Southern California Edison
EPIC Update

November 8, 2019

Highlights from EPIC 1 & 2

EPIC 1 & 2 have helped with our analytics and transportation electrification efforts

Analytics

1. **Storm Impact Prediction Demonstration** to predict estimated asset damage by district to pre-stage resources.
   - Technology has been operationalized by Grid Ops & Business Resiliency for use in assessing prospective storms and associated damage.

2. **Advanced Grid Capabilities Using Smart Meter Data** analyzes customer outage information to perform transformer-to-meter and meter-to-phase correlations, helping to identify errors in system topology data.
   - Technology implemented by Grid Operations, improving data accuracy by ~10% to-date.

3. **Next Generation Distribution Automation** provides telemetry information for distribution circuit sub-segments that increases situational awareness and improves reliability.
   - Intelligent automated switches and remote fault indicators are key elements of Grid Modernization's distribution automation strategy.

Transportation Electrification

1. **DC Fast Charger Impact Demonstration** assessed the grid impacts of 13 DC fast charger sites to validate compliance with standards, determined SCE infrastructure supports current demand, and informed development of future demand management.

EPIC 1 & 2 have advanced our Grid Modernization efforts

Technical Findings

1. Informed **Advanced Distribution Management System** (ADMS) and **DER Management System** (DERMS) technical requirements.
2. Informed **grid controls** and **communications** approaches.
3. Developed SCE standards for **substation IT network design.**
   - Informing substation automation capital deployment decisions
4. Advanced development of **Distribution Automation** devices and **High Impedance Fault Detection.**

Process Findings

1. Determined that **DER contracts** need to allow resource dispatch both at the individual and aggregate level.
   - Engagement with DER acquisition organizations to ensure feasibility and viability of DER services.
2. Moving from manual to automated processes, including distribution automation, requires extensive **cybersecurity** assessments and controls.
   - Early engagement with IT needed to ensure cyber and IT/OT integration challenges can be mitigated.

EPIC 3

EPIC 3 Overview

Portfolio Highlights

1. EPIC 3 application included 24 projects
2. Proposed 2 replacement projects in the RAP filing (*May 1, 2019*)

Cancelled Projects	Replacement Projects
1. Reliability Dashboard Tools 2. Beyond the Meter Phase 2	1. Wildfire Prevention & Resiliency Technology Demonstration 2. Beyond Lithium-Ion Energy Storage Demonstration

3. Portfolio is balanced across project types[1] and electric utility value chain

	Renewables & DER Integration	Grid Modernization & Optimization	Customer-focused Products & Services	Cross Cutting/ Foundational
Grid Operations/ Market Design		1		3
Generation	*Generation projects are only performed by the CEC*			
Transmission		1		
Distribution	7	6	2	2
Demand-side Management	1		1	

Highest Priority Projects

1. SCE identified 11 projects for the first wave of execution[2]
2. All 11 are currently in planning and expected to commence by Q1 2020; details provided in the following slides

1. Many projects span multiple project types and positions within the value chain. This table identifies the primary categories for each.
2. These projects have the highest alignment with the joint IOU framework and potential to create customer benefits.

1 Smart City Demonstration

Overview

What does the project consist of?

Partner with a city to deploy a front-of-the-meter microgrid that supports a significant portion of the city's essential facilities (e.g., fire and police stations, community and senior centers, and emergency shelter) using SCE-owned energy storage and customer-owned DERs.

Objective

What is the project trying to achieve?

Demonstrate how a utility could use customer- and utility-owned DERs to operate a front of-the-meter microgrid to enhance resiliency while maintaining safety and reliability through minimally-disruptive islanding and reconnection.[1]

Profile

What are some relevant project details?

Timing
Expected to launch Q4 2019

Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
✓	✓	

Project Type | ***Value Chain***
Cross Cutting/Foundational | *Distribution*

1. SCE plans to use the same microgrid controller vendor for both the Smart City Demonstration and the Control and Protection for Microgrids and Virtual Power Plants project. The vendor is still to be determined.

2 Power System Voltage & VAR Control Under High Renewables Penetration

Overview

What does the project consist of?

Perform hardware-in-the-loop simulation and demonstration of volt/VAR management and system restoration plans following a blackout event utilizing grid-forming inverter-based resources (BESS, PV or wind).

Objective

What is the project trying to achieve?

Demonstrate the capabilities and features of a blackstart-capable BESS on the SCE system and analyze new control methods to enable inverter-based resources to address inertia loss issues, and grid-forming controls through the blackout and subsequent restoration.

Profile

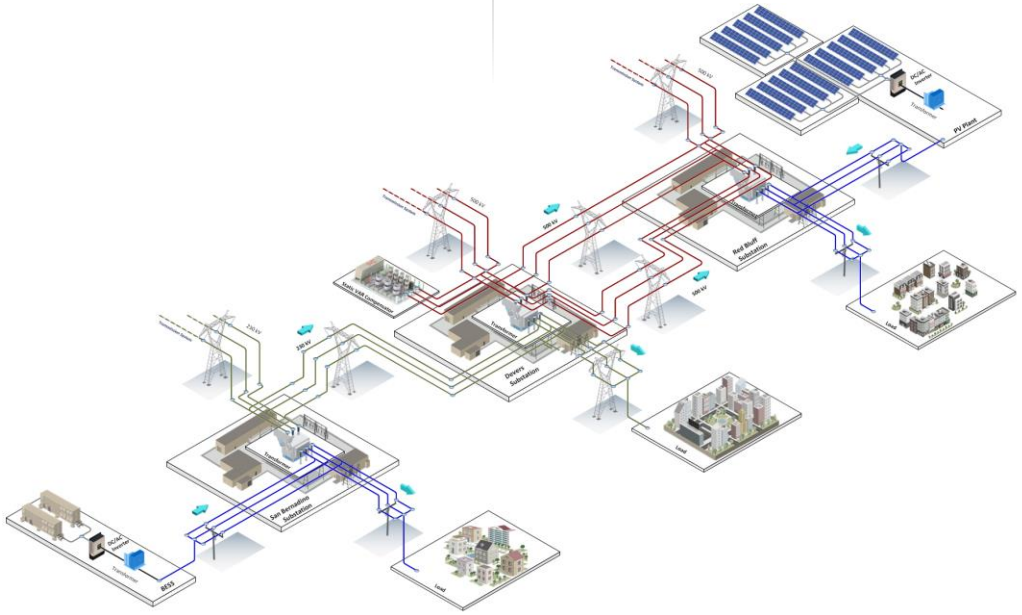
What are some relevant project details?

Timing
Expected to launch Q4 2019

Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
✓	✓	✓

Project Type | ***Value Chain***
Renewables & DER Integration | *Distribution*



3 DER Dynamics Integration Demonstration

Overview

What does the project consist of?

Engage utility partners, inverter manufacturers and software vendors to demonstrate and validate DER dynamics using real-time hardware in-the-loop testing (distribution circuit and substation level testing). Lab testing data will be validated against field measurements.

Objective

What is the project trying to achieve?

Better understand the protection system impacts of high DER penetration, and the adverse interactions between multiple DER types. This should help to optimize SCE's integration capacity analysis (for bulk system constraints) and inform technical requirements and standards discussions in the industry.

Profile

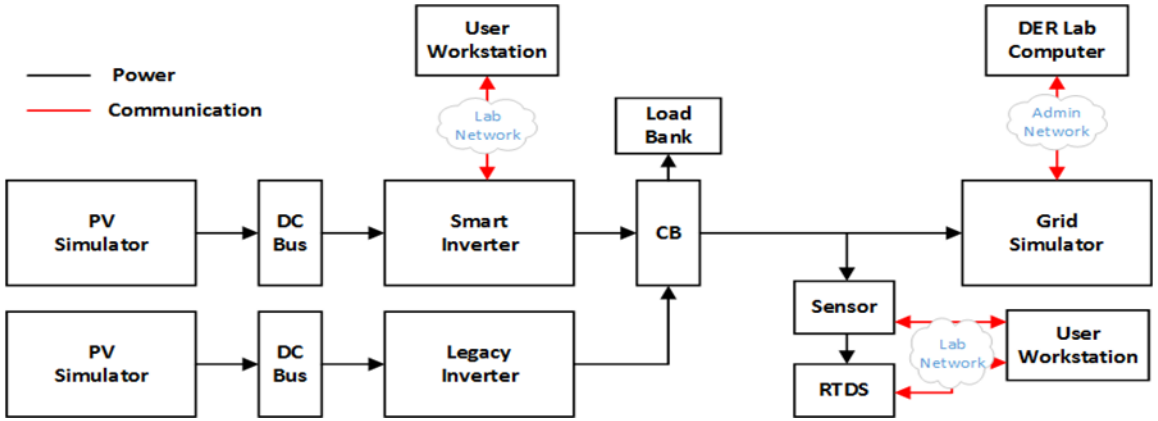
What are some relevant project details?

Timing
Expected to launch Q4 2019

Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
✓	✓	✓

Project Type | ***Value Chain***
Renewables & DER Integration | *Distribution*



4 Control and Protection for Microgrids and Virtual Power Plants

Overview

What does the project consist of?

Evaluate control and protection schemes for microgrids and virtual power plants (VPPs) at the distribution level. This will include assembling a microgrid testbed using a real-time simulator and performing hardware-in-the-loop testing. This testbed will be used for design, testing, and for an eventual behind-the-meter microgrid field demonstration.

Objective

What is the project trying to achieve?

Identify control and protection schemes that can ensure the safe and reliable operation of distribution systems with microgrids and VPPs. Such methods could also support system operations under high renewables penetration and highly variable grid topology. Cybersecurity testing is another primary goal.

Profile

What are some relevant project details?

Timing
Expected to launch Q4 2019

Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
✓	✓	✓

Project Type | ***Value Chain***
Renewables & DER Integration | *Distribution*

5 Distributed Plug-in Electric Vehicle Charging Resources

Overview

What does the project consist of?

Pair plug-in electric vehicle (PEV) fast charging stations with energy storage to mitigate the grid impacts of fast charging. The project will also evaluate using energy storage for grid services.

Objective

What is the project trying to achieve?

Demonstrate how fast charging stations and energy storage can be used to improve grid reliability while supporting customer PEV adoption and fast charging. The project also aims to demonstrate the use of second-life PHEV batteries to support fast charging by reducing demand.

Profile

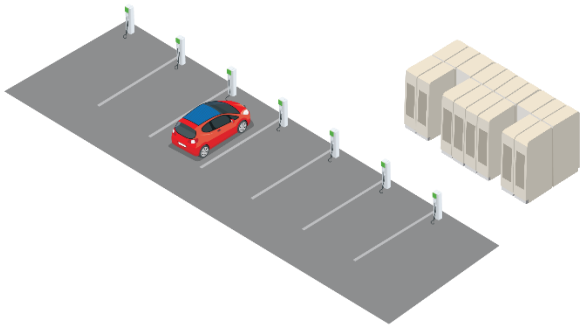
What are some relevant project details?

Timing
Expected to launch Q1 2020

Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
✓	✓	✓

Project Type | *Value Chain*
Customer-focused Products & Services | *Distribution*



6 SA-3 Phase III Field Demonstrations

Overview

What does the project consist of?

Perform field demonstration of SA-3 technologies at SCE's Viejo Substation (220/66/12 kV). This will introduce IP-based communications to a transmission substation (for the first time). This project will also evaluate new substation technologies at other distribution substations.[1]

Objective

What is the project trying to achieve?

Demonstrate a modern substation automation system that meets the high availability needed for SCE's critical bulk power (>220 kV) substations, and demonstrate and evaluate the benefits of new substation automation technologies.

Profile

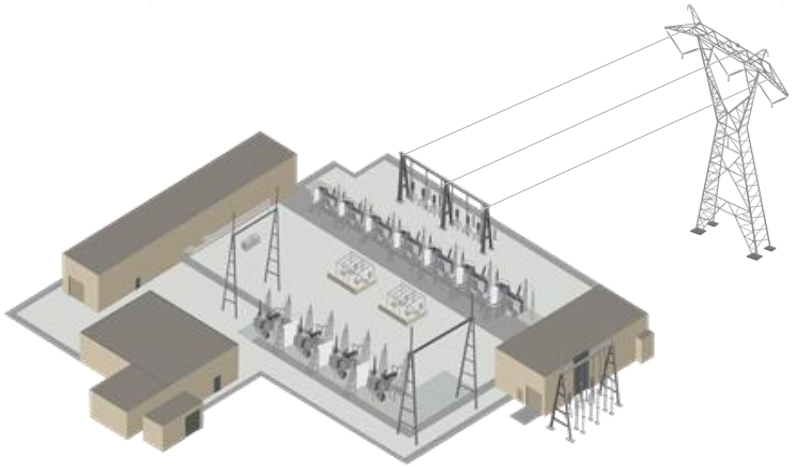
What are some relevant project details?

Timing
Expected to launch Q1 2020

Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
✓	✓	✓

Project Type | ***Value Chain***
Grid Modernization & Optimization | *Transmission*



1. SCE will demonstrate a resonant ground fault interrupter, an IEC 61850 protection automation controller, process bus (in a field demonstration, and a virtualized protection system.

7 Distribution Primary & Secondary Line Impedance

Overview

What does the project consist of?

Advance SCE's data validation for its grid network connectivity model using data-driven techniques based on machine learning and artificial intelligence. This project will identify data gaps and provide recommendations to correct problems for network phasing, meter-to-transformer connectivity, and primary impedances.

Objective

What is the project trying to achieve?

Improve the accuracy of load flow and distribution state estimation results and improve real-time distribution grid management with more accurate distribution grid impedance models

Profile

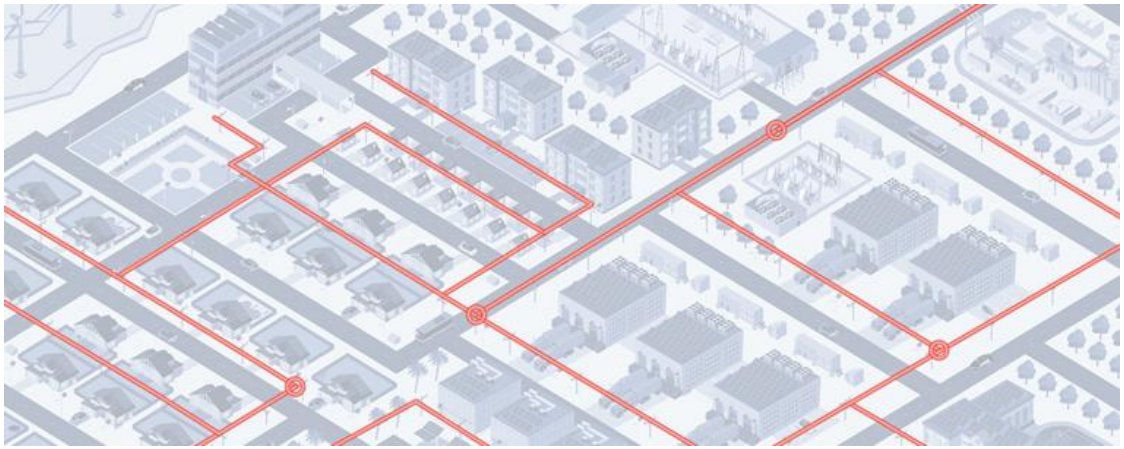
What are some relevant project details?

Timing
Expected to launch Q1 2020

Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
✓	✓	✓

Project Type | *Value Chain*
Grid Modernization & Optimization | *Distribution*



8 Cybersecurity for Industrial Control Systems

Overview

What does the project consist of?

Test adaptive security controls and dynamic re-zoning of operational data networks while the Industrial Control System (ICS) is either under cyberattack or subject to an increased threat level.

Objective

What is the project trying to achieve?

Demonstrate the ability to isolate affected grid sections from ongoing cyber attacks through multiple approaches. Success would include being able to clearly define a response to a cyber attack and to automate isolation of affected grid communications.

Profile

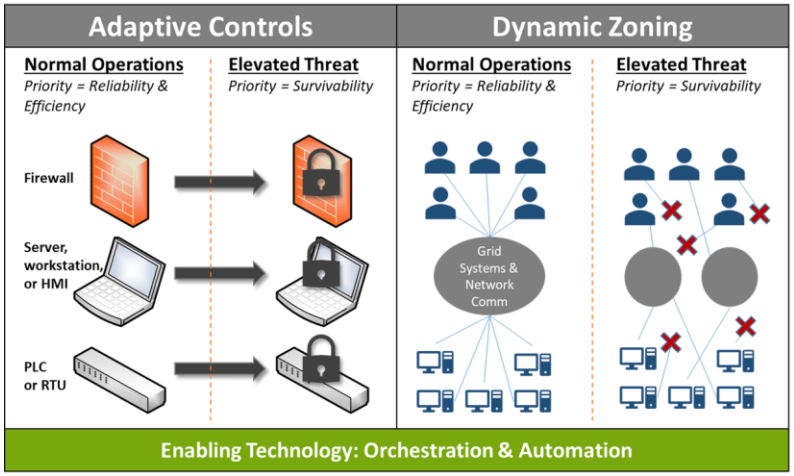
What are some relevant project details?

Timing
Expected to launch Q1 2020

Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
✓	✓	

Project Type | *Value Chain*
Cross Cutting/Foundational Strategies & Technologies | *Grid Operations*



9 Distributed Cyber Threat Analysis Collaboration

Overview

What does the project consist of?

Collaborate with utility peers and notational analysis centers to consume internal and external sourcing cybersecurity threat feeds, process them for legitimacy, determine risk impacts, and potential responses

Objective

What is the project trying to achieve?

Demonstrate the ability to standardize and automate cyber-threat feeds across security operations centers, utilities and government agencies to shorten the time needed to analyze and respond to cybersecurity events.

Profile

What are some relevant project details?

Timing
Expected to launch Q1 2020

Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
✓	✓	

Project Type | *Value Chain*
Cross Cutting/Foundational Strategies & Technologies | *Grid Operations*

10 Advanced Comprehensive Hazards Tool

Overview

What does the project consist of?

Demonstrate the use of geospatial analysis and risk assessment to identify high-risk hazard areas, asset specific vulnerabilities, and the impact of mitigations to enhance overall grid resilience. The analyses will be based on asset information, fragility analysis, and natural hazard data.

Objective

What is the project trying to achieve?

Determine the potential for configuring an extendible platform to determine the overall hazard risk of an asset (or area) by combining several hazard assessment features into a single tool. This would inform long term hazard mitigations and prove integrated situational awareness capabilities.

Profile

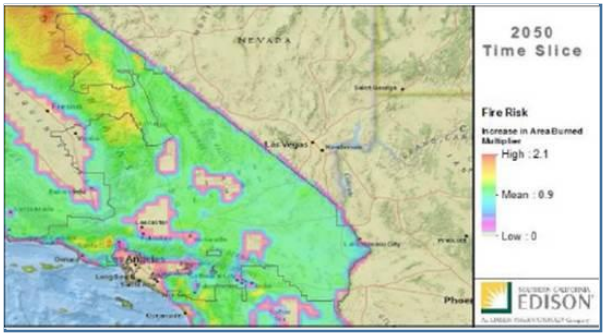
What are some relevant project details?

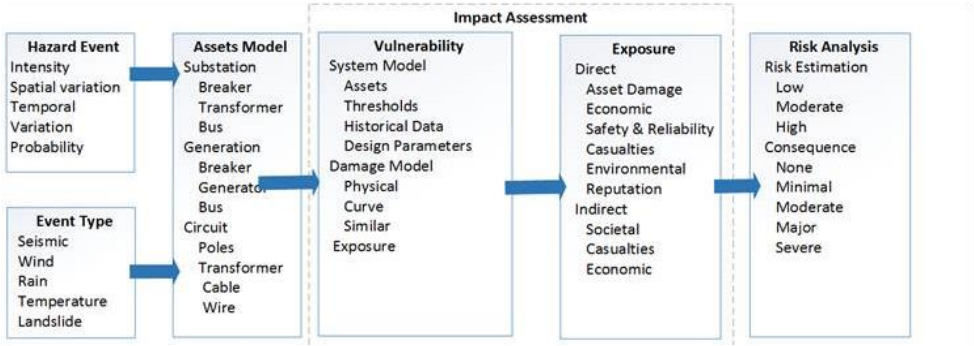
Timing
Expected to launch Q1 2020

Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
✓		

Project Type | ***Value Chain***
Grid Modernization & Optimization | *Grid Operations*





11 Service and Distribution Centers of the Future

Overview

What does the project consist of?

Deploy building electrification technologies and electric vehicle supply equipment (EVSE) with advanced communications and controls, and manage a commercial customer fleet of PEVs through demand response grid signals to help ensure reliable charging, support system voltage and balance demand (both at the service center and across the local service area).

Objective

What is the project trying to achieve?

Evaluate the ability to fully electrify a fleet service center with building electrification technologies (e.g., space and water heating), EVSEs and employee charging while managing any associated impacts to the local grid system. The results could inform future efforts to electrify other service centers, while also supporting commercial customer electric vehicle loads.

Profile

What are some relevant project details?

Timing
Expected to launch Q1 2020

Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
	✓	✓

Project Type | *Value Chain*
Renewables & DER Integration | *Demand-side Management*