email can be accessed at SCEEPICProgram@sce.com.

which includes: (i) Grid operations/market design; (ii) Generation,[19] (iii) Transmission; (iv) Distribution; and (v) Demand-side management. SCE's investment plan builds on the first triennial investment plan, while proposing funding for new and innovative smart grid efforts. To prevent duplication of existing work, SCE and the other IOU's contacted the Electric Power Research Institute (EPRI)[20] – and hosted an in-depth discussion on gaps in the California utility industry's technology demonstrations and deployments. EPRI ultimately concluded that gaps do exist in utility technology demonstrations and deployments, and that these gaps can be filled with the EPIC Program proposed by the IOUs.

Pursuant to the Commission's EPIC requirements, SCE's triennial investment plan is limited to technology demonstrations and deployments.[21] To effectively and efficiently assess the category of technology demonstrations and deployments, the IOU Administrators continued to use the jointly developed investment plan frame work used for the 2012-2014 program cycle; this framework has been adopted by the Commission.[22]

The Joint IOU Triennial Investment Plan Program Framework (Joint IOU Framework) contains four categories: (1) Renewable and Distributed Energy Resources Integration, (2) Grid Modernization and Optimization, (3) Customer-Focused Products and Services Enablement and Integration, and (4) Cross-Cutting/Foundational Strategies and Technologies. Each of these categories addresses initiatives that SCE may pursue as potential projects. Initiatives in each of the four categories ultimately focus on safety, reliability and affordability of electric service, while also decreasing greenhouse gas emissions, supporting use of low emission vehicles and spurring the retention and creation of jobs within California.

Initiatives for the Renewable & Distributed Energy Resources Integration category aim to facilitate the safe and reliable interconnection of variable energy resources, such as wind and solar energy. Variable energy resources pose problems such as supply/load imbalance and voltage fluctuations. Energy storage represents a potential solution to support the integration of variable resources. Projects in this area will demonstrate technologies that minimize grid disruptions and mitigate power quality issues. Such renewables and distributed energy resources potential projects include:

- Optimized Control of Multiple Storage Systems; and
- Bulk System Restoration under High Renewable Resources Penetration Demonstration

The Grid Modernization and Optimization category addresses the continuing need to replace

[19] SCE does not have any potential projects in this Investment Plan that map to generation.
[20] EPRI is a respected and long-established national non-profit research institute.
[21] D.12-05-037, at OP 5.
[22] D.13-11-025, at OP 8.

aging infrastructure with new and more effective assets that can enhance reliability and safety. To achieve improved reliability and safety, it will be imperative for new devices to capture and transmit ever increasing amounts of data. Projects in this field will analyze this data with the goal of providing a more accurate assessment of infrastructure performance. Potential grid modernization and optimization demonstration projects include:

- Versatile Plug-in Auxiliary Power System (VAPS),
- Next Generation Distribution Automation & Equipment, and
- Fast Dynamic Voltage & Frequency Response

The third category, Customer-Focused Products and Services Enablement and Integration, recognizes that use of electric plug-in vehicles is growing, and the customers' demands of the electric grid are changing. Plug-in vehicles are an exciting component of California's energy future, but also require safe, efficient methods to charge in convenient locations and properly record the energy consumption from charging. This category will also apply new strategies to improve operations. Now that SCE has fully deployed its SmartConnect® meters, potential projects will analyze smart meter data to enhance voltage and VAR controls and identify and analyze outages. All potential projects in this category focus on grid impacts and operations, which are separate and apart from existing energy efficiency and demand response efforts. Per the Commission's requirement,[23] a detailed list of current energy efficiency and demand response projects including the purpose, funding, deliverables and progress to date is provided in this filing as Appendix B. Potential Customer Focused Products and Services Engagement projects include:

- Regulatory Mandates: Submetering Enablement Demonstration – Phase 2; and
- Direct Current (DC) Fast Charging Demonstration

The final category, Cross-Cutting/Foundational Strategies and Technologies addresses the emerging challenges of advancing the power grid. The developing amount of renewable generation, energy storage and other distributed technologies drives greater needs for system architecture, cybersecurity, data analytics, and telecommunications and standards development. Architecture projects will enable the integration of advanced technologies. Grid modernization will require increasing amounts of data as more operations are automated; data analytics projects will focus on aggregating and analyzing the increasing amount of data being collected. Improved data analysis will improve grid operators' insight into system operations. Telecommunications and standards development projects will foster interoperability and help maximize grid reliability and safety. Cybersecurity projects will test, demonstrate, and verify how SCE can mitigate the threat of cyber-attacks on an increasingly

[23] D.13-11-025, at OP 40.

automated grid. Potential cross-cutting demonstration projects include:

- Demonstrate advanced analytics for grid management and optimization;
- Demonstrate utility ability to facilitate the dispatch of DR capacity to meet CAISO needs; and
- Demonstrate Cyber Intrusion Auto Response and Policy Management System (CAPMS);

For the 2015-2017 Investment Plan, SCE actively pursued partnerships with other agencies in an effort to leverage the funding and opportunities available through EPIC. SCE and the CAISO have met and agreed to partner on a potential project that should give the CAISO greater visibility and access to smaller-scale California preferred resources, and thereby help balance generation with load (aggregate customer energy consumption). SCE also was successful in receiving cost-share from the United States Department of Defense (DoD) for a potential project, Cyber Auto-Response and Policy Management System. This project aims to demonstrate automated actions that can protect the electric grid from fast, automated cyber-attacks. SCE will continue to look for partnerships and opportunities to leverage funding, wherever possible.

The EPIC Administrators have collaborated throughout the development of the 2015-2017 investment plan cycle. To maximize EPIC's benefit to customers and the public, the Administrators have agreed to share information regarding investment plans, programs, and projects. On-going collaboration between the EPIC Administrators helps guard against unnecessary duplication of projects among Administrators, and also permits the Administrators to share lessons learned from projects, and communicate best practices.

Lastly, SCE's investment plan furthers the policies and intent underlying Public Utilities Code sections 740.1 and 8360. Specifically, the proposed projects are designed to promote customer benefits, including the achievement of California's energy policy objectives. Recognizing that not all projects will succeed and that testing viability and cost are imperative to demonstrations, SCE will nevertheless endeavor to minimize the funding of those projects that appear to have a relatively low probability of success. The proposed projects are consistent with SCE's resource plan, including the loading order and a focus on safety, reliability and environmental stewardship. SCE's investment plan describes projects that are designed to address all ten of the state's smart grid policies, as described in Public Utilities Code section 8360.

2. SCE Technology Vision and Strategy

Today's electric grid will need to become much more flexible if we are to achieve California's energy goals. Increasing amounts of renewable resources, as well as distributed generation require a dynamic grid that can quickly react to ever changing conditions. For the grid to become more flexible and dynamic, operations will need to become increasingly automated. While automation is necessary for the grid to adapt, it also increases the possibility of threats from cyber-attacks. Cross-cutting technologies and strategies, such as cyber security, systems architecture and telecommunications standards will become increasingly important to maintaining the safety and reliability of the electric grid. Advancing pre-commercial technologies and engineering new strategies are imperative to enhancing grid capabilities, and creating a smarter, more advanced transmission and distribution system that is capable of incorporating and optimizing, based upon customer technology choices. The integration of these elements will be critical to meeting California's ambitious energy policies. A sampling of these policy goals includes:

- California's Greenhouse Gas (GHG) reductions (Assembly Bill (AB) 32);[24]
- California's Renewable Portfolio Standard (RPS);[25]
- Commission Distributed Generation Programs, such as the California Solar Initiative (CSI), Renewable Auction Mechanism (RAM) and California Feed-in Tariffs;[26]
- Commission's Energy Storage Procurement Requirement;[27]
- North American Reliability Corporation (NERC), Critical Infrastructure Protection (CIP) Version 5 Compliance Requirement;[28] and
- Governor's goal of 1.5 Million Zero Emission Vehicles (ZEVs) by 2015.

SCE's EPIC Investment Plans will continue to be managed by the Advanced Technology organization. Advanced Technology's mission is to identify, develop, demonstrate and evaluate an evolving portfolio of new technologies to create a smarter, more robust, resilient and efficient power grid. Advanced Technology manages the EPIC Investment Plan, as part of a broader Advanced Technology effort to ensure planning and coordination is cohesive and aligns to corporate goals, while staying aware of industry developments. Such a holistic strategy for Advanced Technology helps integrate new technologies into existing infrastructure to help meet the energy policy goals and changing conditions on the electric system. Moreover, this holistic strategy helps to ensure efficient program management and minimizes administrative expenses.

[24] State GHG emissions must be reduced to 1990 levels by 2020 and 80% below 1990 levels by 2050.
[25] 33% of Utilities' procurement must be from renewable generation.
[26] CSI, 3,000M Statewide; RAM, 1,225 MW Statewide and California feed-in tariffs, 750 MW statewide, plus 250 MW statewide for bioenergy.
[27] D.13-10-040, at Appendix A, p. 2; statewide energy storage procurement target: 1,325MW.
[28] Stricter controls for infrastructure protection

As SCE's 2012-2014 Investment Plan continues to mature and projects from the first triennial plan conclude there may be instances where a second phase of the project is merited. One such immediate example is the Submetering Enablement Demonstration project. The Submetering Enablement Demonstration project was initiated by a Commission requirement in the Alternative Fuel Vehicle (AFV) Rulemaking[29] to conduct a pilot of plug-in electric vehicle submetering.[30] The Submetering Enablement Demonstration, Phase II[31] builds on the EPIC1 project which will have demonstrated plug-in electric vehicle submetering leveraging third-party metering for billing various sites, including those with multiple customers of record.

2.1 SCE's Smart Grid Strategy

To ensure SCE's broader Advanced Technology effort is managed effectively, industry awareness is imperative. SCE has always been proactive in engaging industry and shortly after the Advanced Technology organization was established, it created and maintains a Technical Advisory Board (TAB), comprised of members from academia, industry, research organizations and standards bodies to provide a broad perspective on technology issues confronting electric utilities. The TAB meets semi-annually to discuss and offer guidance on SCE's technology portfolio.

SCE also stays aware of industry opportunities, strategies and developments through collaborative groups and engagements. One example of such collaborative participation is the Research & Technology Management Forum (RTM). SCE participates in an independent forum with nine other U.S. electric utilities to collect, share and promote research & technology (R&T) management best practices. The RTM Forum's on-going knowledge-expansion process revolves around acquiring relevant insights from leading companies outside the utility industry and sharing knowledge among participants to help utilities maximize the return on research, development, or demonstration investments. Areas of focus include strategic technology roadmaps, portfolio and program management, project management, project selection processes, technology and knowledge transfer, metrics and communication best practices.

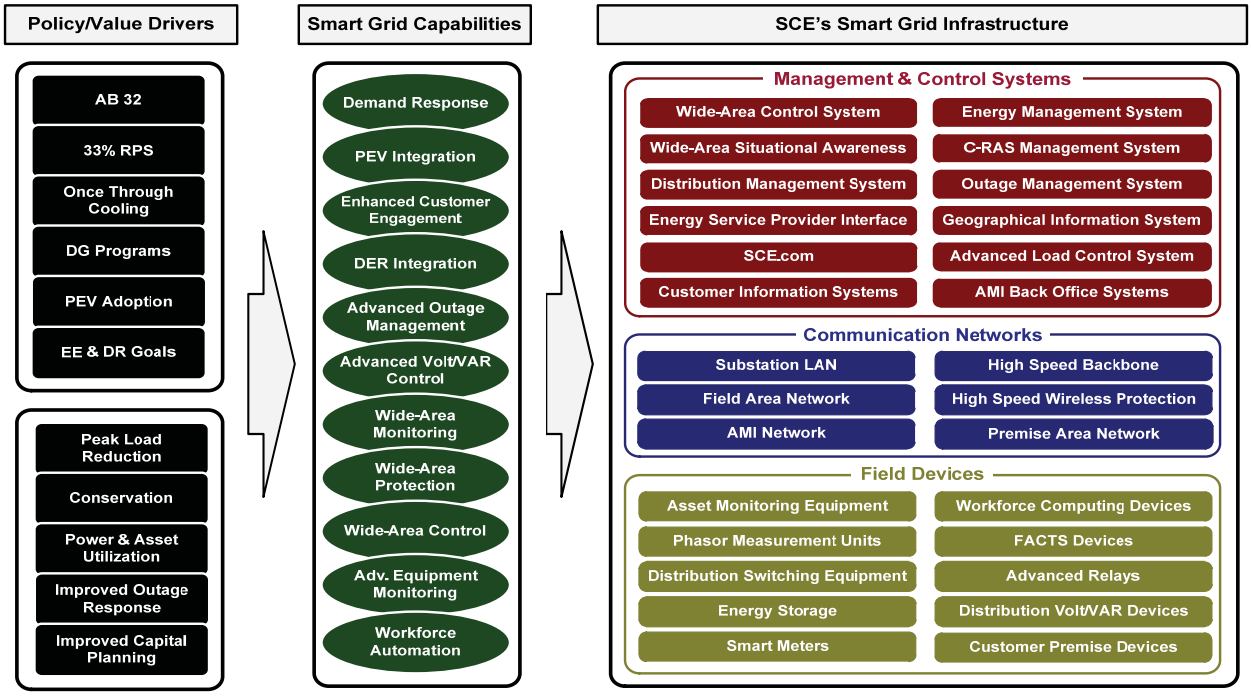
Additionally, SCE actively participates in a variety of electric groups such as Institute of Electrical and Electronics Engineers (IEEE), Edison Electric Institute (EEI), North American Synchrophasor Initiative (NASPI) and GridWise® Architecture Council (GWAC). SCE's Advanced Technology engineering experts also facilitate and lead industry discussions, through engagements such as the IEEE General Meeting, 40th Annual Western Protective Relay Conference and the Micogrid Global Summit 2014.

[29] R.09-08-009.
[30] D.13-11-002, at OP 1.
[31] See Appendix A.

2.2 SCE's Smart Grid Deployment Plan

The evolution of SCE's technology and strategy is described in SCE's Smart Grid Deployment Plan.[32] In this document, SCE introduces its evolving approach to identifying key smart grid capabilities that SCE must enable to address the various smart grid policy drivers and value opportunities, determining the types of technologies and operational efforts needed to enable the capabilities, and evaluating the deployment readiness of such technologies and operational efforts.

Figure 1 - SCE Smart Grid Approach



Importantly, SCE's Smart Grid Deployment Plan provides a deployment baseline and smart grid roadmap with respect to the following areas:

- Customer Empowerment;
- Distribution and Substation Automation;
- Transmission Automation;
- Asset Management; and
- Platform Technologies

[32] Commission approved in D.13-07-024; for additional information, see Footnote 10.

2.3 SCE's Administration of EPIC Demonstrations & Deployments

SCE will continue to administer the EPIC funding as part of its broader Advanced Technology effort to ensure the EPIC portfolio aligns with corporate goals and regulatory policy drivers, while staying aware of industry developments to leverage opportunities and avoid unnecessary duplication. SCE, as it has done with the 2012-2014 Investment Plan will continue to administer EPIC funds to advance the smart grid objectives detailed in Public Utilities Code section 8360. Moreover, SCE's administration of EPIC will continue to be consistent with the requirements of D.13-11-025 and the objectives of D.12-05-037, with the primary goal of producing customer benefits by achieving state energy policy objectives, lowering costs, improving reliability and/or improving safety. Secondary considerations may include, societal benefits, GHG emissions reductions in the electricity sector at the lowest possible cost, the loading order, low emission vehicles and transportation, economic development, and efficient use of customer monies. SCE will continue to update the Commission and stakeholders on the status of EPIC projects via an Annual Report, filed February 28.[33]

3. IOU-Administered Program Funding Allocation

For the 2015-2017 EPIC Program cycle, the Commission's allocation[34] continues to be applicable, as shown in the table below:

Funding Element	CEC	Utilities	CPUC	Total
Applied Research	$55.0	-	-	$55.0
Technology Demonstration and Deployment	$45.0	$30.0	-	$75.0
Market Facilitation	$15.0	-	-	$15.0
Program Administration	$12.8	$3.3	-	$16.2
Program Oversight	-	-	$0.8	$0.8
Total	**$127.8**	**$33.3**	**$0.8**	**$162.0**

The IOU's are only allowed to administer the Technology Demonstration and Deployment category. The Commission's Phase I Decision that continued the expiring PGC established the following resultant allocation of 50.1% to PG&E, 41.1% to SCE and 8.8% to SDG&E. SCE's allocated budgetary share of approximately $37 million[35] for Technology Demonstrations and Deployments will fund existing EPIC Projects that require a second phase, or new smart grid

[33] D.12-05-037, at OP16; D.13-11-025, at OPs 22 and 23.
[34] D.12-05-037, at p. 73.
[35] Amount to be adjusted for inflation according to the Consumer Price Index for Urban Wage Earners and Clerical Workers for the third quarter, for the previous three years, pursuant to D.12-05-037, at OP 7.

efforts. SCE will also use its allocated program administration budget, consistent with the 10% administrative cost cap.[36] In the future, EPIC will eventually replace SCE's existing RD&D Program and balancing account.[37] SCE has maintained a successful RD&D program consistent with the objectives of Public Utilities Code 740.1 since the Program's inception in the Commission's decision in SCE's Test Year 1988 General Rate Case (GRC). Given the existing RD&D program's maturity, SCE may find the need in the future to create a new funding category and will file a petition to modify the Commission's Decision in compliance with D.13-11-025, Ordering Paragraph 36.

4. Stakeholder Input

The Commission requires EPIC Administrators to hold at least two stakeholder engagements, prior to submitting an Investment Plan application.[38] To fulfill this Commission requirement, the IOUs collaborated and held a joint webinar on February 21, 2014. The EPIC Administrators also held joint workshops. The CEC hosted a Northern California public workshop on March 17 and SCE, at its Advanced Technology facility, hosted a Southern California public workshop on March 21. The EPIC webinar and workshops were well-attended by stakeholders, including local agencies (i.e., California State Water Resources Control Board, California Environmental Protection Agency, County of Santa Clara), national labs (i.e., Pacific Northwest National Lab, Lawrence Berkeley National Lab), universities (i.e., University of California, Los Angeles, University of California at Berkeley, California Institute of Technology), consumer groups (i.e., Office of Ratepayer Advocates), environmental groups (i.e., National Resources Defense Council, Clean Coalition), energy efficiency community (Bridge Energy Group, Energy Solutions, Visage Energy Corporation), clean energy industry (Cogera Solar, Foresight Renewable Solutions) and other stakeholders.

The webinar solicited input from stakeholders on the utilities' proposed EPIC framework, including categories of focus and associated initiatives. The subsequent public workshops built on this framework and provided further context into the Investment Plans by highlighting a few potential projects in each of the four categories of the IOU's joint framework for Demonstrations and Deployments. Stakeholders had the opportunity to ask questions and directly provide input on the aforementioned Plans.[39]

Stakeholder feedback from the webinar was particularly useful toward putting together SCE's Investment Plan. During the webinar, the National Aeronautical and Space Administration (NASA) raised a question that identified a possible industry gap, inquiring whether EPIC Administrators have interest in cloud prediction technologies together with PV modeling to better estimate the impact of grid stability.

SCE greatly appreciates the stakeholder feedback on the Renewables and Distributed Energy Resources category from the academic community. To address NASA's aforementioned

[36] As adopted by the Commission in D.12-05-037, at OP 5.
[37] Id., at Conclusion of Law 15.
[38] D.12-05-037, at OP 15.
[39] Exhaustive lists of stakeholder questions from the webinar and workshops are posted on SCE's EPIC website.

concern, SCE has directly incorporated their stakeholder feedback and created a potential project entitled:

- Proactive Storm Analysis Demonstration

This potential project will examine the possibility of analyzing a storm prior to its arrival and potential impact on utility operations. The demonstration will investigate a new strategy to model a storm's potential movement through a utility service territory and its impact on grid operations, based on weather projections.

5. Discussion of Gaps

Public Utilities Code 740.1(d), as well as Commission D.12-05-037[40], requires the IOU's to not unnecessarily duplicate work. To address these concerns of duplication, the IOUs met with EPRI experts[41] on March 3, to discuss industry gaps in technology demonstrations and deployments.

The IOUs began the discussion by presenting the Joint IOU Framework categories, previously used for the 2012-2014 investment plans and subsequently adopted by the Commission. The IOUs then proceeded to discuss initiatives within each of the aforementioned four program categories to support this Investment Plan. Some of the initiatives build on SCE's first triennial Investment Plan, while other initiatives are new to address emerging challenges. For the first category, Renewables and Distributed Energy Resources Integration the IOUs discussed developing projects within the following initiatives:

- Demonstrate the use of inverter based technology to achieve distribution circuit load balancing and other distribution-system-support functions;
- Demonstrate the use of a centralized controller to dispatch multiple energy storage systems and integrate with the Distribution Management System; and
- Demonstrate the use of advanced power system simulator tools for special protection scheme development, testing and training.

For the Grid Modernization and Optimization Program Category, the IOUs discussed developing projects within the following initiatives:

- Demonstrate newer mobile technologies for first responders & crews to work more safely & efficiently in the field;

[40] Conclusion of Law 1.

[41] EPRI's expertise covered the four areas of the Joint IOU's framework. Specific attendance included: Jeff Hamels (Industry Challenges), Ivo Hug (Renewables & Distributed Energy Resources), Don Von Dollen and Richard Lorden, via tele-presence (Grid Modernization & Optimization), David Bowermaster and Mark Duvall (Customer Focused Products & Services), Galen Rasche (Cross-cutting, Foundational Strategies and Technologies, cyber-security).

- Demonstrate next generation Distribution and Substation Automation that will integrate advanced control systems, modern wireless communications,and the latest breakthroughs in distribution equipment, software and sensing technologies; and
- Demonstrate the integration of advanced substation and distribution automation, system intelligence & situational awareness capabilities with new DMS/EMS smart applications to support the operator and integrated operations of the future.

Similarly for the Customer Focused Products and Services Enablement Program category, the IOUs discussed developing projects with the potential to advance:

- Pilot Subtractive Billing with Submetering for Electric Vehicles; and
- Demonstrate data analytics capabilities of the Smart Meter platform to improve distribution system safety and reliability.

The last category, Cross-cutting/Foundational Strategies and Technologies, the IOUs discussed developing projects within the following initiatives:

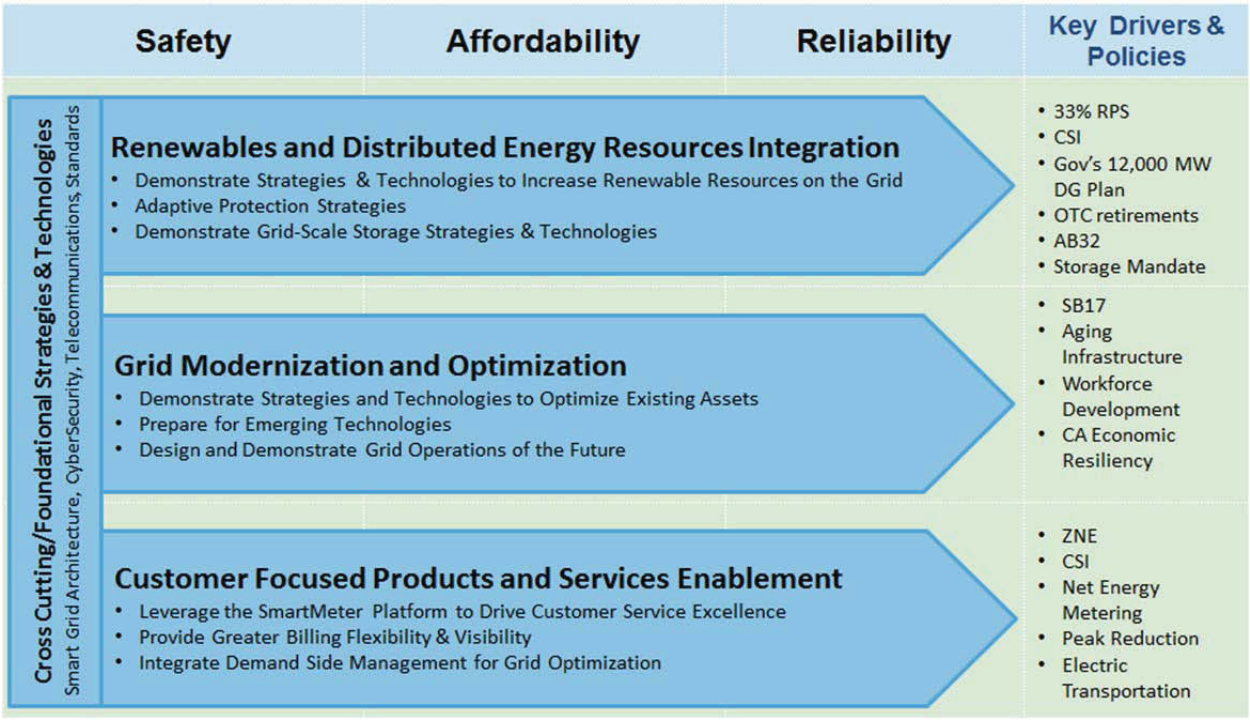
- Demonstrate Cyber Intrusion Auto Response and Policy Management System (CAPMS);
- Demonstrate utility ability to facilitate the dispatch of DR capacity to meet CAISO needs; and
- Demonstrate advanced analytics for grid management and optimization.

EPRI concluded from the IOUs presentation and list of potential projects that there are industry gaps in the categories proposed by the IOUs that could be filled by the EPIC Program. However, since the Investment Plans could change as needs change or new technology emerges, it is imperative the EPIC administrators continue to regularly meet to discuss Program challenges, leverage lessons learned and identify possible collaborative opportunities on an ongoing basis.

6. SCE's EPIC Investment Plan

SCE's second triennial investment plan continues to leverage the Joint IOU Framework. During the first triennial planning period, the IOU's collaborated to develop a common methodology for assessing Technology Demonstrations and Deployments. This Joint IOU Framework presents a broad spectrum of smart grid capability gaps, which was adopted by the Commission and shown below:

Figure 2 - Joint IOU EPIC 2015-2017 Triennial Investment Plan Program Framework



The Joint IOU EPIC Triennial Plan Program Framework (Joint IOU Framework) is divided into four funding categories: (1) Renewable and Distributed Energy Resources Integration, (2) Grid Modernization and Optimization, (3) Customer-Focused Products and Services Enablement and Integration, and (4) Cross Cutting/Foundational Strategies and Technologies. These funding categories are supported by initiatives intended to further expand upon the strategic technology capability and/or new strategy demonstrated; the initiatives map to the Electricity System Value Chain.[42] While the Joint IOU Framework was developed during the first EPIC triennial planning period, SCE has updated the initiatives proposed in this Investment Plan to reflect changes in grid challenges since SCE's 2012-2014 EPIC Investment Plan Application was approved by the Commission.[43]

SCE's proposed potential projects presented in this Investment Plan (see Appendix A), serve to demonstrate viable technology solutions and novel strategies needed to enable these smart grid capabilities to address grid challenges and advance California's energy policy objectives. Some of these grid capabilities and potential projects will need to span multiple EPIC funding cycles, due to regulatory mandates and/or the results of the project merit a second phase. This is especially true for the Cross Cutting/Foundation Strategies and Technologies category, which will need to continually evolve as technology improves and the grid becomes more automated and interoperable. All of these potential projects ultimately are intended to yield customer benefits of lower costs, greater reliability and/or increased safety. In addition to primary customer benefits, projects may also result in societal benefits, GHG emissions reductions,

[42] Except generation
[43] D.13-11-025, at OP 8.

supporting the loading order, low-emission vehicles/transportation, economic development and/or efficient use of customer monies.[44]

As communicated in SCE's first EPIC Triennial Investment Plan, the Administrators have maintained close coordination and engaged in information sharing sessions to ensure the identified gaps are current and valid. Furthermore, the IOUs have participated in a public webinar and held workshops and met with EPRI for a discussion on industry gaps. At these public forums, SCE gained valuable stakeholder feedback that was directly incorporated into the investment plan process. The IOUs discussion with EPRI was also vital, because meeting confirmed the validity of the gaps that could be filled by EPIC projects.

As the EPIC Program becomes more mature and additional projects are initiated, it will be imperative for the EPIC Administrators to continue regularly meeting to ensure: future program coordination, leverage funding, identify areas of collaboration and avoid needless duplication of efforts.

6.1 Renewable & Distributed Energy Resource Integration

To achieve California's energy policy goals, renewable and distributed energy resources will need to be safely and reliably integrated into the electric grid at increasing amounts. Renewable resources encompass a broad collection of technologies that are eligible to meet California's RPS. Geothermal and biomass renewable resources provide baseline power, however wind and solar resources are variable energy resources (VERs) and present new operational challenges when added to the bulk electric system (BES). VERs generate energy when weather conditions allow. The intermittent nature of VERs, present additional operating challenges, such as voltage stability issues on the BES.

The increasing penetration of distributed energy resources (DER) on SCE's distribution grid also poses new planning and operational challenges. DER includes a broad range of technologies, such as rooftop solar photovoltaics (PV), distributed energy storage, and fuel cells. The technical challenges to grid operations attributed to adding increasing amounts of DER to the distribution grid include such issues as voltage stability, frequency control, power quality, harmonics, system protection and control. As discussed in EPRI's recently published white paper on the topic of DER deployment challenges,[45] a number of capability gaps and opportunities have been identified to better facilitate and manage DER integration with the utility distribution grid.

Priority Initiatives

SCE has considerable experience safely and reliably integrating and managing VERs and DERs on the electric grid. SCE has been involved with VERs since the nation's first large wind generation stations were installed in the Tehachapi and Palm Springs areas in the early 1980's.

[44] D.12-05-037, at OP 2.

[45] The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources". EPRI. 2014.

More recently, SCE has embarked on a major transmission system upgrade, the Tehachapi Renewables Transmission Project (TRTP), to bring approximately 4,000MW of wind generation from Kern County to its load centers in the Southern California region.

SCE's experience with deploying and demonstrating energy storage technology spans several decades as well. In the 1990s, SCE deployed a first of its kind 1MW battery storage system at its Chino substation, providing voltage regulation support and enhanced reliability for that particular region. More recently, the energy storage landscape has evolved and is now comprised by a wide array of technologies with very unique operational capabilities and potential business applications. In an effort to appraise the technical capabilities and potential benefits battery energy storage devices can provide on both the bulk power transmission and distribution levels, SCE embarked on two DOE American Recovery and Reinvestment Act (ARRA) projects: The Tehachapi Wind Energy Storage Project (TSP) and the Irvine Smart Grid Demonstration (ISGD) Project. Additional discussion on the scopes and objectives for these projects are provided in the Section 6.1.3: Demonstrate Grid-Scale Storage Technologies and Strategies.

SCE continues to serve as a thought leader and advance knowledge in the Renewables & DER Integration space by authoring and presenting various papers at technical conferences. Recent papers include:

- 40th Annual Western Protective Relay Conference Spokane WA: "Real Time Digital Simulator (RTDS) Simulation and Testing of a Remedial Action Scheme at Southern California Edison," Park, Auld, 2013.
- IEEE General Meeting: "Three Phase Solar Photovoltaic Inverter Testing," Bravo, Yinger and Robles, 2013.
- IEEE General Meeting: "Evaluation of Residential Solar PV Inverter with Advanced Features for the U.S. Market," 2012.

In addition to these papers, presentations have been made at IEEE PES, Distributech, WECC meetings and Utility Wind Integration Group meetings (now the Utility Variable-Generation Integration Group).

The IOUs worked collaboratively to develop the Renewable and Distributed Energy Resources Integration priority initiatives. SCE deems these initiatives high priorities based on its extensive history with VERs and DERs, and the Commission's recent energy storage procurement requirement,[46] which include:

- Demonstrate the use of inverter based technology to achieve distribution circuit load balancing and other distribution-system-support functions;

[46] D.13-10-040, at OPs 3-4.

- Demonstrate the use of a centralized controller to dispatch multiple energy storage systems and integrate with the Distribution Management System; and
- Demonstrate the use of advanced power system simulator tools for special protection scheme development, testing and training.

These initiatives have been reviewed and confirmed with EPRI subject matter experts as having a high priority. Moreover, these initiatives are timely and necessary to address key smart grid capability gaps within the Renewables and DER Integration funding category.

The overarching goal of this funding category is to demonstrate and deploy promising new technologies and innovative strategies to facilitate the integration of increasing amounts of renewable resources, DER, and energy storage devices at both the BES and distribution system, in order to achieve California's energy policy objectives as well as SCE's strategic goals. The potential projects proposed in this Investment Plan map to the following elements of the electric system value chain: Grid Operations/Market Design, Transmission and Distribution.

6.1.1 Demonstrate Strategies and Technologies to Increase Renewable Resources on the Grid

Problem or Opportunity to be addressed

The inherent operating characteristics of VERs pose numerous technical challenges related to grid integration for the IOUs. The supply availability of solar photovoltaics (both central-site and distributed installations) and wind are often difficult to predict and subject to atmospheric conditions. In the case of solar PV, the availability of these resources is often coincident with high customer loads, although not necessarily during system peaks. In the case of wind, peak generating capacity often occurs at night when customer load requirements are lowest. At the bulk power transmission level, these VER operating characteristics translate to potential generation/supply mismatch (i.e., over or under-generation), voltage stability issues, and potential special protection issues that pertain to the systems that protect key transmission corridors and interconnection points on the grid. At the distribution level, distributed VERs such as solar PV systems can cause voltage fluctuations that may result in poor power quality for utility customers. The industry's recent transition from conventional generation sources to VERs further complicates system restoration plans under high renewables penetration, and must be addressed as well. The technologies and strategies associated with this priority initiative are intended to address these challenges.

Ensuring the secure operation of the bulk power system is of paramount importance to the utility industry, and is critical to maintaining the reliability and vitality of our nation's energy economy.

SCE has taken proactive steps to enhance its understanding of the potential grid impacts caused by integrating increasing amounts of VER to its system through the development of its world-class power system modeling and simulation capabilities. Through the use of SCE's RTDS, SCE engineers and researchers have the ability to replicate a significant portion of the bulk electric system in the western United States, including transmission, generation, controls and protection system elements. Using advanced computer hardware and sophisticated algorithms, SCE engineers can model the behavior of the power system under numerous operational scenarios involving the integration of VERs. This capability allows SCE to understand the impacts of various combinations and quantities of VERs at both the bulk power system and distribution levels to system performance, generation controls, remedial action schemes, and system protection in a simulated environment first, prior to physically deploying new VERs to the grid. The results of simulations on SCE's existing systems and control strategies can provide targeted strategies and implementable mitigation measures to avoid unfavorable operational issues.

In addition to SCE's extensive power system modeling efforts, SCE has performed significant performance testing and evaluation of solar PV inverters. SCE has worked closely with EPRI, the National Renewable Energy Lab (NREL), and third party developers to establish best practices in this area. In the distribution interconnection area, SCE has assembled detailed test procedures for inverters to address the voltage and frequency transients that routinely occur on the electric grid. The goal of this work is to construct power system models that will predict the behavior of these devices when higher penetrations occur. SCE led the development of these test procedures with review by NREL, Sandia National Labs, Oak Ridge National Labs, Western Electricity Coordinating Council (WECC), and other utilities. The laboratory and field test results have been widely shared with national labs, utilities, inverter manufacturers, EPRI, the Utility Wind Integration Group, IEEE and universities.

The establishment of widely accepted technical standards for VER integration is another critical component for successfully incorporating VERs onto the grid. SCE has been active in the review and pending modification of IEEE 1547 (interconnection standard for distributed generation) and UL 1741 (Underwriters Lab standard for testing inverters). In the bulk power grid integration area, SCE has been active in the study of how variable generation will affect the stability and reliability of the broader transmission system. Much work still needs to be accomplished with respect to VER integration. Testing done to date has helped establish desired characteristics and functional requirements for inverter based generation powered by variable renewables. These desired characteristics now need to be incorporated into standards and products to be used by utilities to ease integration.

The distribution system will continue to evolve as it becomes more automated, technology improves and interoperability increases. The integration of diverse systems and technologies

that can efficiently and effectively transmit data will require an energy management system that is dynamic and contains both centralized and decentralized control mechanisms. An optimized control structure for energy management will require accurate system models and pilot demonstrations using a variety of technologies and strategies.

How the initiative will advance the strategy and overcome barriers

This initiative aims to examine a variety of strategies and technologies that facilitate the integration of increasing amounts of VERs into SCE's grid at both the bulk power transmission and distribution levels. These include strategies and technologies that have the potential to minimize grid disruptions, increase the flexibility of generation resources to manage the short-term variability related to VERs and mitigate power quality issues. One of the primary concerns is the ability of system operators to maintain proper system generation load balance without overloading any transmission lines. In a system operating environment characterized by high renewable resource penetration, the system operator will need to understand how close to the boundary of stability the system can operate under various operating scenarios. One of the potential projects that SCE wishes to pursue in this area pertains to demonstrating new advanced on-line security assessment tools. The goal of this demonstration is to provide system operators with a real-time assessment of the grid's operating state under high renewable penetration, in order to determine the safe operating boundaries before entering into an unstable operating mode. This capability will allow SCE system operators to better optimize power flows on key transmission paths to maintain service reliability.

Another potential barrier to integrating large quantities of VERs to the bulk power system is the issue of insufficient system restoration plans following a significant blackout event. In order to prevent or reduce cascading sequences of outages, SCE proposes to demonstrate new system restoration strategies that will potentially reduce the vulnerability of the power system and ensure the successful restoration of electric service to customers. Consistent with SCE's approaches to other smart grid demonstration efforts, these new system restoration strategies will first be modeled using sophisticated power system modeling and simulation techniques. Once the concepts are proven in a simulated environment, the process can then transition to a field deployment pilot demonstration. The expected outcome includes revised system restoration plans that account for high renewable resource penetration, resulting in improved reliability.

The following are commonly discussed impacts and barriers to the widespread adoption of renewable and distributed energy resources:

a. Frequency control,
b. Voltage regulation,

c. Reverse power flows,
d. Operational flexibility,
e. Reliability capacity and planning, and
f. Capacity margin.

SCE's Potential Demonstration Projects

- Online Security Assessment Tools Demonstration
- Bulk System Restoration Under High Renewable Resources Penetration Demonstration

The following table lists the potential demonstration projects and the drivers/barriers they are intended to address.

SCE Project	Barriers Addressed
Online Security Assessment Tools Demonstration	a, b, d, e, f
Bulk System Restoration Under High Renewable Resources Penetration Demonstration	a, b, d

6.1.2 Adaptive Protection Strategies

Problem or Opportunity to be Addressed

Under the traditional utility operating paradigm, electric power flowed from central-site generation sources over transmission lines and then distributed to customer load centers over distribution grids. This “one-way flow” of energy allowed electric utilities to plan and operate the grid in a straight-forward manner. In more recent times, the proliferation of renewable generation and distributed energy resources at both the bulk power transmission and distribution levels create new challenges for existing system protection strategies.

At the bulk power level, dynamic climatic conditions such as rising wind strength or cloud accumulations alter renewable energy resource generation output. High winds can cause sudden “cutouts”, where wind turbines suddenly and completely cease generating electricity. Likewise, rapid cloud accumulation can substantially reduce the output of solar renewable resources. This variability increases the complexity of scheduling and delivering energy to the grid, and ultimately increases grid instability. In this context, grid stability refers to the balancing of electricity supply and demand on a short term, minute-by-minute basis. Active power flow control also becomes critical when high penetrations of renewables are interconnected to the

transmission grid. At the distribution level, bi-directional power flows caused by distributed energy resources installed behind the meter can cause operational issues as well, such as invalidating distribution level protection schemes and causing power quality issues.

The electric utility industry have used a Remedial Action Scheme (RAS) for several decades as a means of mitigating system problems, including thermal overloads, post-transient voltage problems and transient stability events. In general RASs have been used to manage overloaded lines during transmission line and transformer outages. RASs operate by detecting abnormal grid conditions and initiating pre-planned corrective actions to restore grid stability. An example of an abnormal grid condition is a transmission corridor that exceeds its line flow limit while experiencing a concurrent line outage. A RAS would detect the condition and initiate corrective action to restore stability. Corrective action may include tripping generation, shedding load, or changing the system configuration to isolate the problem. Each RAS possesses unique arming and activation conditions. For example, all RAS will arm if line flows exceed predetermined thresholds. However, different RASs activate based on different factors, including line flow conditions, facility outages and thermal constraints. Each RAS requires a unique planning study to determine arming conditions and corrective action strategies. Corrective action strategies are pre-determined for a limited number of potential contingency scenarios. These strategies are summarized in “mitigation logic tables”, and are programmed into the RAS logic controllers. RAS logic controllers are devices which are located in the substation most central to the RAS. These devices activate RASs based on the mitigation logic tables. If subsequent changes are made to the mitigation logic, personnel must travel to the substation to reprogram the device.

How the initiative will advance the strategy and overcome barriers

The primary objective of this initiative is to demonstrate and deploy new adaptive protection strategies and technologies in order for the IOUs to accommodate higher penetrations of renewable energy resources on the grid. In the case of transmission system design and operations, long transmission lines are typically series compensated to maximize power flow efficiency. On SCE’s 500kV system in particular, several long transmission paths are series compensated using fixed capacitor segments that do not support active control of power flow. The lack of this capability makes managing the effects of renewable energy resource intermittency and fast changes in generation difficult. SCE proposes to demonstrate the implementation of Thyristor Controlled Series Capacitors (TCSC) in order to enable power flow control on series compensated transmission lines as a means to ease renewable resource integration.

As mentioned in the preceding section, utilities employ a RAS as a means to protect transmission lines from various contingency events. The increase in operational complexity for

implementing new RAS will require better tools for utility personnel to ensure its proper functionality. SCE proposes to demonstrate a new special protection scheme platform to assist SCE engineers and technicians in the development, testing and implementation of RAS.

For the transmission system, analyzing models with powerful computing systems like the RTDS will ensure that the bulk power system is adequately protected and proper controls systems are in place to deal with the VERs across the Western Interconnect. Wide area voltage and VAR controls as well as adaptive relaying will need to be studied to ensure that voltage and angular stability can be maintained during contingencies. Remedial action schemes will need to be integrated with other protection schemes to ensure proper overlapping protection.

The IOUs will need to demonstrate a variety of protection strategies and technologies to effectively integrate distributed energy resources into the system and optimize any benefits associated with such resources. It is important to test these technologies in concert with existing utility assets, protection schemes and operating systems to ensure they are backwards compatible and can be safely, reliably and affordably deployed.

SCE's Potential Demonstration Projects

- Series Compensation for Load Flow Control
- Special Protection Scheme Platform

SCE Project	Barriers Addressed
Series Compensation for Load Flow Control	a, b, d, e, f
Special Protection Scheme Platform	a, b, d, e, f

6.1.3 Demonstrate Grid-Scale Storage Strategies and Technologies

Problem or Opportunity to be Addressed

The recent Commission Energy Storage Decision mandates that SCE procure and deploy 580 MW of storage capacity on SCE's system.[27] Energy storage has the potential to provide many services that will be required to integrate more VERs at the transmission and, especially, the distribution level. For example, energy storage can provide ancillary services to CAISO, or can be used to improve reliability of distribution systems by mitigating the impacts of distributed energy resources or to accommodate more distributed resources by increasing available distribution asset capacity. After many years of industry discussion, energy storage now enjoys

a growing sense of promise, as many expect it will become a viable part of the electric system over the next decade. However, there are still very real challenges to the cost-effective deployment of energy storage solutions. SCE has done a great deal of thinking on this topic as has the Commission, and there are a vast number of demonstration opportunities across a variety of technologies. SCE's initial approach was set forth in the white paper entitled "Moving Energy Storage from Concept to Reality: Southern California Edison's Approach to Evaluating Energy Storage", which was published in 2010. SCE's approach to energy storage involves a road map process which includes initial desktop work, battery chemistry testing, system evaluations, field demonstrations and pilot projects. Real world data is essential to the commercialization and the safe, reliable and affordable utilization of energy storage on the grid.

SCE has also taken the lead in evaluating energy storage technologies in the field via two DOE funded programs, the Tehachapi Wind Energy Storage Project (TSP) and the Irvine Smart Grid Demonstration (ISGD) program. While the 8MW/32MWh Battery Energy Storage System under TSP aims at evaluating the technology for mitigating the transmission level impacts of VER and providing services to the CAISO market, the ISGD program evaluates customer sited and utility sited energy storage devices to understand the impact at the distribution level. The details of these projects were discussed in SCE's first EPIC Triennial Investment Plan.[47]

SCE recognizes that a gap exists in the implementation of a multi-vendor communication and control system standard for integrating multiple energy storage devices that can respond to both localized grid support and broader external system operational requirements. The charging and discharging functions of the energy storage devices themselves have the risk of being suboptimized if left in autonomous stand-alone modes, and may actually be detrimental to grid stability, if not managed properly.

How the initiative will advance the strategy and overcome barriers

The Commission Energy Storage Framework Staff Proposal in R.10-12-007 identifies the following nine energy storage adoption barriers:

a. Lack of definitive operational needs;
b. Lack of cohesive regulatory framework;
c. Evolving markets and market product definition;
d. Resource adequacy accounting;
e. Lack of cost-effective evaluation methods;
f. Lack of cost recovery policy;
g. Lack of cost transparency and price signals;

[47] A.12-11-004, at p. 25 & Appendix B.

h. Lack of utility operating experience; and
i. Lack of well-defined interconnection process.

While IOU technology demonstration and deployment projects cannot solve each of the barriers, EPIC funding could be employed to address a number of the barriers and provide important data to address other barriers. In short, IOUs can demonstrate the value, technical performance, and costs of energy storage systems that facilitate integration of VERs into the grid. Various types of emerging energy storage technologies and sophisticated control strategies will need to be assessed, evaluated through laboratory studies, and demonstrated at field scale. Data gathered during these demonstrations will also be used to improve inverter standards, validate models and facilitate integration on the grid.

Simulations may be performed to determine the optimum location and siting of distributed energy storage or to analyze how energy storage would perform under various system contingencies, such as rapid changes in renewable resource generation levels, loss of a major conventional generation source, or loss of a transmission line. Control systems and software may be developed to aggregate distributed energy storage to support the transmission and distribution grid and the CAISO.

SCE's Potential Demonstration Projects

- Optimized Control of Multiple Storage Systems
- EPRI Research Program 94: Energy Storage

The following table lists the SCE proposed energy storage projects and how they address the barriers identified in the Commission Energy Storage Framework Proposal.

SCE Project	Barriers Addressed
Optimized Control of Multiple Storage Systems	a, b, c, d, e, f, g, h, i
EPRI Research Program 94: Energy Storage	a, b, c, d, e, f, g, h, i

6.2 Grid Modernization & Optimization

The electric grid connecting customers to generation resources over vast transmission and distribution networks was heralded as the greatest engineering achievement of the twentieth century by the National Academy of Engineering. While this resource has historically provided the California IOUs' customers with reliable electric service, new emerging grid technologies and aging grid and asset infrastructure coupled with the state's environmental policy goals call for a future grid that is more modern, efficient, resilient and flexible. The existing electric grid

must be modernized using more advanced technologies and strategies, while existing assets and infrastructure are optimized to increase operating efficiencies and maximize useful lifecycle.

Today's power delivery system is characterized by foundational infrastructure elements such as generation plants, wires, towers, poles, transformers, circuit breakers and switches. However, the grid is becoming increasingly automated and in recent decades, the electric grid has witnessed enhancements involving the application of computer-based management and control systems (i.e., energy management systems, distribution management systems, etc.), various field devices (i.e., remote terminal units, protective relays, remote distribution switches, etc.), and communications networks (i.e., fiber optic and microwave links, etc.). These systems will continue to evolve to enhance remote monitoring, control and automation capabilities, as technology improves and the grid becomes more interoperable.

SCE has much experience with cutting edge management and control systems, and is an industry leader in both substation and distribution system automation technologies. SCE has equipped over 55% of its 900 substations with automation technology -- 30% of substations have state-of-the-art microprocessor-based systems that operate over local area networks, and 25% of substations have remote terminal units and programmable logic controllers. SCE has also equipped approximately 50% of its 4,300 distribution circuits with automation equipment that operates using advanced wireless technology. In addition, SCE has developed and deployed an automated bulk capacitor switching system to offset purchasing expensive must-run generation and increase the power import capability for the Southern California region.

SCE's automation strategy allows for both remote control/monitoring and autonomous control of critical grid components, which helps protect the system during abnormal conditions and maintain reliability. While SCE believes it is an industry leader with its current automation strategies, much work remains to be done to fully integrate both distribution and substation automation into one comprehensive and coordinated system automation approach.

The proliferation of digital devices across the system will also enable smarter maintenance and work practices. SCE currently depends on numerous Intelligent Electronic Devices (IED) to provide information on the condition of Transmission and Distribution assets. SCE calls this information "Data Beyond SCADA" and has plans to extend such monitoring capabilities to more assets at all levels of the grid network, creating billions of new equipment-state status points at regular intervals that will need to be processed and synthesized into actionable information.

The capability to transmit, collect and store data is becoming increasingly important to operations, as the grid becomes more automated and incorporates greater amounts of computer based management and control systems, field devices and communication networks. The IOUs' information systems have improved over the last several years through the introduction of enterprise resource planning, geographical information systems (GIS) and improved work scheduling systems. These critical systems are augmented by the evolving introduction of real-time monitoring devices. Additionally, information available from smart meters, phasor measurement units (PMUs), advanced distribution management system and other emerging data management and control systems provide rich details of the conditions

experienced by infrastructure system components on the grid. This "Big Data" issue is an emerging opportunity that will require demonstration of information integration and correlation of data to the performance of an asset. Harnessing new technological advances in grid management and asset management and optimization has the potential to improve customer service, safety and reliability, cut long-term asset management and maintenance costs and help provide skilled jobs for Californians.

The objective of the Grid Modernization and Optimization funding category is to further advance the California electric grid through the introduction of new smart grid technologies and system capabilities necessary to meet the state's policy objectives, while optimizing existing assets to ensure continued reliable and safe electric service. Furthermore, the potential projects proposed in this category map to the Grid Operations/Market Design, Transmission and Distribution elements of the electric system value chain.

Priority Initiatives

Within the Grid Modernization and Optimization funding category, the administrators have jointly developed the following priority initiatives:

- Demonstrate newer mobile technologies for first responders & crews to work more safely & efficiently in the field;
- Demonstrate next generation Distribution and Substation Automation that will integrate advanced control systems, modern wireless communications, and the latest breakthroughs in distribution equipment, software and sensing technologies; and
- Demonstrate the integration of advanced substation and distribution automation, system intelligence & situational awareness capabilities with new DMS/EMS smart applications to support the operator and integrated operations of the future.

These initiatives have been reviewed and confirmed with EPRI subject matter experts as having a high priority.

6.2.1 Demonstrate Strategies and Technologies for Optimizing Assets

Problem or Opportunity to be Addressed

The overarching objective for this initiative is to improve capital efficiency using better intelligence and technology to optimize system planning and improve asset throughput. This goal can be achieved by increasing power throughput on transmission and distribution system assets, improving capital efficiency through condition-based maintenance and asset

replacement, and using better information on load and grid operating performance to improve system planning.

In the case of SCE's distribution system, Edison SmartConnect® has the potential to address many distribution network issues related to feeder loading and efficiency, voltage profiles, reliability, power quality, etc. by optimizing the coordination of switching devices and VAR resource controllers at a more localized level. Using the information that SmartConnect® provides such as voltage measurements at customer sites, in addition to information provided by existing systems such as SCADA, the utility's ability to improve the quality and efficiency of network optimization applications and services increases significantly.

Today's distribution network operations are characterized by disparate, special purpose applications that are largely uncoordinated. The potential network optimization applications that could leverage the Edison SmartConnect® platform include:

- Loss Analysis;
- Load balancing on distribution feeders (by phase);
- Fault Location, Isolation and Service Restoration;
- Contingency analysis;
- Feeder reconfiguration;
- Load shedding and load curtailment;
- Protection re-coordination;
- Voltage and VAR control;
- Intelligent alarm processing;
- Customer to transformer connectivity model configuration;
- Transformer voltage regulation;
- Load forecasting and state estimation;
- Automatic feeder and capacitor bank switching; and
- Power quality monitoring and reporting.

One potential project opportunity in this area will demonstrate models for estimating the potential energy savings based on measurement and adjustment of the voltage of individual smart meters and distribution feeders through Advanced Voltage and VAR Control (AVVC). Technologies are being developed in the market place to study the voltage quality at various points in the power system and apply voltage correction techniques to maintain the values within acceptable thresholds. The technologies will then be able to estimate the potential energy savings due to this voltage correction. Availability of such technologies will enable SCE to prepare better business cases for investments in AVVC hardware and devices to realize the

energy savings projected. This information will be valuable for system planning and engineering to better utilize existing energy sources and utility infrastructure.

How the initiative will advance the strategy and overcome barriers

SCE proposes to demonstrate and deploy technology solutions geared towards enabling new distribution system capabilities and optimizing existing assets on the distribution grid. An existing barrier in this space includes unbalanced loading on individual distribution circuit feeders on a per phase basis. Proper phase balancing is necessary to ensure service reliability and power quality for customers. One potential demonstration area involves the establishment of accurate circuit by circuit phasing information by examining voltage signature information at customer smart meters and individual transformers. The availability of accurate phase information can result in effective phase balancing of load, leading to power system stability and improved power quality. Phase information will also be helpful in power system planning and design, as it allows for full utilization of available capacity within the existing installed infrastructure before new assets are deemed to be required. SCE also seeks to use EPIC funding to demonstrate dynamic phase balancing techniques, using the latest advancements in power electronic devices and energy storage systems. Additional system capabilities enabled by this demonstration include improved voltage control, harmonics cancellation, sag mitigation and power factor control.

SCE also proposes to leverage the voltage data at the individual customer level from smart meters to understand the full extent of AVVC measures that need to be undertaken. To better understand voltage data at this granular level, SCE proposes models, demonstrating customer voltage trends and the corollary energy savings.

Another potential demonstration will examine the possibility of establishing transformer to meter connectivity based on the voltage signature at the meter and at the transformer level. Through this project, SCE will evaluate technologies that are capable of studying the voltage signature at the smart meter and the transformer and confirm that the right meters are connected to the right transformers. This accuracy of meter-to-transformer connectivity supports key IOU business functions, including outage notifications, outage duration reporting, trouble operations, local planning for load additions and asset condition. This information could also be utilized to enable new grid optimization functions such as improved volt/VAR control schemes at the distribution level.

The following are commonly discussed drivers for and barriers to the widespread adoption of technologies with the potential for enhancing the utilization of existing utility assets:

a. Electric system safety, security and reliability,

b. Regulatory and legislative requirements,
c. System limitations,
d. Operating capabilities,
e. Industry standards, and
f. Business case and operating information.

SCE's Potential Demonstration Projects

- Advanced Grid Capabilities Demonstration Using Smart Meter Data
- Energy Savings Model Demonstration Using Smart Meter Data
- Dynamic Power Conditioner

The following table lists the potential demonstration projects and the drivers/barriers they are intended to address.

SCE Project	Barriers Addressed
Advanced Grid Capabilities Demonstration Using Smart Meter Data	a, b, c, d, e, f
Energy Savings Model Demonstration Using Smart Meter Data	a, b, c, d, e
Dynamic Power Conditioner	a, b, c, d

6.2.2 Prepare for Emerging Technologies

Problem or Opportunity to be Addressed

Federal and state policymakers alike have recognized the need for a smarter, more robust electricity infrastructure if the United States is going to successfully incorporate greater amounts of renewable generation, use electricity as a fuel for vehicles and enable consumers to become active participants in the energy supply chain. SCE seeks to demonstrate and deploy new technologies and strategies to support California's energy policy objectives, with particular emphasis on emerging technologies in the distribution system space.

The anticipated proliferation of distributed energy resources, energy storage systems and electric vehicles on the distribution system will require new innovative strategies and technologies in order to safely and reliably facilitate grid integration at the distribution system level. One potential project in this area plans to integrate advanced control algorithms, modern wireless communication systems, and the latest advancements in distribution sensors and equipment in order to appraise the overall system performance. This demonstration activity

aims to improve system reliability by reducing Customer Minutes Interrupted (CMI), System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI), improve field worker and public safety, and improve asset utilization and efficiency with better distribution equipment and operating strategies. Another potential demonstration area involves the deployment of distributed synchronized control mechanisms across a variety of behind-the-meter devices at customer sites that can mitigate both voltage and frequency fluctuations caused by VERs on the distribution system.

How the initiative will advance the strategy and overcome barriers

Recent advancements in individual distribution equipment components, sensing technologies and automation systems have yielded new products in the utility marketplace. While it is beneficial for the IOUs to comprehend the incremental performance improvements and capabilities afforded by these new technologies individually as point solutions, understanding how these disparate technologies operate fully integrated will provide the IOUs with a comprehensive view of how these elements fit and work together as a complete system. SCE plans to demonstrate and deploy the latest, state-of-the-art sensing devices, intelligent controllers, protection devices, behind-the-meter devices, and wireless communications in order to appraise the system-level performance of these technologies. The goal is to determine the optimal selection of distribution equipment and automation strategies needed to facilitate increasing amounts of renewable resources and DER on the distribution system.

The following are commonly discussed drivers for and barriers to the widespread adoption of emerging utility system technologies:

a. Electric system safety and reliability,
b. Regulatory and legislative requirements,
c. System limitations,
d. Operating capabilities,
e. Industry standards, and
f. Business case and operating information.

SCE's Potential Demonstration Projects

- Next Generation Distribution Automation and Distribution Equipment
- Fast Dynamic Voltage and Frequency Response
- Dynamic Power Conditioner
- EPRI Research Program 180: Distribution Systems

The following table lists the potential demonstration projects and the drivers/barriers they are intended to address.

SCE Project	Barriers Addressed
Next Generation Distribution Automation and Distribution Equipment	a, b, c, d, e, f
Fast Dynamic Voltage and Frequency Response	a, b, c, d
Dynamic Power Conditioner	a, b, c, d
EPRI Research Program 180: Distribution Systems	a, b, c, d, e, f

6.2.3 Design and Demonstrate Grid Planning and Operations of the Future

Problem or Opportunity to be Addressed

The primary objective of this initiative is to automatically monitor, assess and control the grid to adapt to changing conditions to meet customer reliability and power quality requirements. This goal can be achieved by implementing technologies and strategies to prevent catastrophic bulk power system failures, minimize service disruptions due to distribution system failures and provide timely and accurate information about service issues. A secondary objective of this initiative is to also maximize workforce productivity, effectiveness and safety through the application of enabling tools and technologies. This objective can be accomplished by using advanced visualization and control systems to support and automate decision-making, and using emerging field technologies to improve crew safety and efficiency.

Due to the expected growth in distributed energy resource and energy storage installations, increasing flexibility in distribution system designs and configuration has the potential to improve DER and energy storage siting options, while deferring the need for infrastructure upgrades. One potential project opportunity will demonstrate and assess the advantages of new distribution circuit designs that incorporate an increased number of distribution switches to allow greater flexibility in dynamically reconfiguring circuits and leveraging storage capabilities across a large region of SCE's service area.

Advanced analytical applications including new situational awareness and decision-support capabilities are another opportunity area SCE plans to pursue within this initiative. In the case of substation automation, SCE plans to demonstrate and deploy advanced applications that include intelligent alarm processing, predictive maintenance algorithms, high impedance fault

detection by leveraging the IEC 61850 substation automation standard, next-generation control system designs, and advanced intelligent algorithms. Another potential opportunity in this area involves the deployment of new systems and algorithms to assist SCE grid operations in managing the utility's severe storm planning and response activities. From a planning perspective, SCE aims to implement new tools that can analyze a storm prior to its arrival and assess its potential impact to utility operations. This information and model could then be integrated with SCE's GIS electrical connectivity model, Distribution Management System (DMS), and Outage Management System (OMS) functionalities. The damage assessment performed will result in proactive estimation of material and resources needed to respond to a storm prior to its arrival. Furthermore, once a storm arrives in SCE's service territory, the system could potentially access near real-time customer meter voltage data to develop a simulated circuit model that can be effectively utilized for storm management and crew deployment.

Lastly, SCE plans to pursue opportunities in the area of emerging field technologies to improve worker safety and productivity. One potential project will demonstrate the electrification of transportation and vocational loads that previously used internal combustion engines powered by petroleum fuels in the SCE fleet. Using automotive grade lithium ion battery technology, SCE fleet vehicles could use on-board batteries to support essential safety gear, radios, tools and equipment at the work site. This provides field crew members and customers with a quiet, clean and efficient work site. Another potential project will demonstrate the establishment of an advanced street lighting sensor network that can be integrated with SCE's existing smart meter network to help dispatchers obtain the most up to date status of the street lighting infrastructure resulting in a reduction of customer calls and street light outage durations.

How the initiative will advance the strategy and overcome barriers

Flexible distribution circuit designs and configurations will aid the IOUs in overcoming challenges associated with siting and integrating increasing quantities of distributed energy resources and energy storage devices. New situational awareness and decision-support capabilities will also allow SCE to handle the challenges that DER, energy storage and electric vehicles, while improving safety and reliability. Advanced street lighting capabilities and proactive storm impact analysis will provide SCE with more efficient operational capabilities to respond to outages from severe weather events, thereby reducing customer outage time and improving communications. Finally, emerging field worker technologies and safety programs will improve worker productivity while mitigating climate impacts.

The following are commonly discussed drivers for and barriers to the widespread adoption of future grid operations and planning technologies:

a. Electric system safety and reliability,

b. Regulatory and legislative requirements,
c. System limitations,
d. Operating capabilities,
e. Industry standards, and
f. Business case and operating information.

SCE's Potential Demonstration Projects

- System Intelligence and Situational Awareness
- Dynamic Distribution Circuit Configuration
- Versatile Plug-in Auxiliary Power System (VAPS)
- Advanced Street Lighting Technology Capabilities Demonstration
- Proactive Storm Impact Analysis Demonstration
- EPRI Research Program 62: Occupational Health and Safety

The following table lists the potential demonstration projects and the drivers/barriers they are intended to address.

SCE Project	Barriers Addressed
System Intelligence and Situational Awareness	a, b, c, d, e, f
Dynamic Distribution Circuit Configuration	a, b, c, d, f
Versatile Plug-in Auxiliary Power System (VAPS)	a, d, f
Proactive Storm Impact Analysis Demonstration	a, b, c, d, f
Advanced Street Lighting Technology Capabilities Demonstration	a, b, c, d, f
EPRI Research Program 62: Occupational Health and Safety	a, e

6.3 Customer-Focused Products & Services Enablement and Integration

To achieve California's energy policy goals ultimately requires a change in the way customers manage and consume electricity. Therefore the goal of this category is to empower customers to become active participants in the energy supply chain by enabling energy management and consumption.

This capability to enable customers to actively participate in energy management and consumption is now possible with Smart Meter technology fully deployed. Smart Meters enable the utility to measure a customer's energy usage at a more granular level than traditional meters (e.g. every hour or every 15 minutes). This information can be used by customers to manage their energy costs more closely or by the utilities and third parties to design products that more closely reflect customer needs. Moreover, the foundational technology deployed through Edison SmartConnect® will provide a platform that can be utilized to leverage future customer technology. To take advantage of this platform, SCE continues to support the development of industry standards at the customer level and encourages third-party product innovations.

SCE is a national leader in evaluating, demonstrating and facilitating the safe, reliable and efficient connection of transportation to the electric grid. In the past, SCE has had the nation's largest private fleet of more than 300 plug-in electric vehicles (PEVs) that traveled more than 1 million miles. In 2009, SCE launched an internal PEV Readiness initiative to address the challenges and solutions associated with widespread PEV adoption.

Recognizing increasing PEV adoption and smart meter deployment, the IOUs worked collaboratively and developed the following priority initiatives to enable and integrate customer-focused products and services:

- Pilot Subtractive Billing with Submetering for Electric Vehicles; and
- Demonstrate data analytics capabilities of the Smart Meter platform to improve distribution system safety and reliability.

These initiatives were reviewed and confirmed with EPRI to be high priorities that could help to fill existing industry gaps.

6.3.1 Leverage the Smart Meter Platform to Drive Customer Service Excellence

Problem or Opportunity to be Addressed

The primary objective of this initiative is to empower customers to become active participants in the energy supply chain by enabling management of their own energy consumption, thereby reducing carbon emissions. This goal can be achieved by providing customers with pricing and usage information necessary to help manage consumption and production of energy at residences and/or places of business. SCE will also continue to engage with technology providers to develop effective and interoperable new smart grid technologies and services. Moreover, SCE will also continue to actively support interoperability standards development to promote wide-scale adoption.

Now that SCE's SmartConnect® smart metering system is fully deployed, energy consumption can be measured at a much more granular level than previously possible. This improvement to energy consumption measurement will further enable customer choice and energy management capabilities. SCE plans to leverage this system to enable additional operational enhancements that will benefit its customers.

Another potential project opportunity will expand on the submetering project launched in the first EPIC triennial investment plan. Specifically, the project will leverage 3rd party metering to conduct subtractive billing for various sites, including those with multiple customers of record. In order to accommodate multiple 3rd parties in an open market and insure accuracy of the billing system certain aspects will need to be standardized. Specifically the components that will require standardization include:

- Meter accuracy and frame;
- Data files;
- Data delivery method (Communications); and
- Delivery Intervals.

How the initiative will advance the strategy and overcome barriers

SCE plans to address consumer energy consumption for PEV customers. Historically, SCE has traditionally offered PEV drivers / owners the TOU-EV-1 rate for residential charging. This rate incentivizes customers to charge “off-peak” by offering a discounted rate after 9pm. However, in order to enroll in the TOU-EV-1 rate, the customer is required to have a separate independent meter to measure the energy consumed by the vehicle. This presents an adoption barrier, as installing a separate meter can be cost prohibitive and hence is not popular among PEV adopters. The previous submetering project pursued in the first EPIC Triennial Investment Plan is in the process of demonstrating the use of a submeter to collect PEV consumption, which is later subtracted from other home loads on the customer’s bill. For the potential Phase 2 portion of this project, the use of this same technology for multiple customers of record will be demonstrated.

The following are drivers for and barriers to leveraging the smart meter platform to drive customer service excellence:

a. Linkages between metering systems and grid operations,
b. Regulatory and legislative requirements,
c. System limitations,
d. Operating capabilities, and
e. Business case and operating information.

SCE's Potential Demonstration Projects

- Regulatory Mandates: Submetering Enablement Demonstration Phase 2

The following table lists the potential demonstration projects and the drivers/barriers they are intended to address.

SCE Project	Barriers Addressed
Regulatory Mandates: Submetering Enablement Demonstration Phase 2	b, c, d

6.3.2 Integrate Demand Side Management to Optimize the Grid

Problem or Opportunity to be Addressed

The objective of this initiative is to enable customers to actively participate in managing their energy consumption. This goal can be accomplished by providing real-time information and response capabilities to enable customers to adjust and manage their energy use in response to changing grid conditions, while also enabling the grid to automatically adjust to changing customer loads and supply requirements.

One potential project opportunity in this initiative builds upon the "Beyond the Meter Advanced Device Communications" project from the first EPIC triennial investment plan, and purposes to demonstrate how the concept of "big data" can be leveraged for automated load management. More specifically, this potential project would demonstrate the use of big data acquired from utility systems such as SCE's advanced metering infrastructure (AMI), distribution management system (DMS), and Advanced Load Control System (ALCS) to determine the optimal load management scheme and execute by communicating to centralized energy hubs at the customer level. Furthermore, the energy hubs would support a closed loop automation function by providing feedback information to SCE for evaluating the impacts of load management decisions. This capability is beneficial for both SCE and its customers, because it will help increase reliability by better managing customer loads when system conditions are critical.

How the initiative will advance the strategy and overcome barriers

SCE has made significant investments in developing back-office systems such as AMI and ALCS to leverage customer owned technologies. However, none of these systems are fully

integrated to create a harmonized load management approach. Today, SCE's independent systems must be manually coordinated to perform important system functions, such as demand response. SCE's proposed big data integration demonstration for advanced automated customer load management will investigate how to integrate existing back-office systems with emerging technologies in the home to create an advanced "closed loop" automated control system to better manage customer loads and improve grid reliability.

The following are drivers for and barriers to integrating demand-side management to optimize the grid:

a. Linkages between metering systems and grid operations,
b. Regulatory and legislative requirements,
c. System limitations,
d. Operating capabilities,
e. Business case and operating information.

SCE's Potential Demonstration Project

- Integration of Big Data for Advanced Automated Customer Load Management

The following table lists a potential demonstration project and the drivers/barriers they are intended to address.

SCE Project	Barriers Addressed
Integration of Big Data for Advanced Automated Customer Load Management	a, c, d, e

6.3.3 Respond to Emerging Grid Integration Issues

Problem or Opportunity to be Addressed

Continued market growth in customer technologies such as plug-in electric vehicles (PEVs) is expected in the IOUs respective service territories. The increased rollout of PEVs by startups and major auto manufacturers has provided an opportunity for customers to diversify their transportation fuel source. However in the case of existing public PEV charging systems, current PEV drivers face a somewhat inconsistent and unreliable out-of-home charging environment. Unlike PHEV drivers who have the option of an internal combustion engine, battery electric vehicle (BEV) drivers cannot expand their vehicle's range unless they have access to a reliable and convenient source of electric fuel. This initiative demonstrates public

DC fast charging stations at SCE facilities near freeways in optimal locations that can benefit PEV electric vehicle miles traveled (eVMT). This initiative will also demonstrate the deployment of low cost Level 1 Make-Readies (i.e., all electrical components required to supply power to an Electric Vehicle Supply Equipment cord set at 120 volts, including panel, stubbing, wiring, etc.) at selected businesses to optimize PEV eVMTs while minimizing grid impacts. In addition, these demonstrations would implement smart grid equipment and innovative techniques to minimize system impacts. The projects will leverage SCE's vast service territory and its facilities to help PEVs reach destinations that would otherwise be out of range. Moreover, SCE will demonstrate and deploy hardware such as energy storage, along with equipment and controls that could receive and respond to DR signals and shift from grid to storage, to supply a vehicle while reducing grid impacts.

How the initiative will advance the strategy and overcome barriers

Nearly all major automakers are reaching out to the utility industry to help develop and standardize infrastructure for recharging PEVs. Utility customers, including local governments, are looking to utilities to provide guidance on the design, location, and installation of charging infrastructure. Moreover if market adoption of PEVs continues its upward trend, there may be demand to increase the availability of PEV charging infrastructure, including DC fast chargers. Therefore this demonstration aims to understand best system operating techniques and potential impacts to the grid. Wider availability of fast charging may allow more BEVs to become primary vehicles.

The following are drivers for and barriers to responding to emerging grid integration issues:

a. Linkages between metering systems and grid operations,
b. Regulatory and legislative requirements,
c. System limitations,
d. Operating capabilities, and
e. Business case and operating information.

SCE's Potential Demonstration Project

- DC Fast Charging Demonstration
- Level 1 Make Readies Demonstration
- EPRI Research Program 18: Electric Transportation
- EPRI Research Program 60: Electric and Magnetic Fields and Radio-Frequency Health Assessment

The following table lists a potential demonstration project and the drivers/barriers they are intended to address.

SCE Project	Barriers Addressed
DC Fast Charging Demonstration	a, c, d
Level 1 Make Readies Demonstration	a, c, d, e
EPRI Research Program 18: Electric Transportation	b, c, d, e
EPRI Research Program 60: Electric and Magnetic Fields and Radio-Frequency Health Assessment	b, d

6.4 Cross Cutting/Foundational Strategies and Technologies

Transitioning SCE's existing electrical infrastructure toward a smart grid necessitates automation and interoperability. To achieve this end, a multitude of smart grid devices, in concert with new strategies will be deployed. In recent years, SCE's quantity of communicating devices has increased from the tens of thousands to several million. For example, at the conclusion of 2012 SCE had installed 5 million new smart meters through its Edison SmartConnect® program. In the future this figure could grow to include an even larger number of communicating devices, such as Programmable Communicating Thermostats, Plug-in Electric Vehicles, other customer-owned devices, power system infrastructure devices and communications network and infrastructure equipment. This proliferation of devices and related applications requires an evaluation of how the communications network is managed, how information is managed and shared and the degree to which control operations are coordinated across the company.

In addition to the need for an updated smart grid electric system design, SCE will also need to develop and adopt new smart grid information systems architectures. To achieve each of the elements of the SCE smart grid vision and the previously discussed EPIC investment initiatives (Sections 6.1-6.3), this future architecture will need to be agile and flexible, in order to meet increasing data management and analytics demands, support unanticipated needs and readily enable the integration of new smart grid technologies that emerge over time.

The IOUs' smart grid architectures will need to accommodate AMI smart meters, HAN devices, substation devices, energy storage, distributed renewable generation, grid control systems, security and network management systems, as well as other new or yet to be developed future smart grid technologies, such as "microgrid" applications. These architectures will also need to take into account the low latency communication performance requirements for managing and dispatching control commands, and sending and receiving measurement data critical to

establishing wide-area and deep situational awareness across the electric grid. In addition to managing compliance, risk and security this approach would ensure functional quality, scalability, manageability and system performance. These smart grid technologies increase information demands from not only utilities to support operational needs, but also from customers and third parties looking to support their own near real-time decision making needs.

Most importantly, SCE's smart grid architectures will need to incorporate robust cyber-security features to ensure that as the grid automates and increases flexibility, electric services remains safe and secure. SCE has made significant progress on a foundational cybersecurity solution for the electric grid by developing Common Cybersecurity Services (CCS). SCE is actively engaged in technology transfer of advanced cybersecurity technologies from the defense and intelligence industries to the smart grid. CCS is designed to implement security mechanisms to enforce confidentiality, integrity and availability of security services and policies that protect electronic information communication and control systems necessary for the management, operation and protection of the SCE Smart Grid System of Systems (SoS). CCS is specifically designed to satisfy the requirements and standards developed by the Smart Grid Interoperability Panel Cyber Security Working Group and the impending North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) Version 5 requirements.

California's IOUs worked collaboratively to develop the following elements that comprise the Cross Cutting / Foundational Strategies and Technologies program category, see below.

- Demonstrate advanced analytics for grid management and optimization;
- Demonstrate utility ability to facilitate the dispatch of DR capacity to meet CAISO needs; and
- Demonstrate Cyber Intrusion Auto Response and Policy Management System (CAPMS).

These elements were reviewed and confirmed with EPRI's subject matter experts and this section's potential investments, map to the following elements of the electricity value chain: Grid Operations/Market Design, Transmission and Distribution.

Problem or Opportunity to be Addressed

To address the increasing flexibility needs of the grid, SCE proposes a potential system architecture project, addressing micogrid applications. This potential project will demonstrate advanced commercial-grade microgrid controllers capable of managing/controlling microgrid systems consisting of between 1 and 10 megawatts (MW) of aggregated generation capacity. The project will evaluate microgrid's effectiveness for energy resilience (including protection of critical infrastructure and public resources). The focus will be on strengthening the resilience of electrical infrastructure against adverse effects of natural disaster and other unforeseen occurrences such as an earthquake, windstorm and/or hurricane.

Another potential project will demonstrate Utility/Distribution System Operator facilitated access to customer resources. Specifically, the California ISO (CAISO) will send a signal to SCE that

will be interpreted into a grid state that reflects the level of need to dispatch signals for customer-owned resources such as load controlling devices, energy storage devices and distributed generation. The signals may include prices, controls or grid state signals that invoke a response from preferred resources in support of the transmission and distribution system reliability. This project is intended to be a technology and communications focused demonstration in support of enhanced grid reliability, and is not a demand response project.

In the area of cybersecurity, SCE is proposing a potential project that will demonstrate the ability of SCE's CCS to support cyber-intrusion auto-response and policy management for distribution and critical infrastructure protection. Specifically, this system will demonstrate the effectiveness of cyber security software and system configurations to automatically detect a cyber-attack and take automated action to protect the electric system through the enforcement of advanced cyber security devices. The project will deploy these policies on utility equipment (i.e., digital fault recorders, smart inverters, and relays). The technology and strategies used in this system will demonstrate the effectiveness of transferring advanced military-grade cyber security technology onto the electric grid.

How the initiative will advance the strategy and overcome barriers

In the case of SCE's proposed microgrid demonstration, this project will evaluate an advanced control system, potentially consisting of multiple components and subsystems, capable of sensing grid conditions, and monitoring and controlling the operation of a microgrid during all microgrid operating modes (grid-connected, islanded, and transition between the two). It will demonstrate microgrids with various load-block sizes (community microgrid vs. mini-microgrid) to determine the most desirable configurations. SCE plans to leverage other sources of funding such as Department of Energy (DOE). In particular, this project will address the barrier of absent system standards to implement microgrids. Some microgrid technologies have been piloted, but are still widely experimental and few to none commercial implementations exist today. This potential demonstration seeks to address this gap by demonstrating and developing a microgrid reference model that can be implemented by other utilities.

Independent System Operators and Regional Transmission Operators tasked with balancing generation with load and managing the dispatch of supporting ancillary services in operating wholesale electric markets have limited visibility of and access to smaller-scale California preferred resources. This potential demonstration purposes to address the lack of a mechanism or design for establishing hierarchical access to effectively coordinate these resources between a Distribution System Operator (SCE) and a Wholesale Market operator (CAISO). This potential project would integrate:

- Communications,
- Embedded Systems,
- Control Systems,
- Market Access of DR,
- DG & Energy Storage to Emerging Retail and Existing Wholesale Markets, and
- New strategies and emerging technologies.

The integration of the aforementioned system requires new security protections from possible cyber-attacks. These cyber-attacks often are executed in time frames beyond the ability of a human operator to observe, assess, respond and reconfigure the cyber security system and protect the electric system it secures. To guard against such cyber-attacks, SCE proposes to demonstrate automated actions that can protect the electric grid from fast, automated cyber-attacks. The project shall use SCE's CCS platform to configure and deploy policies, advanced cyber security automated software and central monitoring and configuration services necessary to automatically detect and respond to cyber-intrusion.

The following are drivers for and barriers to using existing and new data sources to better leverage existing assets and implement strategies to benefit the safe, reliable and affordable operation of SCE's electricity system:

a. Electric system safety, security and reliability,

b. Regulatory and legislative requirements/recommendations,

c. System limitations,

d. Operating capabilities,

e. Industry standards, and

f. Business case and operating information.

SCE's Potential Demonstration Projects

- Microgrid for Enhanced Grid Reliability and Security
- CAISO Operations and Utility Grid Coordination
- Cyber-Intrusion Auto-Response and Policy Management System (CAPMS)
- Regional Grid Optimization Demonstration – Phase 2

The following table lists the potential demonstration projects and the drivers/barriers they are intended to address.

SCE Project	**Barriers Addressed**
Microgrid for Enhanced Grid Reliability and Security	a, b, c, d, e, f
CAISO Operations and Utility Grid Coordination	a, b, c, d, e, f
Cyber-Intrusion Auto-Response and Policy Management System (CAPMS)	a, c, d, e, f
Regional Grid Optimization Demonstration –	a, b, c, d, e, f

SCE Project	Barriers Addressed
Phase 2	

7. Program Administration

The EPIC Administrators have engaged in numerous meetings and conference calls to ensure the investment plan applications are well coordinated.[16] Moreover, the IOU's have agreed to continue using the Joint IOU Framework (Section 6) for program administration. Additionally, to ensure the EPIC planning process is publically transparent, the IOU Administrators held a webinar, as well as a Northern California and Southern California stakeholder workshops. This investment plan directly incorporates valuable feedback from these stakeholder engagements.

To further coordinate the EPIC program, leverage funding and identify areas of collaboration and to avoid duplication of efforts, the EPIC Administrators will continue to hold regular meetings and conference calls, as well as potentially sponsoring an annual EPIC symposium. This EPIC symposium would provide the Commission and stakeholders a forum to hear from the Administrators about key results from highlighted EPIC projects.

7.1 Program Coordination

SCE has and will continue coordinating with the other Administrators. Regular meetings between Administrators allow an opportunity to discuss programmatic issues, identify collaboration where possible; exchange lessons learned from projects and ensure there is not any duplication of efforts.

SCE also proposes an annual California EPIC Symposium. At this Symposium, the EPIC Administrators would present key results from their respective Investment Plans to the Commission and stakeholders. Such a public forum would increase the overall transparency of the Program and moreover, would provide the opportunity to gain insight on the progress the Administrators have made on EPIC funded projects.

7.2 Contracting

For this Investment Plan, SCE will use pay-for-performance contracts to fund its technology demonstration and deployment projects. While SCE appreciates the Commission giving the EPIC Administrators the option to use either grants or pay-for performance to fund projects, pay-for performance contracts are typically used for electric industry procurement. Moreover, SCE has long standing, documented and Commission approved pay-for-performance procurement policies and procedures. SCE plans to comply with the Commission's

requirements for competitive bidding,[48] but will continue to use non-competitive awards in limited instances such as when:

- Material or services required are available from only one reliable source and no other supplier will satisfy utility requirements;
- Specialized knowledge, skill, experience or expertise is needed for the work and only one supplier is determined to have what is needed;
- Bidding is cost prohibitive relative to the cost of materials or services needed;
- An opportunity exists to develop Diverse Business Enterprise suppliers;
- The procurement provides special discounts, rates, or terms and conditions (i.e., cost share) that are not available under normal competitive conditions; or
- Equipment, materials, or services are obtained for trial testing, research or experimental work.

These limited instances of using non-competitive awards will be reflected in SCE's Annual Report, per the Commission's requirements. [49]

7.3 Intellectual Property

As a result of a request for information that was issued by SCE to potential participants in its EPIC funded projects, SCE has identified three areas where the EPIC Decision should be clarified:

- The potential benefits from the IOUs retaining an ownership interest of intellectual property (IP) developed with EPIC funds can be outweighed by other considerations, such as the benefits from developing a promising technology in collaboration with others who are able to contribute unique skills or resources to a joint effort under less stringent IP requirements.
- When an IOU obtains a license to use IP developed with EPIC funds, then the IOU does not need to compete against the IP owner by licensing to others. [50]
- Indemnification of the state of California is limited to claims that arise from an EPIC-funded project and not as a result of subsequent licensing of EPIC-funded IP.

Commercialization versus other Ratepayer Benefits: SCE agrees that EPIC funds should be used to encourage the development of promising new technologies and believes the treatment of IP developed using EPIC funds should provide clear benefits to SCE's ratepayers. But SCE (and the other IOUs) should be given the flexibility to forgo rights to commercialize when the potential benefits from future commercialization is outweighed by other considerations. Two examples of when this can occur are described below:

[48] D.12-05-037, at Findings of Fact (FoF) 18.
[49] D.13-11-025, at OP 18.
[50] Washington State University, Iowa State University and Schweitzer Engineering Lab would give a limited license to SCE to meet its EPIC obligations. LBNL is required to adhere to all DOE requirements regarding IP. LBNL would provide a license for research purposes only and no sublicensing in the non -exclusive license.

- In some cases, SCE may be able to involve corporations, universities or research institutions that have past experience or key expertise as participants in an EPIC-funded project, which increases the likelihood that the project will be successful. But SCE may need to forgo rights to incremental IP that might be developed as a part of the new EPIC project in order to secure the participation of these entities.
- In other cases, SCE may be able to use EPIC funds to advance the development of a new technology by combining EPIC funds with funds provided by others, but SCE may not be able to do this if SCE also needs to obtain commercialization rights that are incompatible with the requirements of these funders.

Based on information obtained from universities, research institutions and others, SCE is concerned that the EPIC decision may unintentionally prevent or delay the pursuit of promising ways to develop successful projects (including those described above) by focusing attention on commercialization of IP and ignoring the often more important benefits that result from successful project completion and from minimizing the overall cost of these efforts.

License to Use, Not to Compete: SCE appreciates the fact that the EPIC Decision gives SCE flexibility in securing intellectual property rights associated with EPIC-funded projects. But this flexibility may be somewhat illusory where the alternative to ownership (i.e., a nonexclusive license to use the EPIC-funded intellectual property) is viewed as unacceptable by those who worry that SCE may compete against them by sublicensing their IP to others, thereby limiting the commercial marketplace available to them as the owner of the IP. The Commission should clarify that the nonexclusive licenses granted to the IOUs do not require that the IOUs sublicense IP to third parties.

Indemnity for the State of California: SCE believes the Commission should recognize that EPIC demonstrations and deployments could involve universities and government funded laboratories that may not be able to contract in the same manner as large commercial entities. For example, a number of entities have expressed a concern about the requirement to indemnify the state of California, especially if the indemnity includes separate efforts by the state of California to license EPIC-funded IP on a commercial basis.[51] Lawrence Berkeley National Labs' (LBNL) recently submitted comments on the current Commission rules for IP in which LBNL stated that it could not agree to indemnify the CEC or the Commission for use of intellectual property created by LBNL. Under UC and DOE policy, LBNL cannot indemnify a third party for their actions. SCE believes it would be desirable for the Comission to clarify the purpose for its indemnity requirement and that this indemnity is not intended to require Universities to obtain a change in their existing policies.

In sum, the EPIC program's success is dependent on participation by those who are best able to advance the most promising of the new technologies, regardless of whether such entities are governmental agencies, universities, national labs, community nonprofits or large companies.

[51] Washington State University, Iowa State University, Virginia Polytechnic Institute and State University (Virginia Tech) have informed SCE that, as agencies of the state, they have limited indemnity authority or are unable to indemnify third parties.

Given the pre-commercial aspect of EPIC, potential revenues from licensing these new technologies can be outweighed by tangible, immediate and practical benefits from accelerating when a new technology is available to the marketplace. When those who are best able to further develop and commercialize new technologies have the right incentives to do so, the result is likely to be that the new technology will be available sooner and at a lower cost to all. As the initial cost of a new technology is lowered, then widespread adoption of the technology is encouraged and more uniform standards for use of the technology are put into place, which in turn can lead to improvements in grid safety and reliability. The three clarifications described above to the EPIC Decision are being presented as a part of this application because SCE believes these will assist SCE in its effort to move forward with the projects identified in this application. But these clarifications will also further the development of EPIC-funded projects already approved by the Commission as a part of previous filings by SCE.

7.4 Project Reporting and Information Dissemination

In Compliance with the Commission's EPIC requirements,[52] SCE submitted its first Annual Report of EPIC activities conducted during the calendar year of 2013 to the Commission, February 28, 2014.

As the Investment Plan matures and a project concludes, SCE will prepare a final report. This final report will comply with the Commission's reporting requirements and include a description of the issue or problem the project addresses, the approach and analysis, key findings and recommendations for subsequent actions.

As part of SCE's broader technology efforts, EPIC funding will be used to advance technology and utilize new strategies to improve the electric grid. To increase adoption and standards, SCE will continue to publish papers, share project results and make presentations to a variety of regulatory, academic, industry and standards organizations, including: DOE, EPRI, IEEE, National Institute of Standards and Technology (NIST), Pacific Northwest National Lab (PNNL), among others.

7.5 Metrics

SCE will use the metrics in D.13-11-025, which were adopted by the Commission as a supplement to each Investment Plan.[53] The following metric areas will help to evaluate the progress and overall success of SCE's Investment Plan:

- Potential energy and cost savings;
- Job Creation;
- Economic Benefits;

[52] D.13-11-025, at OPs 14, 22-23, Attachments 5-6.
[53] D.13-11-025, at OP 26, Attachment 4.

- Environmental Benefits;
- Safety, Power Quality and Reliability;
- Other Metrics (to be developed based on specific projects through ongoing administrator coordination and development of competitive solicitations);
- Identification of barriers or issues resolved that prevented widespread deployment of technology or strategy;
- Effectiveness of information dissemination;
- Adoption of EPIC technology, strategy, and research data/results by others; and
- Reduced ratepayer projects through external funding or contributions for EPIC-funded research on technologies or strategies.

SCE appreciates the Commission's flexibility in choosing metrics on a project-by-project basis and recognizing the list of metrics discussed by stakeholders at the January 17, 2013 Commission workshop and subsequently developed by the EPIC Administrators is not exhaustive.[54] When developing projects from the Investment Plan, SCE will comply with the Commission's directives to determine the applicable elements to be measured and/or evaluated and to establish a measurement plan to evaluate the effectiveness of the planned area of investment. When developing these project metrics, SCE will also look to identify additional metrics to further improve EPIC evaluation.

7.6 Allocation of Programmatic Funding to the CEC

The IOUs remit administrative budget allocations to the CEC and the Commission on a quarterly basis. The IOUs have been working with the CEC to establish processes and procedures to remit programmatic funding from the EPIC balancing accounts when funds are encumbered by the CEC. The CEC has requested the IOUs to provide programmatic funding once a month, after approved at a Business Meeting. Once programmatic funding is approved, the CEC will issue a letter to each of the utilities, requesting remittance of funding with a detailed explanation of the project(s) and CEC approved amount.[55] The IOUs must receive this letter 30 days prior to the expected remittance date. Once the letter is received, the IOUs will remit its allocated portion of costs for the funding requested.[56]

The IOUs are reviewing the CEC's requested programmatic funding remittance process with other internal departments to determine the viability of using the CEC's approach.

[54] D.13-11-025, p. 67.
[55] *The IOUs are in no way responsible for monitoring CEC Business Meetings, nor responsible for assessing the validity and/or accuracy of CEC programmatic funding requests.*
[56] D.12-05-037, at OP 7.

8. State Policy Direction for IOU-Administered RD&D & Smart Grid Programs

The Commission requires the investment plan to further the policies and objectives of Public Utilities Code Sections 740.1 and 8360. The Joint-IOU Framework applies to the statutory principles in the respective Code Sections. Moreover, SCE's programmatic administration intends to continue to fully comply with the Code Sections.

8.1 Public Utilities Code Section 740.1

For evaluating research, development and demonstration projects proposed by electrical and gas corporations, Public Utilities Code (PUC) Section 740.1 requires the Commission to consider a set of guidelines.

- First Guideline: projects should offer a reasonable probability of providing benefits to ratepayers. SCE will select projects from its Investment Plan that it determines will provide the best probability of providing customer benefits in lowering costs, improving safety and/or increasing reliability, as well as other societal benefits. Due to the nature of demonstrations, not all projects will be successful in achieving direct customer benefits. However, all demonstrations are useful to the utility industry, because even unsuccessful projects may produce results that could help to inform the electric industry.

- Second Guideline: Expenditures on projects with a low probability for success should be minimized. As mentioned above, SCE will only select projects deemed with the greatest probability of providing direct customer benefits. However, if during the course of a project it experiences excessive delays, cost overruns, or if the probability of success is insufficiently low, SCE will terminate the project. While SCE will attempt to avoid such projects, it should be noted that success is not guaranteed, because the point of a pre-commercial technology demonstration phase is to prove the cost effectiveness of the technologies' and the viability of its capabilities.

- Third Guideline: Projects remain consistent with the corporation's resource plan. SCE's Investment Plan is consistent with the broader corporation objectives of safety, reliability and affordability. Moreover, the Joint IOU Framework, used in this Investment Plan relates to the established loading order and broader state energy policy objectives.

- Fourth Guideline: Avoid unnecessarily duplicating research being done by another entity. Demonstration funding for pre-commercial technologies and new strategies are of limited supply, so EPIC Administrators are particularly motivated to not duplicate existing work. To allay concerns of duplication, SCE held a discussion with EPRI on industry gaps in technology demonstrations and deployments, which is included in Section 5, Discussion of Gaps.

- Fifth Guideline: Each project should support at least one of the following objectives:
    - Environmental Improvement;
    - Public and Employee safety;
    - Conservation by efficient resource use or by reducing of shifting system load
    - Development of new resources and processes, particularly renewables resources and processes that further supply technologies; and
    - Improvement of operating efficiency and reliability or otherwise reducing operating costs.

  Environmental improvement and public and employee safety objectives are embedded in each of the Joint IOU Framework categories. With respect to conservation, existing Energy Efficiency and Demand Response Programs primarily cover this objective. SCE has no intention of duplicating its EPIC efforts with existing Energy Efficiency and Demand Response Programs and has provided a list of these projects, included as Appendix B to this filing, as confirmation that no overlap between programs exist. The Customer Products/Services Enablement category of the Joint IOU Framework, distinguishes from energy efficiency and demand response, by focusing on system and operations integration of technologies and strategies. To meet the objective of developing processes for renewable resources that further supply technologies, the IOU's created the Renewables & Distributed Energy Resources Integration category, which will address demonstrating pre-commercial technologies and novel strategies to facilitate the safe and reliable integration of renewables and distributed energy resources into the grid. To meet the final objective to improve operating efficiency and reliability or otherwise reduce costs, the IOU's created the category of Advanced Asset Management & Optimization. The goal of Advanced Asset Management & Optimization is to demonstrate technologies and new strategies that will lead to deployment of assets that meet and support both existing and future system needs and requirements, to avoid stranding assets.

8.2 Public Utilities Code Section 8360

Public Utilities Code Section 8360 sets ten separate objectives to modernize the state's electric grid with infrastructure that can meet existing and future demand, while providing safe, reliable, efficient and secure electric service for customers. All ten of these objectives are incorporated into the Joint IOU Framework categories, earlier described in SCE's Investment Plan, Section 6.

The Renewable and Distributed Energy Resources Integration funding category (Section 6.1) is intended to address the integration challenges of greater renewable and distributed generation penetration, so that these resources can safely, reliability and affordably be incorporated into the electric grid. This category directly supports the following paragraphs in Public Utilities Code Section 8360:

(c) Deployment and integration of cost-effective distributed resources and generation;
(g) Deployment and integration of cost-effective advanced electricity storage; and

(j) Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices and services.

The Grid Modernization and Optimization funding category (Section 6.2) recognizes the continual need to replace aging infrastructure with new and more effective assets that will be reliable, safe and cost-effective. This area directly supports the following objectives of PUC, Section 8360:

(a) Increased use of cost-effective digital information and control technology to improve reliability, security and efficiency of the electric grid;
(b) 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; and
(j) Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices and services.

The Customer Products & Services Enablement funding category (Section 6.3) addresses the changing needs and role of electric customers, as products such as plug-in electric vehicles increase. This category addresses grid impacts and operations, which is separate from existing Energy Efficiency and Demand Response programs[23] and supports the following paragraphs of PUC, Section 8360:

(d) Development and incorporation of cost-effective demand response, demand-side resources and energy efficient resources;
(e) Deployment of cost-effective smart technologies, including real time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices for metering, communications concerning grid operations and status and distribution automation;
(f) Integration of cost-effective smart appliances and consumer devices;
(g) Deployment and integration of cost-effective advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid vehicles, and thermal-storage air-conditioning;
(h) Provide consumers with timely information and control options;
(i) Develop standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid; and
(j) Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices and services.

The final section, the Cross-Cutting Strategies & Foundational Technologies funding category (Section 6.4) focuses on enabling foundational capabilities for an increasingly automated electric grid that cut across the three previous categories. Cross-cutting and Foundational Technologies initiatives, such as advancing interoperability, system architecture and cyber security directly supports all of PUC, section 8360's objectives.

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE

STATE OF CALIFORNIA

Application of Southern California Edison Company (U) 338-E) for Approval of its 2015-2017 Triennial Investment Plan for the Electric Program Investment Charge,	))))	A.14-05-005 (Filed May 1, 2014)

CERTIFICATE OF SERVICE

I hereby certify that, pursuant to the Commission's Rules of Practice and Procedure, I have this day served a true copy of **AMENDMENT TO APPLICATION OF SOUTHERN CALIFORNIA EDISON COMPANY (SCE) (U 338-E) FOR APPROVAL OF ITS 2015- 2017 TRIENNIAL INVESTMENT PLAN FOR THE ELECTRIC PROGRAM INVESTMENT CHARGE,** on all parties identified on the attached service list(s) **A.14-05-005, A.10-12-005, A.12-11-001, A.12-11-009, and A.13-11-003** Service was effected by one or more means indicated below:

☒ Transmitting the copies via e-mail to all parties who have provided an e-mail address.

☒ Placing the copies in sealed envelopes and causing such envelopes to be delivered by hand or by overnight courier to the offices of the ALJ(s) or other addressee(s).

ALJ David M. Gamson
CPUC
505 Van Ness Ave
San Francisco, CA 94102

Executed this May 22, 2014**,** at Rosemead, California.

/s/Michal Odorczuk
Michal Odorczuk
Project Analyst
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Appendix A

Potential Projects

PROJECT NAME: ADVANCED GRID CAPABILITIES USING SMART METER DATA

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This project will examine the possibility of establishing the Phasing information for distribution circuits, by examining the voltage signature at the meter and transformer level, and by leveraging the connectivity model of the circuits. The availability of phase information can result in effective phase balancing of load leading to power system stability and quality. Phase information will also be very helpful in power system planning and design, as it allows for full utilization of capacity within the existing installed infrastructure before new assets deemed to be required. Conceptually, we would like to explore technologies that are capable of studying the voltage signature at the smart meter and map it to the unique characteristics of the phase. Some additional technologies also send a signal at the source (at the start of the circuit at the substation) and study the receipt of this signal through signature at the meter and correlate the meter to the right phase. Additionally, the technology will also enable us to identify which devices (transformers, fuses, switches etc.) are contained within that phase of the circuit. For system planning and engineering groups, this technology would provide up to date phase information. That information combined with the load data from smart meters can provide significantly better inputs into the power flow analysis. For local planning and design groups, this technology would provide up to date phase information and allows them to plan load additions in a balanced way and avoid power quality issues due to system imbalances. This project will also examine the possibility of establishing transformer to meter connectivity based on the voltage signature at the meter and at the transformer level. Through this initiative, we will evaluate technologies that are capable of studying the voltage signature at the smart meter and the transformer and confirm that the right meters are connected to the right transformers. This accuracy of meter to transformer connectivity helps in many areas of the business including outage notifications, outage duration reporting, trouble operations, local planning for load additions, and asset condition. For outage notifications and outage duration reporting, accurate meter to transformer connectivity will ensure that the right customers are notified in cases of a planned outage and also the outage duration is accurately reported in cases of a structure or circuit level outage, both planned and unplanned. For trouble operations, accurate meter to transformer connectivity information will help establish the proper cause/corrective action for a trouble call and helps direct the first responders to the right locations. For local planning and design groups, accurate meter to transformer connectivity information is critical to determine the existing load on a given transformer based on the current connected load. This information is used by planners to determine if a future load addition by the customer warrants additional asset upgrade or can be accommodated from the existing installed assets. Finally, the accurate meter to transformer connectivity information is critical to determine the current loading of a transformer. This load information will help SCE determine the risk of failure due to overload conditions, potential replacement strategies, and an accurate prediction on the overall loss of life.
Concern, problem or gap to be addressed	Individual circuit phasing information at the distribution level is currently not fully available at SCE, resulting in ineffective phase balancing of load leading to power system instability and quality issues. Through this technology we will examine the possibility of establishing phasing of distribution circuits. Lack of phasing information will limit the ability to conduct effective load flow studies and cannot leverage the rich load data available from smart meters. The accuracy of the meter to transformer connectivity information is questionable in some areas of the utility due to various reasons. Inaccuracies in this information could lead to improper and inadequate outage notifications to customer for planned outages. Inaccuracy of this information will also lead to less accurate outage duration reporting. Inaccurate information will also lead to ineffective dispatch of first responders to wrong locations. Lack of accurate meter to transformer connectivity will potentially lead to the local planners making errors during load additions. Assessment of overall load condition and life span of the transformer becomes difficult to establish if the proper meter connectivity is not available.

EPIC DESCRIPTION	PROJECT EXPLANATION
Pre-commercial technology or strategy aspect	The technologies in this space are still in the development stage. While significant improvements are claimed to have been made, SCE has not yet come across a software or technology solution that is deemed completely proven. However, the advances are adequate enough to warrant further investigation and demonstration, given the benefits of the results of such a technology.
How the project avoids duplication from other initiatives	Within SCE, there are no other groups that are working on a similar project. SCE has also benchmarked other investor-owned utilities (IOUs) across the state, and there does not appear to be any similar work being performed.
Prioritization: High priority project	This project is considered high priority. Phase information will allow SCE to benefit significantly by conducting effective load flow studies and avoid power quality issues. The availability of phase information also means effective utilization of load data available from smart meters to define the most accurate condition of the power system. This load information in conjunction with phase information can be very useful in load switching during emergent operating conditions.
EPIC primary or secondary principles met	This project provides clear electricity ratepayer benefits and supports EPIC's primary principles of promoting greater reliability and lower costs by examining the possibility of establishing the Phasing information for distribution circuits, which can result in effective phase balancing of load leading to power system stability and quality. Phase information will also be very helpful in power system planning and design, as it allows for full utilization of capacity within the existing installed infrastructure before new assets deemed to be required. This project also supports EPIC's primary principles of promoting greater reliability by examining the possibility of establishing transformer to meter connectivity based on the voltage signatures at the meter and transformer level. This accuracy of meter to transformer connectivity helps in many areas of the business including outage notifications, outage duration reporting, trouble operations, local planning for load additions, and asset condition.

PROJECT NAME: BULK SYSTEM RESTORATION UNDER HIGH RENEWABLE RESOURCES PENETRATION DEMONSTRATION

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This proposed demonstration project aims to evaluate system restoration plans following a blackout event under high penetration of wind and solar generation resources. In order to prevent or reduce cascading sequences of outage events, SCE is researching ways to improve and optimize restoration strategies that will significantly reduce the vulnerability of the power system and will ensure successful restoration of service to customers. The demonstration project will be divided into two different phases. Phase I of the project will address the feasibility of new approaches to system restoration by reviewing the existing system restoration plans and it's suitability for higher penetration of renewable generation. It will also include the modeling of the wind and solar generation. Phase II of the project will focus on the on-line evaluation of restoration plans using scenarios created using Real Time Digital Simulator (RTDS) with hardware in the loop. After the restoration process is evaluated and tested in the lab environment, a recommendation will be made to implement in the field.
Concern, problem or gap to be addressed	Ensuring the secure and reliable operation of large interconnected power systems is of paramount importance from social, economic, and political perspectives. The increase in variable renewable resources connected to the grid introduces new sets of challenges that require better monitoring and control of the bulk power system. The high degree of variability inherent to renewable resources introduces more complexity in the operation and on-line control of the bulk system. Updated power system restoration plans that take into account renewable resources may translate into increased reliability and improved cost effectiveness of existing restoration plans.
Pre-commercial technology or strategy aspect	System operators currently rely on system restoration plans that were developed with an emphasis on only conventional generation (e.g., centralized thermal or hydro units). This demonstration project's intent is to provide system operators with the ability to precisely predict the system response during the restoration process and incorporate any existing renewable resources into the restoration process.
How the project avoids duplication from other initiatives	There are no similar efforts taking place around the US, including ERCOT. Given the fact that these technologies are very dependent on the unique characteristics and topology of each IOUs electric system, the potential for duplication is minimal.
Prioritization: High priority project	This demonstration project is considered high priority as SCE continues to integrate renewable energy resources (i.e., large wind farms and solar generation) to the grid annually. This project has the potential to provide system operators the ability to better manage the restoration process by taking the availability and intermittency of renewable generation into consideration.
EPIC primary or secondary principles met	This project provides clear electricity ratepayer benefits, and supports the EPIC primary principle of providing greater reliability by supporting the integration of renewable resources during large scale system disturbances. The potential use and/or integration of renewable sources will also translate into the reduction greenhouse gases during system restoration. In any large scale system disturbance, a rapid and orderly restoration of customer loads will reduce unnecessary delays in the bulk system restoration and translates into lower costs and increased safety.

PROJECT NAME: CYBER-INTRUSION AUTO-RESPONSE AND POLICY MANAGEMENT SYSTEM (CAPMS)

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This project will demonstrate the ability of SCE's common cyber security services (CCS) to support cyber-intrusion auto-response and policy management for distribution and critical infrastructure protection. Specifically, this system will demonstrate the effectiveness of cyber security software and system configurations to automatically detect a cyber-attack and take automated action to protect the electric system through the enforcement of advanced cyber security devices. The project will deploy these policies on utility equipment (e.g., digital fault recorders, smart inverters, and relays). The technology and strategies used in this system will demonstrate the effectiveness of transferring advanced military-grade cyber security technology onto the electric grid.
Concern, problem or gap to be addressed	Many cyber attacks are executed in time frames beyond the ability of a human operator to observe, assess, respond, and reconfigure the cyber security system and protect the electric system it secures. This project will demonstrate automated actions that can protect the electric grid from fast, automated cyber attacks.
Pre-commercial technology or strategy aspect	The project shall use SCE's common cyber-security platform to configure and deploy policies, advanced cyber security automated software and central monitoring and configuration services necessary to automatically detect and respond to cyber-intrusion with advanced policies.
How the project avoids duplication from other initiatives	SCE's pioneering efforts in adapting military grade cyber security technology onto the electric grid have driven the development of the CCS platform. Moreover, SCE is coordinating with the Department of Energy (co-funding this project) and other IOUs and EPIC stakeholders to ensure that this project does not duplicate other known initiatives in this space.
Prioritization: High priority project	This EPIC funds used to support this project shall be matched by the Department of Energy through an existing Cyber security FOA awarded to ViaSat, SCE and Duke Energy. All EPIC funds matched by the DOE shall be used to support the SCE portion of the CAPMS project. This project will help demonstrate how to effectively protect our modernized electric system from cyber attack while facilitating interoperability and reliability across the electric system
EPIC primary or secondary principles met	This project provides clear electricity ratepayer benefits and supports EPIC's guiding principle to improve system reliability by demonstrating the effectiveness of cyber security software and system configurations to automatically detect a cyber-attack and take automated action to protect the electric system through the enforcement of advanced cyber security devices.

PROJECT NAME: DC FAST CHARGING

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	The goal of this project is to demonstrate public DC fast charging stations at SCE facilities near freeways in optimal locations to benefit electric vehicle miles traveled (eVMT) by plug-in electric vehicles (PEVs) while implementing smart grid equipment and techniques to minimize system impact. The Transportation Electrification (TE) Organization is actively pursuing several strategic objectives, including optimizing TE fueling from the grid to improve asset utilization. Deploying a limited number of fast charging stations at selected SCE facilities that are already equipped to deliver power at this level (without additional infrastructure upgrade) will support this objective. The project will leverage SCE's vast service territory and its facilities to help PEV reach destinations that would otherwise be out-of-range. Hardware such as associated energy storage, along with equipment and controls that could receive and respond to DR signals and shift from grid to storage to supply a vehicle while reducing grid impact, will be demonstrated.
Concern, problem or gap to be addressed	Current PEV drivers face a somewhat inconsistent and unreliable out-of-home charging environment. Unlike plug-in hybrid electric vehicle (PHEV) drivers who have the option of an internal combustion engine, battery electric vehicle (BEV) drivers cannot expand their vehicle's range unless they have access to a reliable and convenient source of electric fuel. DC fast charging is not meant to be the only source to recharge a PEV (it can wear out the battery faster), but wider availability may allow more BEVs to become primary vehicles. If PEVs become very popular, there may be demand to install large numbers of fast chargers, and utility systems must understand the impact and the best techniques.
Pre-commercial technology or strategy aspect	This project is strategic in nature and leverages existing technology to optimize PEV load by expanding eVMT. This, in turn, may result in more electric miles driven by PEV drivers with positive implication on the utility.
How the project avoids duplication from other initiatives	While the Commission has entered into a settlement with NRG Energy to deploy DC fast charging, siting for the new stations has been difficult and very few have been deployed in SCE's service territory. To our knowledge, no other California IOU is planning a similar effort. The proposed project may actually show a pathway for others to follow and improve deployment of the technology by third parties. Other initiatives do not involve smart grid techniques.
Prioritization: High priority project	This project is considered a high priority. Transportation electrification has significant potential for load growth, storage, system efficiency improvement, and carbon emission reduction. SCE is focused on developing solutions to optimize PEV load by maximizing the use of electric fuel and minimizing grid impact.
EPIC primary or secondary principles met	This project meets the following primary principles: Reliability: This project will demonstrate how DC fast charging stations may fuel EVs without generation, transmission or distribution system impact on utility customers Costs: PEV load, at scale, may provide increased asset utilization which may result in a downward pressure on costs. This project also meets secondary principles (including societal benefits, GHG emission mitigation, low-emission vehicles/transportation); it is directly aligned with the objectives of SB 626, AB 32, and the 2013 ZEV Action Plan issued by California Governor Brown.

PROJECT NAME: DYNAMIC DISTRIBUTION CIRCUIT CONFIGURATION

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	Distributed generation, electric vehicles, energy storage, and other emerging customer-sited energy technologies are changing the flow of power on the electric grid, making it more challenging to manage system disturbances and reliability. The planning, design, and operation of the electric grid will need to evolve with advancement of technology and increasing use of distributed energy resources. Increased flexibility in the way SCE designs and configures the distribution system may provide benefits that minimize the need for infrastructure upgrades and lower the risk of siting storage resources in areas where their grid support functions are sub-optimized. This project would demonstrate the advantages of increasing the installed quantity of distribution switches across the distribution grid to enable improved operational flexibility in dynamically reconfiguring circuits and leveraging storage capabilities across a greater part of the service area.
Concern, problem or gap to be addressed	Siting devices such as energy storage, capacitors, and solid state voltage devices on a particular area of the distribution grid to address an acute issue may limit the usefulness of those devices as the circuit load profile and grid-connected resources evolve over time. A greater installed quantity of switches and new control algorithms to optimize these resources would extend the device capabilities and associated benefits over a greater area. This approach could potentially decrease overall service costs and reduce the risk of siting a device at a less than optimal location where its grid benefits would be diminished.
Pre-commercial technology or strategy aspect	Flexible intelligent circuit interrupters are a new class of distribution switches and considered pre-commercial in nature.
How the project avoids duplication from other initiatives	The new class of distribution switches proposed in this project has been deployed in limited quantities as part of the Irvine Smart Grid Demonstration (ISGD) project for increased reliability. This project is unique in that it would extend the ISGD concept by incorporating increased flexibility into the distribution circuit design and planning process to facilitate the optimal siting of both utility-owned and customer-sited distributed energy resources. Lastly, SCE is not aware of any other initiatives attempting to achieve an equal level of flexibility in distribution circuit design flexibility.
Prioritization: High priority project	This project is considered a high priority due to the expected proliferation of distributed energy resource deployments on SCE's distribution grid. This project has the potential to increase flexibility in the planning process, increase the value proposition of storage, and increase the penetration level of renewable resources.
EPIC primary or secondary principles met	This project provides clear electricity ratepayer benefits and supports EPIC's guiding principles to provide greater reliability and lower costs by increasing the installed quantity of circuit switches on the distribution system to increase system resiliency and lowering the risk of sub-optimal DER grid support performance due to a rapidly changing distribution system.

PROJECT NAME: DYNAMIC POWER CONDITIONER

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This project will demonstrate the use of the latest advances in power electronics and energy storage devices and controls to provide dynamic phase balancing as well as providing voltage control, harmonics cancellation, sag mitigation, and power factor control while providing steady state operations such as injection and absorption of real and reactive power under scheduled duty cycles or external triggers. This project aims to mitigate the cause of high neutral currents and provide several power quality benefits through the use of actively controlled real and reactive power injection and absorption.
Concern, problem or gap to be addressed	While it is the aim of distribution engineers to have all three phase loading as closely balanced as possible to minimize neutral current flow and to optimize for system upgrade triggers, perfect phase balancing is neither perfect nor always feasible in a distribution system. The issue of phase balancing becomes more acute due to the increasing penetration of DER devices such as PV inverters deployed on residential rooftops, causing unpredictable loading and variable generation profiles. Furthermore, load characteristics associated with electronically controlled customer side loads also inject harmonics into the system causing undesirable current flows on the neutral conductor.
Pre-commercial technology or strategy aspect	The implementation of active power electronics based devices on the distribution system to provide dynamic phase balancing is a new operational concept in the electric utility space. Historically, phase imbalance mitigation schemes have consisted of manual provisions employed by field crews on an as needed basis. This project will prove the viability of active power electronics and energy storage devices as a means to facilitate increasing DER penetrations on the distribution network while improving power quality.
How the project avoids duplication from other initiatives	Within SCE, there are no other groups that are working on a similar project. Recent advances in power electronics and energy storage now make it feasible to control real and reactive power on the distribution system dynamically while coupling directly to the distribution system. SCE is not aware of any other initiative that aims to solve the phase balancing and power quality issues presented by DER load characteristics and the proliferation of residential roof top PV.
Prioritization: High priority project	This project is considered high priority due to safety and reliability concerns over high neutral current flow, the difficulty in balancing all phases due to changing grid conditions, and the concerns associated with two-way power flows caused by increasing DER penetrations at the distribution level.
EPIC primary or secondary principles met	This project provides clear electricity ratepayer benefits and supports the EPIC primary principles to provide greater reliability, increased safety, and lower costs by deploying the necessary hardware, controls and infrastructure for active power devices coupled with energy storage to facilitate the integration of increasing quantities of distributed energy resources on the distribution grid while mitigating potential power quality issues.

PROJECT NAME: ENERGY SAVINGS MODEL DEMONSTRATION USING SMART METER DATA

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This project will develop models for estimating the potential energy savings based on measurement and adjustment of the voltage of individual smart meters/feeders through Advanced Voltage/VAR Control (AVVC). Technologies are being developed in the market place to study the voltage quality at various points in the power system and apply voltage correction techniques to maintain the values within the allowable and acceptable thresholds. The technologies will then be able to estimate the potential energy savings due to this voltage correction. Availability of such technologies will enable SCE to prepare better business cases for investments in AVVC hardware and devices to realize the energy savings projected. This information will be valuable for system planning and engineering in better utilization of existing energy sources and utility infrastructure. It will also provide SCE better modeling capabilities to accurately estimate generation capabilities needed to serve the customer load.
Concern, problem or gap to be addressed	Currently SCE does not leverage the voltage data at the individual customer level (available from smart meters) to understand the full extent of AVVC measures that need to be undertaken. Availability of a good voltage model and the corresponding model for potential energy savings will be immensely helpful in determining the scale and adequacy of AVVC devices to be deployed. The resulting model will also help in achieving energy savings for the customers and the utility.
Pre-commercial technology or strategy aspect	The technologies in this space are ~~in the~~ considered nascent ~~in~~ and pre-commercial in nature, but are beginning to find significant traction in the industry due to the sizeable value proposition in energy savings. The advances in the technologies are adequate enough to warrant further investigation and investment in this space, given the benefits of the results of such a technology. This is also a strategic element in the sense that an educated decision could be made to invest in AVVC devices in the field based on the scale of the potential energy savings that will be determined as part of this demonstration.
How the project avoids duplication from other initiatives	Within SCE, there are no other groups that are working on a similar project. SCE has also benchmarked other investor-owned utilities (IOUs) across the state, and there does not appear to be any similar work being performed.
Prioritization: High priority project	This project is considered high priority. The energy savings projections demonstrated by the vendors in the space are significant and warrant immediate investigation and investment.
EPIC primary or secondary principles met	This project provides clear electricity ratepayer benefits by promoting greater reliability and lower costs based on effective voltage management at the customer level. This project will develop models for estimating the potential energy savings based on measurement and adjustment of the voltage of individual smart meters/feeders through AVVC control. It will also enable SCE to prepare better business cases for investments in AVVC hardware and devices to realize the energy savings projected.

PROJECT NAME: EPRI RESEARCH PROGRAM 18: ELECTRIC TRANSPORTATION

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	The Electric Transportation program conducts research and development on vehicle and infrastructure technologies that enable the use of electricity as a transportation fuel. The program has played a leading role in the development of PEV technologies that are at the forefront of automotive industry development efforts. The Electric Power Research Institute (EPRI) also serves as a focal point of collaboration between the automotive and utility industries for the development of infrastructure standards, vehicle demonstration programs, and advanced infrastructure technologies. EPRI's non-road electric transportation efforts have demonstrated the cost-effective use of battery electric vehicles in numerous commercial and industrial applications, and serve as the technical foundation for successful, customer-focused utility non-road electric transportation market expansion programs.
Concern, problem or gap to be addressed	Nearly all major automakers are reaching out to the utility industry to help develop and standardize infrastructure for recharging PEVs. Utility customers, including local governments, are looking to utilities to provide guidance on the design, location, and installation of charging infrastructure. Utilities need to understand the system impacts and customer requirements associated with plug-in vehicles while conducting the necessary preparations to support the rollout and adoption of PEVs by their residential, commercial, and industrial customers. Electricity is the only potential energy source for transportation that addresses the simultaneous need for fuel diversity, energy security, reductions in greenhouse gas emissions, and improvements in air quality that is widely available and produced domestically. Electric utilities must understand the paradigm shift that will occur with an inevitable transition of transportation energy from petroleum to electricity, as well as their new role as a fuel provider for vehicles. In addition, vehicle fleets can offset high fuel costs and meet environmental requirements by incorporating PHEVs or battery electric vehicles (BEVs) into their operations. Adoption of non-road electric vehicles at customer sites can reduce fuel costs and increase customer satisfaction. Emission-constrained sites such as seaports and airports can reduce the cost of environmental compliance.
Pre-commercial technology or strategy aspect	• Analysis of the grid impacts of PEV charging to utility systems; • Utility-specific analyses on potential PEV market size, load shape and requirements, customer expectations, infrastructure requirements, and other material required to support internal utility PEV readiness or mainstreaming programs; • Testing and evaluation of PEVs and electric vehicle charging equipment; data collection and analysis of real-world PEV operation in utility fleet and other applications; • Formation of major vehicle and infrastructure demonstration initiatives to collect and analyze real-world operating data on the latest vehicle and infrastructure technologies; • Development of advanced charging technologies that enable integration of PEVs into the utility smart grid; • Development of non-road electric transportation programs through field demonstration and technology development and assessment; and • Validation of the economic and environmental benefits (including greenhouse gas emissions) of PEVs to the utility, utility customers, and their communities.
How the project avoids duplication from other initiatives	The Electric Power Research Institute (EPRI) is an independent, nonprofit organization that conducts research, development and demonstration (RD&D) for the electric utility industry. Through EPRI's advisory structure, SCE and other members provide input on proposed EPRI projects within this program, including identifying and preventing duplicative efforts between EPRI and internal utility projects.

EPIC DESCRIPTION	PROJECT EXPLANATION
Prioritization: High priority project	This is a high priority for SCE. The collaborative research and development efforts at EPRI provide value to SCE's PEV Readiness and Advanced Technology programs. PEV Readiness is driven by three critical factors: Market awareness, technology standards, and alignment between the vehicular systems and the electricity grid today and smart grid tomorrow. For the overall effectiveness, Program 18 provides quality information to assist with the technology deployment of vehicle related activities. Standards development is critical to AT as we enable the connectivity between the grid – especially the future smart grid – and the vehicle. Standards awareness and the impact are also critical to PEV readiness as External Engagement provides accurate information to our communities and businesses as part of our outreach and education initiatives.
EPIC primary or secondary principles met	This research program supports EPIC principles of GHG emissions reduction and other societal benefits; economic development; and efficient use of ratepayer monies due to leveraged (minimum of 10x) costs/benefits.

PROJECT NAME: EPRI RESEARCH PROGRAM 60: ELECTRIC AND MAGNETIC FIELDS AND RADIO-FREQUENCY HEALTH ASSESSMENT

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	The Electric and Magnetic Fields and Radio-Frequency Health Assessment and Safety program helps electric power companies address questions about EMF and RF exposures and health issues. Program research, combined with the expertise of the Electric Power Research Institute (EPRI) program staff, contributes to the body of scientific knowledge, better enabling objective health risk evaluations and exposure guideline development. The program's commitment to research and public communication on EMF and RF health and safety questions responds to a societal need for information.
Concern, problem or gap to be addressed	Timely implementation of new transmission and distribution (T&D) projects will take on heightened importance as the power grid is expanded, upgraded, and modernized and as it integrates smart grid technology and remotely located renewable energy resources. New T&D construction (including the development of electric vehicle charging infrastructure) and capacity upgrades, and expansion of smart grid technology's reliance on two-way wireless communication, can create public concerns about possible human health risks from electric and magnetic field (EMF) and radio-frequency (RF) exposures. Such concerns can lead to lengthy delays and possibly cause regulatory decisions that affect project schedules and costs, while revisions to guidelines for public and worker EMF and RF exposures could result in altered exposure limits.
Pre-commercial technology or strategy aspect	• Timely, reliable EMF and RF scientific research results, communication materials, relevant background information, and analyses of key external studies; • Publicly accessible, up-to-date information on EMF and RF research, health risk evaluations, and regulatory actions; • Experimental and epidemiologic research investigating high-priority residential and occupational EMF and RF health and safety questions; • EMFWorkstation software for modeling T&D infrastructure EMF in residential and occupational settings; • EMF and RF exposure characterization research and exposure assessment software; • Educational materials, including instructional EMF/RF DVDs, tutorials, and RF safety awareness training; • Comprehensive assessment of the potential effects of EMF on aquatic life from submerged cables; and • Investigation of potential EMF interaction with implanted medical devices
How the project avoids duplication from other initiatives	The Electric Power Research Institute (EPRI) is an independent, nonprofit organization that conducts research, development and demonstration (RD&D) for the electric utility industry. Through EPRI's advisory structure, SCE and other members provide input on proposed EPRI projects within this program, including identifying and preventing duplicative efforts between EPRI and internal utility projects.
Prioritization: High priority project	This is a high priority for SCE. This program investigates potential health impacts from EMF and RF exposures, and thus, though health effects from EMF and from low level RF fields have not been established, the program contributes to our occupational health and safety knowledge. Additionally, this program addresses higher levels of EMF and RF that our employees have the potential to encounter and for which there are safety exposure guidelines.
EPIC primary	This research program supports EPIC principles of increased safety; efficient use of ratepayer

EPIC DESCRIPTION	PROJECT EXPLANATION
or secondary principles met	monies due to leveraged (minimum of 10x) costs/benefits; and other societal benefits.

PROJECT NAME: EPRI RESEARCH PROGRAM 62: OCCUPATIONAL HEALTH AND SAFETY

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	The Electric Power Research Institute's (EPRI) Occupational Health and Safety program provides scientific research needed to make informed decisions about control methods geared toward workplace injury and illness prevention. Products, tools, and design recommendations that emerge from this research help electric power companies maintain safer, healthier work environments and control labor-related costs. The research identifies injury and illness trends, develops cost-effective ergonomic interventions and designs, and addresses critical occupational exposure issues. The program serves as the foundation for occupational health and safety–related work within the electric utility industry.
Concern, problem or gap to be addressed	Workplace injuries affect employee health, quality of life, occupational productivity, and job satisfaction. Efforts to reduce the burden of injuries and illnesses, medical costs, and productivity losses, while helping to improve worker morale and workforce retention, are a critical part of electric power company operations. Within the electric power industry, typical risks may result from poor ergonomic design in equipment, misguided procedures, and long-term or repetitive exposure to various physical and chemical agents. Companies must develop strategies capable of protecting workers while meeting compliance with worker health and safety requirements for reliable, uninterrupted delivery of electricity to customers. Regulatory standard setting and rulemaking by the Occupational Health and Safety Administration (OSHA), as well as sister agencies in Canada and the European Union (EU), influence the amount of exposure monitoring, injury prevention and training programs, and engineering controls or best practice guidelines required within the electric sector.
Pre-commercial technology or strategy aspect	• Easy-to-read handbooks describing ergonomic interventions, best practices, and design guidelines; • Presentations to industry, the scientific community, and regulatory agencies; • Monthly webinar forums for discussions on recent safety research topics of interest to the sector; and • Reports and peer-reviewed literature on toxic and potentially toxic workplace exposures that provide data for guideline setting by OSHA and for compliance with federal and state regulations.
How the project avoids duplication from other initiatives	The Electric Power Research Institute (EPRI) is an independent, nonprofit organization that conducts research, development and demonstration (RD&D) for the electric utility industry. Through EPRI's advisory structure, SCE and other members provide input on proposed EPRI projects within this program, including identifying and preventing duplicative efforts between EPRI and internal utility projects.
Prioritization: High priority project	This project is considered a high priority for SCE. EPRI Program 62 supports SCE's focus on health and safety of its workers and, therefore, is consistent with PU Code 740.1 requirements. EPRI Program 62 has a proven track record of providing quality research that provides benefits to not only utilities but to the public. The benefits of this research will be achieved by pooling research contributions from many utilities. EPRI's Program 62 provides value to SCE by conducting quality research that would not be economically feasible for SCE to conduct alone.
EPIC primary or secondary principles met	This research program supports EPIC principles of increased safety; efficient use of ratepayer monies due to leveraged (minimum of 10x) costs/benefits; and other societal benefits.

PROJECT NAME: EPRI RESEARCH PROGRAM 94: ENERGY STORAGE

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	Electric Power Research Institute (EPRI) research focuses on facilitating the availability of grid-ready energy storage options for utility applications, as well as informing utilities, regulators, government agencies, and the general public on technical and economic issues, opportunities, and challenges related to the use of utility-scale energy storage and distributed generation. The EPRI collaborative research environment enables engagement with utilities, technology developers, and other stakeholders to test and evaluate new technologies and products, define functional requirements for energy storage systems, develop tools and methodologies to analyze the effects of storage on the power delivery network and optimize their use, and create approaches that assess the business cases for storage in various applications and regions.
Concern, problem or gap to be addressed	Advances in storage technology, as well as investment in production capacity, have begun to reduce the price of energy storage technologies, bringing them to the verge of cost-effectiveness in some applications. Nevertheless, the cost-benefit relationship for storage is still marginal in most instances, and cost-effective use of storage requires the user to take full advantage of potential benefit streams. The various applications that contribute to the value of storage have different requirements, however, and the ways in which these requirements are coincident or competitive are yet to be understood.
Pre-commercial technology or strategy aspect	• Understanding the performance characteristics, cost, and expected service lifetime, as well as the relative maturity, of various storage and distributed generation technologies in grid applications; • Identifying the additional hardware, software, and user interfaces required to implement storage on the grid; • Defining the technical requirements for various applications of energy storage; • Understanding the possible impact on transmission and distribution system planning, as well as construction and operations; • Assessing the various uses of storage, including the performance requirements, cost break-even points, and valuation; • Understanding the effects of policy and regulation on the adoption and cost-effectiveness of storage applications; and • Understanding the environmental impact of storage application.
How the project avoids duplication from other initiatives	The Electric Power Research Institute (EPRI) is an independent, nonprofit organization that conducts research, development and demonstration (RD&D) for the electric utility industry. Through EPRI's advisory structure, SCE and other members provide input on proposed EPRI projects within this program, including identifying and preventing duplicative efforts between EPRI and internal utility projects.
Prioritization: High priority project	This is a high priority for SCE. This program provides key information related to all pertinent energy storage policies and initiatives, leveraging EPRI and 34 utility program members. This program also provides feedback on equipment and test standards, through EPRI leadership and credibility. The data and information gathered through this EPRI Energy Storage program support SCE grid peak reduction/shifting, asset optimization, outage prevention and power quality capabilities. The use of energy storage technologies connected to the grid is a recognized path to provide Peak Reduction, through the shift of energy from on-peak to off-peak, or to better integrate renewable resources by mitigating the intermittency and variability of these resources (SBX1-2, 33% Renewable Energy by 2020). Energy Storage Systems allow for a better utilization of asset; for example, energy storage

EPIC DESCRIPTION	PROJECT EXPLANATION
	systems can level the demand on a distribution circuit. Energy Storage Systems can provide backup power and enhance the resiliency of the grid by injecting or absorbing power to minimize disturbances, improve power quality and avoid outages. This program also contributes to our Grid Modernization activities by providing real data to support the Energy Storage OIR.
EPIC primary or secondary principles met	This research program supports EPIC principles of GHG emissions reduction and other societal benefits; economic development; and efficient use of ratepayer monies due to leveraged (minimum of 10x) costs/benefits.

PROJECT NAME: EPRI RESEARCH PROGRAM 180: DISTRIBUTION SYSTEMS

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	EPRI's Distribution Systems program has been structured to provide members with research and application knowledge to support both management of the grid today and the transition to a modern grid. The program includes research that will support smart grid implementation and provide tools for planning, design, maintenance, operation, and analysis of the distribution system. Members of the program have access to a portfolio of projects that cover the range of distribution issues, as well as the opportunity to collaborate with other members and EPRI technical experts to share ideas and solutions, improve knowledge transfer, and ultimately improve operational performance.
Concern, problem or gap to be addressed	The traditional distribution system philosophy has been to maintain acceptable electrical conditions at the lowest possible cost for all customers. Today, system operators also need to improve the efficiency and reliability of the distribution system, accommodate a high penetration of distributed energy resources (DER), and maximize utilization of existing distribution assets without compromising safety and established operating constraints. Significant changes to distribution design and operating practices—often referred to as “grid modernization”—are needed to accommodate these new requirements. At the same time, utilities will continue to grapple with the ongoing challenges of an aging infrastructure, increasing customer expectations, increased competition for resources, and an aging workforce. In addition, recent experience with major storm events has revealed a need to re-examine practices for designing, maintaining, and operating the distribution system to improve the overall resiliency of the distribution system.
Pre-commercial technology or strategy aspect	• Perform component and accelerated aging analysis on key industry assets such as poles, attachment devices, and electronic recloser control systems; • Develop a reference guideline for grounding of underground distribution systems; • Conduct workshops on distribution systems' leading industry practices and key reliability drivers; • Conduct technology assessments and evaluations for distribution system applications such as voltage optimization and automatic circuit reconfiguration; and • Update guidelines to help utilities integrate distributed resources and apply Distribution Management Systems (DMS).
How the project avoids duplication from other initiatives	The Electric Power Research Institute (EPRI) is an independent, nonprofit organization that conducts research, development and demonstration (RD&D) for the electric utility industry. Through EPRI’s advisory structure, SCE and other members provide input on proposed EPRI projects within this program, including identifying and preventing duplicative efforts between EPRI and internal utility projects.
Prioritization: High priority project	This is a high priority for SCE. Direct and sustained improvements to electric system reliability are clearly key benefits of this research. Taking advantage of the collaborative experiences of participating members, coupled with information about the state-of-the-art in technology, programs and practices will provide member utilities with the information necessary to structure and prioritize a reliability improvement program. This project set is focused on managing distribution reliability and will develop and evaluate approaches for designing distribution systems for reliability and selecting the optimum methods for improving reliability as a function of distribution system characteristics. Managing fault performance is a key aspect of managing reliability and the project set includes continued advancement of fault location approaches, fault analytics, and methods to reduce the number of faults.

EPIC DESCRIPTION	PROJECT EXPLANATION
EPIC primary or secondary principles met	This research program supports EPIC principles of increased reliability; improved system performance; increased safety; and efficient use of ratepayer monies due to leveraged (minimum of 10x) costs/benefits.

PROJECT NAME: FAST DYNAMIC VOLTAGE AND FREQUENCY RESPONSE

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	Increased Solar PV resource penetrations as well as potentially other intermittent resources are resulting in intermittency that can cause voltage fluctuations and possible frequency changes on the electric grid. Demand Response has been considered as a mitigation strategy, but it is uncertain if centrally managed demand response control mechanisms can respond quickly enough to stabilize the system. Distributed synchronized control mechanisms across a variety of behind-the-meter devices may provide quick response required to mitigate intermittency while improving reliability on the distribution system.
Concern, problem or gap to be addressed	With the expected increase in Distributed Energy Resources (DER) penetration levels, events like cloud cover over a large enough region could destabilize both voltage and frequency on the electrical system. This proposed project aims to demonstrate and evaluate the effectiveness of multiple behind-the-meter devices in mitigating the effects of voltage and frequency excursions on the distribution system.
Pre-commercial technology or strategy aspect	This project proposes to demonstrate distributed algorithms that use frequency as the primary control input to synchronize, thereby allowing multiple small DER devices to support system voltage and frequency stability. No commercial version of the distributed algorithms proposed in this project is available in the market today.
How the project avoids duplication from other initiatives	Within SCE, there are no other groups that are working on a similar project. SCE is unaware of any other external initiatives that have successfully demonstrated wide scale implementation of small distributed energy resources reacting synchronously through frequency input driving control actions.
Prioritization: High priority project	SCE considers this project to be a high priority. With the anticipated proliferation of renewables and DER integration on the distribution system, this project has the potential to increase system stability and reliability as well as be a component of voltage control on the distribution grid.
EPIC primary or secondary principles met	This project provides clear electricity ratepayer benefits and supports EPIC's guiding principle to provide greater reliability by demonstrating the value of fast acting control signals synchronized through response to frequency deviations at the customer level to improve power quality while mitigating the effects of increasing penetrations of DER on the distribution grid.

PROJECT NAME: INTEGRATION OF BIG DATA FOR ADVANCED AUTOMATED CUSTOMER LOAD MANAGEMENT

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This proposed project builds upon the "Beyond the Meter Advanced Device Communications" project from the first EPIC triennial investment plan, and purposes to demonstrate how the concept of "big data" can be leveraged for automated load management. More specifically, this potential project would demonstrate the use of big data acquired from utility systems such as SCE's advanced metering infrastructure (AMI), distribution management system (DMS), and Advanced Load Control System (ALCS) to determine the optimal load management scheme and execute by communicating to centralized energy hubs at the customer level. Furthermore, the energy hubs would support a closed loop automation function by providing feedback information to SCE for evaluating the impacts of load management decisions.
Concern, problem or gap to be addressed	SCE has made significant investments in developing back-office systems such as AMI and ALCS to leverage customer owned technologies. However, none of these systems are fully integrated to create a harmonized load management approach. Today, SCE's independent systems must be manually coordinated to perform important system functions, such as demand response. SCE's proposed big data integration demonstration for advanced automated customer load management, will investigate how to integrate existing back-office systems with emerging technologies in the home to create an advanced "closed loop" automated control system to better manage customer loads and improve grid reliability.
Pre-commercial technology or strategy aspect	There are various technologies available today to support this project. However, the main objective is to leverage existing technology to integrate existing systems to create one harmonized load management approach.
How the project avoids duplication from other initiatives	California IOUs currently do not have the capability to integrate back office data to actively make informed decisions at the individual customer level. This project purposes to address this capability gap. This project avoids duplication with other entities as it is specific to SCE's own AMI, DMS, and ALCS back-office systems. SCE will share its experiences and lessons learned with other IOUs to help promote best practices in this area.
Prioritization: High priority project	As regulators mandate greater adoption of renewable energy resources, SCE faces increased operating challenges related to intermittency. As a result, SCE must find more effective ways of managing its load and other resources with available supply. This project explores methods of integrating back office data to quickly gauge load availability and better manage large customer devices. More specifically, the project will develop an "energy hub" that receives utility commands and effectively manages local customer load to meet both utility and user demands.
EPIC primary or secondary principles met	This project supports EPIC's primary areas, including : Greater Reliability: This project assists SCE in better managing customer loads when system conditions are critical. Lower Costs: This project allows SCE to leverage customer owned equipment and reduces the need for increased capital investments. Enhanced Environmental Sustainability: Many of the targeted customer devices that this project plans to leverage are key environmental components including Electric Vehicles, Solar Inverters and Energy Storage Units.

PROJECT NAME: LEVEL 1 MAKE READIES

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	The goal of this demonstration project is to deploy low cost Level 1 Make-Readies (i.e., all electrical components required to supply power to an Electric Vehicle Supply Equipment cord set at 120 volts, including panel, stubbing, wiring, etc.) at selected business customers to optimize electric vehicle miles traveled (eVMT) by plug-in electric vehicles (PEVs) while minimizing grid impact. Only business customers with long dwell time opportunities for PEVs (e.g., workplace, destination centers) will qualify. The Transportation Electrification (TE) Organization is actively pursuing several strategic objectives, including optimizing TE fueling from the grid to improve asset utilization. Deploying low cost Level 1 make-readies will support this objective by increasing the eVMT of PEV drivers who face an electric range shorter than their daily vehicle miles traveled (VMT). The project will demonstrate to business customers how to deploy low-cost charging infrastructure that meets their workforce or customer needs while potentially avoiding demand charges.
Concern, problem or gap to be addressed	Two of the most successful PEVs on the market today offer an electric range shorter than the average daily vehicle miles traveled (VMTs). As a result, drivers of these vehicles have to use their combustion engine on most days. If given the opportunity to recharge, these drivers would be connecting more to the grid and use less gas to commute. Many business customers face a complex and expensive task when attempting to deploy charging infrastructure. SCE will demonstrate various simple and low cost solutions to encourage business customers to deploy more PEV charging infrastructure.
Pre-commercial technology or strategy aspect	This project is strategic in nature and leverages existing low cost, low complexity technology to optimize PEV load by expanding eVMT. This, in turn, may result in more electric miles driven by PEV drivers with positive implication on the utility.
How the project avoids duplication from other initiatives	To our knowledge, no other California IOU is planning a similar effort. Most industry players appear focused on adoption of Level 2 charging technology. The proposed project may actually show a simple and low cost pathway for business customers to deploy PEV charging infrastructure.
Prioritization: High priority project	This project is considered a high priority. Transportation electrification has significant potential for load growth, storage, system efficiency improvement, and carbon emission reduction. SCE is focused on developing solutions to optimize PEV load by maximizing the use of electric fuel and minimizing grid impact.
EPIC primary or secondary principles met	This project meets the following primary principles: Reliability: This project will demonstrate how low cost, low complexity charge points may expand eVMT without generation, transmission or distribution system impact on utility customers Costs: PEV load, at scale, may provide increased asset utilization which may result in a downward pressure on costs. This project also meets secondary principles (including societal benefits, GHG emission mitigation, low-emission vehicles/transportation); it is directly aligned with the objectives of SB 626, AB 32, and the 2013 ZEV Action Plan issued by California Governor Brown.

PROJECT NAME: MICROGRID FOR ENHANCED GRID RELIABILITY & SECURITY

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This project will demonstrate advanced commercial-grade microgrid controllers capable of managing/controlling microgrid systems consisting of between 1 and 10 megawatts (MW) of aggregated generation capacity. The microgrid will include a group of interconnected loads and distributed energy resources (DER). The project will evaluate microgrid's effectiveness for energy resilience (including protection of critical infrastructure and public resources). The focus will be on strengthening the resilience of electrical infrastructure against adverse effects of natural disaster and other unforeseen occurrences such as earthquake, windstorm and hurricane. Prior to installation, the project will also construct a micro-grid test bed on the SCE Real-Time Digital Simulator. The structure of the model will be developed in accordance with the microgrid/resiliency plan for the target community. This project will also evaluate an advanced control system, potentially consisting of multiple components and subsystems, capable of sensing grid conditions, and monitoring and controlling the operation of a microgrid during all microgrid operating modes (grid-connected, islanded, and transition between the two). It will demonstrate microgrids with various load-block sizes (community microgrid vs. mini-microgrid) to determine the most desirable configurations. It will leverage other sources of funding such as Department of Energy (DOE).
Concern, problem or gap to be addressed	Adverse effects of natural disaster and unforeseen occurrences such as earthquakes, windstorms, fires, vandalism, and intentional sabotage pose a threat to grid resiliency and security. The new microgrid system will allow SCE to protect the T&D electrical system against these threats by implementing optimal control actions to adjust the system's configuration for maximum security and reliability.
Pre-commercial technology or strategy aspect	There are no industry accepted system standards to implement microgrids. Some microgrid technologies have been piloted, but are still considered early stage in terms of their maturity. Moreover, there are few to none commercial implementations in existence today.
How the project avoids duplication from other initiatives	Within SCE, there are no other groups that are working on a similar project. SCE is not aware of any similar projects in North America underway or planned that overlap with the proposed scope of this project. This project is unique because it is the first to demonstrate comprehensive microgrid architectures and control schemes aimed at enhancing the resilience and reliability of the electric system during natural disasters.
Prioritization: High priority project	This project is considered high priority as microgids can play a critical role in maintaining public safety and protecting the electrical system during natural disasters and other unforeseen occurrences such as earthquakes, windstorms, hurricanes, etc. This project proposes to leverage funding from other sources such as the Department of Energy.
EPIC primary or secondary principles met	This project provides clear electricity ratepayer benefits and supports EPIC's guiding principles to provide greater reliability and lower costs by improving electric system resiliency during natural disasters and informing industry standards groups on optimal microgrid architectures and best practices.

PROJECT NAME: NEXT GENERATION DISTRIBUTION AUTOMATION AND DISTRIBUTION EQUIPMENT – PHASE 2

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This project will leverage lessons learned from the Next Generation Distribution Automation – Phase 1 project performed in the first EPIC triennial investment plan period. This project will focus on integrating advanced control systems, modern wireless communication systems, and the latest breakthroughs in distribution equipment and sensing technology to develop a complete system design that would be a standard for distribution automation and advanced distribution equipment. This project will focus on technologies that are applicable for both overhead and underground circuits. This project will provide solutions that aim to: 1) Improve system reliability by reducing CMI, SAIDI, and SAIFI; 2) Improve safety with high impedance fault detection and protection; and 3) Improve asset utilization by using better distribution equipment material and designs.
Concern, problem or gap to be addressed	Recent improvements in distribution automation system technologies have occurred at the individual device or component level. A gap currently exists in addressing these individual technologies at the integrated system level that addresses other foundational capabilities such as advanced wireless communications, intelligent controller and protection devices, and state-of-the art sensing devices. The proposed new system will allow SCE to better accommodate the unique operating characteristics inherent to distributed generation with the anticipated addition of new future loads and generation sources such as electric vehicles and energy storage systems.
Pre-commercial technology or strategy aspect	The new sensing, control, protection, and communications technologies proposed in this demonstration project are considered nascent and pre-commercial in nature. As an outcome of this demonstration project, SCE aims to develop new engineering standards that employ these new technologies for future distribution system designs and deployments.
How the project avoids duplication from other initiatives	Within SCE, there are no other groups that are working on a similar project. SCE is not aware of any similar projects in North America underway or planned that overlap with the proposed scope of this project. This project is unique from other initiatives because it will investigate the overall integration and interoperability of multiple pre-commercial distribution automation technologies and appraise the project's performance at the system level.
Prioritization: High priority project	This project is considered high priority. SCE's current distribution automation schemes often rely on human intervention that can take several minutes (or longer during storm conditions) to isolate faults, are only capable of automatically restoring power to half of the customers on affected circuits, and require near term replacement due to assets reaching the end of their lifecycle. By utilizing automated switching devices combined with high-speed wireless protection communications, SCE will be able to rapidly detect and isolate faults with less human intervention, enable restoration of at least two-thirds of circuit load quickly, and allow SCE to benefit from the latest technological advancements instead of replacing aging infrastructure with similar equipment. Next-generation distribution automation is critical for safely and reliably integrating the increasing penetration of distributed energy resources (e.g., solar PV).
EPIC primary or secondary principles met	This project supports EPIC's guiding principle to provide electricity ratepayer benefits as demonstrated by its ability to help improve service reliability and lowering costs by standardizing the next generation of distribution automation and distribution equipment as a system. This includes wireless communication, control algorithms, remote intelligent switches, remote fault indicators, and intelligent fuses all working together on the same circuit and integrated with modern distribution management system (DMS).

PROJECT NAME: OPTIMIZED CONTROL OF MULTIPLE STORAGE SYSTEMS

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This project aims to demonstrate the ability of multiple energy storage controllers to integrate with SCE's Distribution Management System (DMS) and other decision making engines to realize optimum dispatch of real and reactive power based on grid needs. The controllers and their integration with hierarchical systems will result in multiple control strategies including responding to local circuit needs, and responding to volt/VAR optimizations schemes. This demonstration will seek to optimize multiple functional requirements and attempt to execute an optimum control strategy based on grid conditions and external events.
Concern, problem or gap to be addressed	Energy storage device deployment is expected to proliferate in response to the CPUC Storage OIR mandate to procure/deploy 580 MW of storage capacity on SCE's system. There exists no implementation of a multiple vendor communication and controls standard that can be integrated with grid needs and respond to external system needs. Charging/discharging of storage devices can be less than optimal at best if left in autonomous stand-alone modes and can actually be detrimental to the grid conditions at worst if not run and directed optimally as determined by the state estimation of the distribution system.
Pre-commercial technology or strategy aspect	Energy storage projects pursued in the first EPIC triennial investment plan cycle were focused on controlling a few energy storage devices with a dedicated centralized controller. The control was strictly focused on just one distribution feeder where the energy storage devices reside, and the control scheme was optimized around real and reactive power dispatch based on the need of the feeder in question. This project greatly expands the scope of the centralized controller to include optimum control strategies based on external triggers and integration with hierarchical systems that look to determine the state of the distribution system. Thus, this project is an integration of multiple control strategies to optimize around various operational scenarios under which all the energy storage devices located on various feeders can operate in concert.
How the project avoids duplication from other initiatives	SCE has identified a gap in energy storage manufacturers' product offerings that account for the optimal configuration and control of multiple storage devices operating as a system. To date, there have not been any implementations of a robust centralized controller that can provide optimized dispatch of energy storage assets while integrating with Distribution Management Systems (DMS). DMS vendors continue to work towards implementing advanced functionality into the platforms that run the distribution system; however, due to DMS software being a binary platform intended for ON and OFF operation of field devices, these platforms are not suitable for complex logic and processing intensive applications in their current state. This project is the only one of its kind where multiple energy storage devices will be optimized based on advanced decision-making engines.
Prioritization: High priority project	This project is considered high priority due to lack of any integration around the control of multiple energy storage devices behaving for the overall benefit of the distribution system by optimizing around many system parameters and becoming an integral part of hierarchical decision making systems such as the Distribution Management System.
EPIC primary or secondary principles met	This project supports EPIC's guiding principle to provide electricity ratepayer benefits by supporting increased reliability through storage technologies' ability to optimize controls on the distribution system by detecting the system's state through field measurements and making dispatch decisions based on real-time operations. Moreover, this project continues to advance energy storage and intermittent renewable power, helping to mitigate greenhouse gas emissions and supporting economic development of renewable technologies in the electricity sector.

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Technology or strategy to be demonstrated	This project aims to demonstrate the ability of multiple energy storage controllers to integrate with SCE's Distribution Management System (DMS) and other decision making engines to realize optimum dispatch of real and reactive power based on grid needs. The controllers and their integration with hierarchical systems will result in multiple control strategies including responding to local circuit needs, and responding to volt/VAR optimizations schemes. This demonstration will seek to optimize multiple functional requirements and attempt to execute an optimum control strategy based on grid conditions and external events.
Concern, problem or gap to be addressed	Energy storage device deployment is expected to proliferate in response to the CPUC Storage OIR mandate to procure/deploy 580 MW of storage capacity on SCE's system. There exists no implementation of a multiple vendor communication and controls standard that can be integrated with grid needs and respond to external system needs. Charging/discharging of storage devices can be less than optimal at best if left in autonomous stand-alone modes and can actually be detrimental to the grid conditions at worst if not run and directed optimally as determined by the state estimation of the distribution system.
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How the project avoids duplication from other initiatives	SCE has identified a gap in energy storage manufacturers' product offerings that account for the optimal configuration and control of multiple storage devices operating as a system. To date, there have not been any implementations of a robust centralized controller that can provide optimized dispatch of energy storage assets while integrating with Distribution Management Systems (DMS). DMS vendors continue to work towards implementing advanced functionality into the platforms that run the distribution system; however, due to DMS software being a binary platform intended for ON and OFF operation of field devices, these platforms are not suitable for complex logic and processing intensive applications in their current state. This project is the only one of its kind where multiple energy storage devices will be optimized based on advanced decision-making engines.
Prioritization: High priority project	This project is considered high priority due to lack of any integration around the control of multiple energy storage devices behaving for the overall benefit of the distribution system by optimizing around many system parameters and becoming an integral part of hierarchical decision making systems such as the Distribution Management System.
EPIC primary or secondary principles met	This project supports EPIC's guiding principle to provide electricity ratepayer benefits by supporting increased reliability through storage technologies' ability to optimize controls on the distribution system by detecting the system's state through field measurements and making dispatch decisions based on real-time operations. Moreover, this project continues to advance energy storage and intermittent renewable power, helping to mitigate greenhouse gas emissions and supporting economic development of renewable technologies in the electricity sector.

PROJECT NAME: PROACTIVE STORM IMPACT ANALYSIS DEMONSTRATION

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This project will demonstrate proactive storm analysis techniques prior to its arrival and estimate its potential impact on utility operations. In this project, we will investigate some technologies that can model a developing storm and its potential movement through the utility service territory based on weather projections. This information and model will then be integrated with the Geographic Information System (GIS) electrical connectivity model, Distribution Management System (DMS), and Outage Management System (OMS) functionalities, along with historical storm data to predict the potential impact on the service to customers. The damage assessment performed will result in proactive estimation of material and resources needed for handling the storm prior to its arrival. Such modeling will primarily assist in storm preparation and assessment and has the potential to reduce the restoration time for outages incurred during the storm. In addition, this project will demonstrate the integration of near real time meter voltage data with the GIS network to develop a simulated circuit model that can be effectively utilized for storm management and field crew deployment. The resulting model will help to optimize field crew deployments during storm response operations. Meter voltage data from smart meter exceptions and selected bellwether meters will be collected in near real time and models will be developed to assess the condition of field assets (switches, fuses, etc.) from this data. Once the status of these devices can be determined in near real time, the resulting model can be extremely useful in deploying field crew resources to the right locations during the storm. This information will in turn assist in providing timely and accurate notifications to customers and regulators.
Concern, problem or gap to be addressed	SCE has developed initial tools for storm modeling and management. However, this initial tool set does not provide a comprehensive integration of storm path and potential damage based on storm severity. As a result, a proactive assessment of damage and required human/material resources for restoration is hindered. A pre-planning of the storm impact will help utilities in preparation for the storm as the possible damage is better understood and modeled. During a storm, field crews are deployed to the locations for restoration based on the best information that is available. Most field assets do not have any communication devices integrated within them, and hence cannot communicate their health to the back office. The deployment of smart meters and the associated communications network provides a significant opportunity to mine the voltage and outage data to develop the status of the field devices using a simulated smart grid model.
Pre-commercial technology or strategy aspect	The technologies in this space are beginning to be widely introduced in the electric utility market. While significant functionalities are claimed to have been developed, SCE has not yet evaluated the veracity of such claims. SCE believes these technologies are now sufficiently mature enough to warrant a further investigation and demonstration in this space.
How the project avoids duplication from other initiatives	This project is unique in that it is the first to demonstrate a fully integrated effort by leveraging recent market innovations and technologies that have not yet been explored at SCE. SCE has also benchmarked other investor-owned utilities (IOUs) across the state, and there does not appear to be any similar work being performed.
Prioritization: High priority project	This project is considered High priority. Storm analytical models could help SCE in preparing for a storm and can reduce the time for customer service restoration. It will also help SCE mobilize crews and material to affected areas proactively to combat the storm damage effectively.

EPIC DESCRIPTION	PROJECT EXPLANATION
EPIC primary or secondary principles met	This project provides clear electricity ratepayer benefits and supports EPIC's primary principle of promoting greater reliability by examining the possibility of analyzing a storm prior to its arrival and its potential impact on utility operations. Furthermore, this project supports EPIC's primary principles of greater reliability and lower costs by demonstrating the integration of near real time smart meter voltage data with the GIS network to develop a simulated circuit model that can be effectively utilized for storm management and crew deployment resulting in the reduction of restoration times for customers.

PROJECT NAME: REGIONAL GRID OPTIMIZATION DEMONSTRATION – PHASE 2

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This project is a continuation of the work initiated in the Regional Grid Optimization – Phase 1 project funded in the first EPIC triennial investment plan cycle. The primary objective for the Regional Grid Optimization Demonstration project is to create a region of the SCE service area that efficiently enables interconnected devices to optimize their operation across the region. These devices may include solar PV, plug-in electric vehicles, programmable thermostats, and energy storage systems. There are three key areas to this demonstration: 1) Identify the value or cost impact of interconnected devices and align the incentive or charge structure to efficiently accommodate the devices; 2) Demonstrate the communication and control strategies to effectively optimize the total value of the interconnected devices; and 3) Demonstrate the necessary market rules to efficiently incent customer and third party decisions to achieve the optimal value of the interconnected devices.
Concern, problem or gap to be addressed	The expected increase in distributed energy resource deployments and the combined interactions of these devices raises a number of questions regarding grid capabilities and benefits. These questions include determining the value of distributed generation, the cost of intermittent resources, the value of storage, the efficacy of demand response in managing intermittency, the optimization approach for managing DER device interactions, and the infrastructure to enable an optimized solution. This project will demonstrate the rules, communication, and controls necessary to optimize the operations of interconnected devices across the distribution grid.
Pre-commercial technology or strategy aspect	SCE plans to demonstrate and deploy both commercially available and early-stage technologies using a unique system architecture that is focused on achieving new distributed control mechanisms, economic models, communications, customer configurations, and utility reliability management strategies that benefit customers and improve distribution grid reliability in areas with high penetrations of DER.
How the project avoids duplication from other initiatives	The Regional Grid Optimization project is unique with its focus on distribution circuit management and developing a framework for leveraging customer owned DER to support grid reliability. SCE is not aware of any similar projects in North America underway or planned that overlap with the proposed scope of this project. While there are some pilot projects underway that are narrowly focused on acute issues related to DER integration and demand response participation, none have demonstrated the unification of customer devices on such a magnitude as proposed in this project.
Prioritization: High priority project	This project is considered a high priority, and has the potential to transform the distribution grid from individual actors attempting to optimize discrete investments in advanced technologies to a more holistic mechanism used to interconnect distribution devices and control characteristics aimed at optimizing their operations and increasing the overall value of these technologies working together as a system.
EPIC primary or secondary principles met	The project will provide clear electricity ratepayer and societal benefits and supports EPIC's guiding principles to provide greater reliability and lower costs by demonstrating a framework to optimize interconnected DER devices while increasing the resiliency and flexibility of the distribution grid.

PROJECT NAME: REGULATORY MANADATES: SUBMETERING ENABLEMENT DEMONSTRATION – PHASE 2

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This project expands on the submetering project from the first EPIC triennial investment plan cycle to demonstrate plug-in electric vehicle (PEV) submetering at multi-dwelling and commercial facilities. Specifically, the project will leverage 3rd party metering to conduct subtractive billing for various sites including those with multiple customers of record. In order to accommodate multiple 3rd parties in an open market and insure accuracy of the billing system certain aspects will need to be standardized. Specifically the components that will require standardization include: meter accuracy and frame; data files; data delivery method (communications); and delivery intervals.
Concern, problem or gap to be addressed	Historically, SCE has traditionally offered PEV drivers / owners the TOU-PEV-1 rate for residential charging. This rate incentivizes customers to charge "off-peak" by offering a discounted rate after 9pm. However, in order to enroll in the TOU-EV-1 rate, the customer is required to have a separate independent meter to measure the energy consumed by the vehicle. This presents an adoption barrier, as installing a separate service can be cost prohibitive and hence is not popular among PEV adopters. The previous submetering project pursued in the first EPIC Triennial Investment Plan is in the process of demonstrating the use of a submeter to collect PEV consumption, which is later subtracted from other home loads on the customer's bill. For the potential Phase 2 portion of this project, the use of this same technology in multi-family and commercial applications will be demonstrated.
Pre-commercial technology or strategy aspect	Various Electric Vehicle Service Providers (EVSPs) offer submetering in existing products. However many of them do not have the back-office functionality to properly gather and deliver large amounts of data to the utility. The issue becomes even more complex when multi-family and commercial facilities are introduced. The concept of using 3rd party data for billing is not new, but applying it to individual customer devices presents a unique challenge.
How the project avoids duplication from other initiatives	Enabling submetering requires active participation between utilities and third party service providers. This demonstration will require close collaboration with all interested stakeholders at every phase. In addition, progress reports, findings, lessons learned, and recommendations will be shared with the industry to promote proper development of submetering and help avoid duplicative efforts.
Prioritization: High priority project	This project is considered a high priority. The risk of not doing this project could result in the ratification of an untested and technically flawed submetering protocol. In addition, without utility leadership we run the risk of inoperable, complex, and non-standardized processes. The ramifications of subtractive billing can lead to very costly back-office upgrades and hence utilities must ensure the protocol is feasible and interoperable among all third party service providers. Submetering has ramifications on other technologies, including inverters and energy storage devices, and the results of this project can apply to these technologies proving a broader value to SCE.
EPIC primary or secondary principles met	This project supports EPIC's guiding principle to provide electricity ratepayer benefits by improving reliability as demonstrated by its ability to shift EV charging off peak. Furthermore, this project supports low-emission vehicles/transportation by helping to break down the cost barriers associated with EV adoption. This increased adoption complements policies to reduce GHG emissions.

PROJECT NAME: SERIES COMPENSATION FOR LOAD FLOW CONTROL

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	The intent of this project is to demonstrate and deploy the use of Thyristor Controlled Series Capacitors (TCSC) for load flow control on series compensated transmission lines. On SCE's 500 kV system in particular, several long transmission lines are series compensated using fixed capacitor segments that do not support active control of power flow. The existing fixed series capacitors use solid state devices as a protection method and are called Thyristor Protected Series Capacitors (TPSC). SCE proposes to demonstrate the implementation of TCSC in order to enable power flow control on series compensated transmission lines as a means to ease renewable resource integration. The demonstration project will be divided into two different phases. Phase I of the project will evaluate the feasibility of converting existing Thyristor Protected Series Capacitors and determine the optimal system configuration. It will also identify the ideal transmission line for the subsequent hardware demonstration. Phase II of the project will focus on the hardware-in-the-loop demonstration using real time simulation. After the controls are tested and optimized in the lab environment, a field demonstration will directly follow.
Concern, problem or gap to be addressed	The increase in variable renewable resources connected to the grid requires better controls to manage power flows on the transmission grid. In today's system environment, power flows according to the path of least resistance and is not actively controlled. The use of Flexible AC Transmission Systems (FACTS) such as TCSC provides the system operator with more flexibility in managing the flow of power in the system. This flexibility translates into improved reliability and increased cost effectiveness of the existing transmission assets.
Pre-commercial technology or strategy aspect	System operators today rely on the system configuration and path diversity (path of least resistance) for managing the flow of power. There are currently no active controls to optimize the flow of power. The intent of this demonstration is to provide system operators with the ability to precisely control power flows on key transmission paths in the SCE bulk electric system.
How the project avoids duplication from other initiatives	Within SCE, there are no other groups that are working on a similar project. Other outside entities such as BPA are beginning to explore active power flow control technologies on their system. SCE's proposed project is unique in that the TCSC system will be specifically configured to operate on SCE's unique system topology and operating characteristics.
Prioritization: High priority project	This demonstration is considered a high priority as SCE will need improved operational tools and strategies to manage the expected increase in renewable energy resource (e.g., large wind farms and solar generation) penetrations on the bulk electric system. This proposed demonstration project will give the operator the ability to better manage the intermittency and fast changes associated with VER generation outputs.
EPIC primary or secondary principles met	This project provides clear electricity ratepayer benefits and supports the EPIC guiding principles of greater reliability and enhanced environmental sustainability by providing system operators with active power flow control mechanisms needed to support the integration of increasing levels of variable energy resources to meet California's policy objectives while minimizing disruptions on the bulk electric system.

PROJECT NAME: SPECIAL PROTECTION SCHEMES PLATFORM

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	In order to keep the system reliable, safe, and cost effective while accommodating new generation resources, electric utilities often rely on special protection schemes. Special protection schemes are put in place in many cases to assure transmission lines are kept under safe loading margins during stress conditions. Some of the special protection schemes include: Remedial Action Schemes (RAS) mainly for load flow control, and separation schemes to maintain system stability. Special protection schemes vary in complexity, from RAS that involve a few lines and protection relays, to high complexity RAS where multiple lines and relays must be coordinated. The design, testing and training of these special protection schemes will require new tools to ensure proper functionality once installed. This demonstration proposes the use of the Real Time Digital Simulator (RTDS), software models, and hardware (relays) where these special protection schemes can be designed, tested and also providing training on the operations to field personnel.
Concern, problem or gap to be addressed	The increase in renewable resources integrated to the grid requires the need for more special protection schemes. The increase in complexity calls for better tools to ensure its proper functionality. It is also important to ensure that these special protection schemes are fully tested before deployment. With current practices, this may take long hours and several field test technicians. The tool proposed in this demonstration project can substantially reduce test hours and personnel involved. The tool will also provide with a larger range of test conditions by taking advantage of the RTDS computational speed and details of the power system model.
Pre-commercial technology or strategy aspect	Currently engineers and test personnel rely on tools that were designed to test systems with a lesser degree of complexity. The new and future special protection schemes require tools that can address the complexity in design, testing and training.
How the project avoids duplication from other initiatives	The proposed demonstration utilizes the RTDS and computational models developed for the testing of new RAS. These models are unique to customize for the SCE system. SCE is the only utility in the state using RTDS for special protections schemes testing.
Prioritization: High priority project	This project has a high priority given the fact that special protection scheme complexity is expected to increase significantly. Therefore there is an imminent need for proper development, testing and training for utility personnel to ensure safe and reliable implementation.
EPIC primary or secondary principles met	This project supports EPIC's guiding principle to provide electricity ratepayer benefits, defined as promoting greater reliability, lower costs, and increased safety. Moreover, this project helps in reducing uncertainty when deploying complex protection systems and therefore increasing system reliability. The project also assists in the integration renewable resources, helping to mitigate greenhouse gas emissions and supporting economic development of renewable technologies in the electricity sector.

PROJECT NAME: ADVANCED STREET LIGHTING TECHNOLOGY CAPABILITIES DEMONSTRATION

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This project will examine the possibility of establishing an advanced street lighting network that can be integrated with SCE's existing smart meter network. Through this initiative, we will evaluate technologies and/or devices capable of tracking and transmitting street light power outage and restoration notifications to help optimize crew deployments. The resulting model will also help dispatchers obtain the most up to date status of the street lighting infrastructure resulting in a reduction of customer calls and street light outage durations. Conceptually, we would like to explore technologies and/or devices that are capable of transmitting outage notifications over the air. Such devices exist today which can track the status of a street lamp by sending a notification through radio communications. The approach would be to enable these devices to communicate through the smart meter network by sending a power outage and restoration notification in near real time. The notifications would function similarly to notifications from the smart meter and would communicate to existing operational systems such as the Outage Management System (OMS). We would be demonstrating the end-to-end capability of the system from the end-point device through a communications network into SCE's back office systems all the way to end-user presentation.
Concern, problem or gap to be addressed	Currently, no smart devices exist on SCE's street lights today, resulting in unnecessary truck rolls for inspections and excess customer calls to the call center during outage events. Through this technology we will examine the possibility of establishing a street lighting network capable of communication through the existing smart meter network.
Pre-commercial technology or strategy aspect	While significant improvements with similar technologies are claimed to have been made, SCE has not yet come across a technology solution or device that is deemed completely proven or can integrate with our existing smart meter network. However, the advances are adequate enough to warrant further investigation and demonstration, given the benefits of the results of such a technology.
How the project avoids duplication from other initiatives	To SCE's knowledge, no similar effort is underway in the company at this time. The solution proposed in this EPIC project is a novel approach and could prove to be cost effective.
Prioritization: High priority project	SCE considers this project a high priority. Outage notifications in near real time will allow SCE to effectively evaluate the status of the street lighting infrastructure which can potential reduce unnecessary maintenance truck rolls and respond to street lamp outages more efficiently.
EPIC primary or secondary principles met	This project supports EPIC's primary principles of promoting greater reliability and lower costs by examining the possibility of establishing a street lighting network capable of tracking the status of street lamps. This technology can result in effective crew deployment in response to outages as well as reduce volume of customer calls during outages.

PROJECT NAME: SYSTEM INTELLIGENCE AND SITUATION AWARENESS CAPABILITIES

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This project will demonstrate system intelligence and situation awareness capabilities such as high impedance fault detection, intelligent alarming, predictive maintenance, and automated testing. This will be accomplished by integrating intelligent algorithms and advanced applications with the latest substation automation technologies, next generation control systems, latest breakthrough in substation equipment, sensing technology, and communications assisted protection schemes, This system will leverage the IEC 61850 Automation Standard and will include cost saving technology such as process bus, peer to peer communications, and automated engineering and testing technology. This project will also inform complementary efforts at SCE aimed at meeting security and NERC CIP compliance requirements.
Concern, problem or gap to be addressed	While distribution automation, sensing, and control technologies have witnessed advancements in recent years, a gap currently exists in the situational awareness and decision support tools that leverage these underlying foundational technologies. This project aims to incorporate advanced applications and new situational awareness capabilities into SCE's substation automation systems. The proposed new system will allow SCE to better accommodate the unique operating characteristics inherent to distributed generation with the anticipated addition of new future loads and generation sources such as electric vehicles and energy storage systems while improving safety and reliability.
Pre-commercial technology or strategy aspect	The advanced substation automation technologies proposed in this project, including advanced applications, intelligent algorithms, and situational awareness capabilities are considered nascent and pre-commercial in nature. Newer technologies such as process bus have been piloted in the industry, but are still considered experimental with few to none commercial implementations in existence today.
How the project avoids duplication from other initiatives	Within SCE, there are no other groups that are working on a similar project. SCE is not aware of any similar projects in North America underway or planned that overlap with the proposed scope of this project. This project is unique from other initiatives because it will investigate the overall integration and interoperability of multiple pre-commercial distribution automation technologies and appraise the project's performance at the system level.
Prioritization: High priority project	This project is considered high priority. System intelligence and situation awareness combined with smarter systems and applications is critical for safely and reliably integrating the increasing penetration of distributed energy resources (e.g., solar PV). This project will also play an important role in developing new substation automation and situational awareness capabilities that meet NERC CIP requirements.
EPIC primary or secondary principles met	This project supports EPIC's guiding principle to provide electricity ratepayer benefits as demonstrated by its ability to help improve service reliability and lower costs by improving SCE's system intelligence and situational awareness capabilities to better manage and accommodate the unique operating characteristics inherent to distributed energy resources on the distribution system.

PROJECT NAME: VERSATILE PLUG-IN AUXILIARY POWER SYSTEM (VAPS)

EPIC DESCRIPTION	PROJECT EXPLANATION
Technology or strategy to be demonstrated	This project demonstrates the electrification of transportation and vocational loads that previously used internal combustion engines powered by petroleum fuels in the SCE fleet. The VAPS system uses automotive grade lithium ion battery technology (Chevrolet Volt and Ford Focus EV) which is also used in notable stationary energy storage projects (Tehachapi 32 MWh Storage). The power from the battery goes into an inverter and a DC-DC converter to provide both AC and DC power needs. Intelligent system controls manage the battery under all operating conditions of charge, discharge and system diagnostics. In addition, this project will investigate the applicability of secondary usage of previously used cells, as this application is conducive to that usage; this may increase the life cycle value of li-ion cells, prior to their disposal. Finally, this technology will demonstrate other uses of this power system as a stand-alone energy resource, where fossil fuel powered generators are typically used.
Concern, problem or gap to be addressed	The way fleets typically operate today on each job is to drive one or more truck a relatively short distance to a job site and then work on that site several hours. There may be two or more different jobs per day. At each job, vehicles are typically parked and left idling while small generators are used to support the essential safety gear, radios, tools and equipment of the work site. The result is excess fuel consumption, emissions, noise, and wear and tear on engines. With the VAPS system, all those engines are turned off, and the built in battery runs the loads all day. In addition, outage duration and customer satisfaction can be improved.
Pre-commercial technology or strategy aspect	All auxiliary power currently is generated by gasoline and diesel engines in the fleet. VAPS eliminates the need to operate those engines at the work site, thus reducing fuel consumption, emissions and noise. This provides crew members and customers with a quiet, clean and efficient work site. A commercial unit could pay for itself in five years, which could be half the life of a new truck. With these units we could quickly make a large impact on our fleet fuel expenditures by retrofitting existing trucks. At this point, the technology is pre-commercial and is more than twice the cost expected.
How the project avoids duplication from other initiatives	Other initiatives have focused on technology that is outdated (storage), has proven unreliable, is not optimally effective (replacement of vehicles), or too expensive. This project focuses on a solution which can be applied to existing vehicles and thus can provide potentially much wider reach and can realize benefits much faster.
Prioritization: High priority project	This project is considered high priority. SCE benefits from the fuel, emissions and noise reductions that result from implementation of this technology in our own fleet. The main benefit of this new product is to reduce our fleet operational costs. We think other utilities will derive similar benefits. The resulting large market will make the technology more affordable to all through the scale of production. This fits perfectly with the SCE goals of operational excellence and the electrification of transportation. It is just that in this case, part of the transportation that is being electrified is the stationary work site part.
EPIC primary or secondary principles met	This project provides clear electricity ratepayer benefits and supports EPIC's guiding principles of lowering costs by making operations more efficient and enhancing environmental sustainability by reducing emissions. Furthermore, this project supports the increased adoption of low-emission vehicles/transportation and corresponding greenhouse gas mitigation by serving as an example which can be studied and emulated by other fleets.