Southern California Edison
Joint Utilities Fall EPIC Workshop

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SOUTHERN CALIFORNIA EDISON®

Our project portfolio is screened to ensure alignment with EPIC's guiding principles and investment planning framework

ENERGY RESOURCES INTEGRATION

- Beyond Lithium-ion Energy Storage
- Control and Protection for Microgrids and Virtual Power Plants
- Smart City Demonstration
- Service and Distribution Centers of the Future
- Distributed Energy Resources Dynamics Integration
- Storage-Based Distribution DC Link

GRID MODERNIZATION AND OPTIMIZATION

- Advanced Comprehensive Hazards Tool
- Next-Generation Distribution Automation III
- SA-3 Phase III Field Demonstrations

CUSTOMER-FOCUSED PRODUCTS AND SERVICES

- Vehicle to Grid Integration Using On-Board Inverter
- Distributed Plug-in Electric Vehicle Charging Resources

CROSS-CUTTING/ FOUNDATIONAL STRATEGIES AND TECHNOLOGIES

- Wildfire Prevention & Resiliency
- Cybersecurity for Industrial Control Systems
- Distributed Cyber Threat Analysis

We're demonstrating the latest advancements in hardware and software-based solutions in wildfire prevention, detection and mitigation

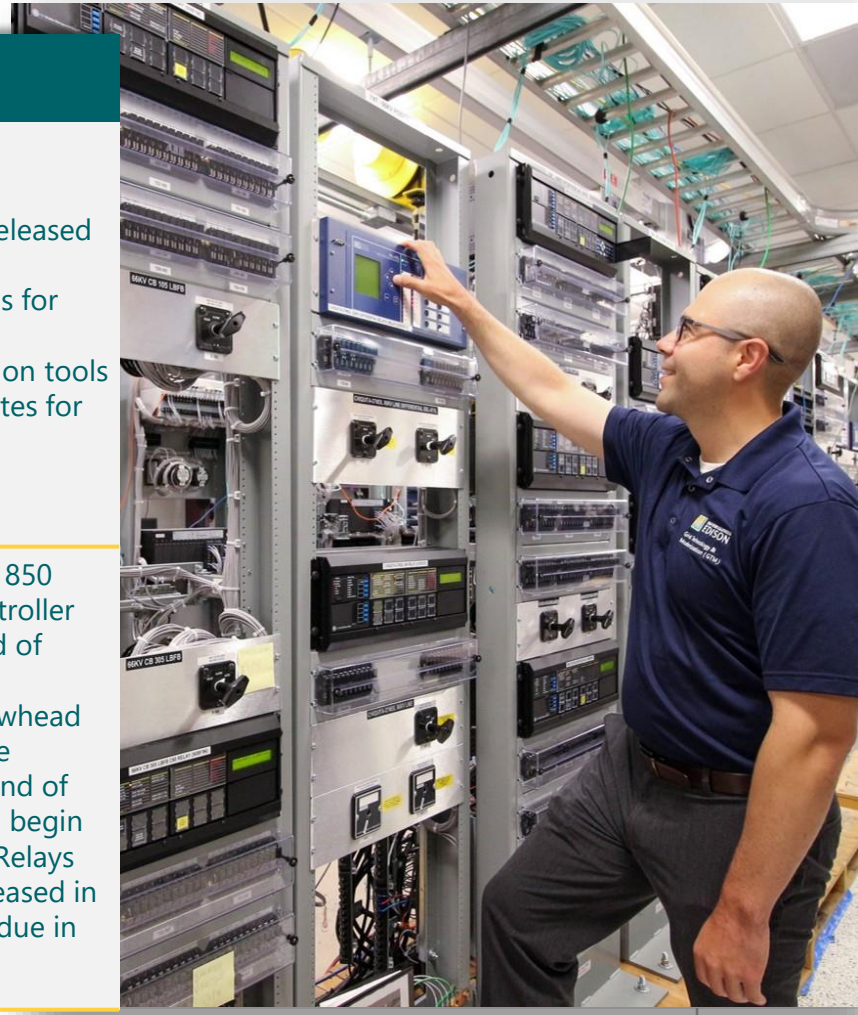
Project Name	Description & Benefits	Updates
Wildfire Prevention and Resiliency	Demonstrate methods of both centralized and decentralized AI and machine learning techniques related to the detection of conditions that could spark a wildfire. Identify, procure, and test an analytics platform that will enable the development algorithms that use grid sensor data for the detection of anomalous grid events. Could support both future GRC requests and Wildfire Mitigation Plan filings. Potential to prevent five high fire threat district (HFTD) ignitions/year and alert operators to thirty HFTD ignitions/year. Potential to increase speed of PSPS patrols leading to faster reenergization.	Public Outreach Workshop held Oct. 20, 2021. Finalizing project scopes with IT/Cybersecurity for data collection and storage, schedules and budgets.

New tools and applications using advanced analytics provide insights into grid vulnerabilities to natural disasters

Project Name	Description & Benefits	Updates
Advanced Comprehensive Hazards Tool	Demonstrate advanced analytics that provide SCE the ability to identify electric asset specific vulnerabilities due to seismic, severe weather and climate change events. Investigate the ability to improve upon and standardize internal tools used for natural hazard risk assessment. Demonstrate capabilities to inform hazard mitigation in the long-term as well as provide early situational awareness in the near-term. This project supports the Commission's Climate Adaptation Rulemaking. The tool being demonstrated as part of this project will improve the Commission and SCE's understanding of the electric system's vulnerabilities to natural hazard events by assisting with risk assessments and identifying grid vulnerabilities that can be documented with SCE's future vulnerability assessment filings. This project's tool will enable cost reductions through more accurate and targeted planning based on an improved understanding of specific vulnerabilities and the impact of potential SCE mitigation responses. The current estimated repair and recovery rate from a seismic event based on the repair rate from the 2019 Ridgecrest Earthquake sequence is 30 man-hours per repair needed to fully restore a distribution circuit to as-built conditions.	RFI/RFP process currently underway and in the final phase to select the vendor Nov. '21.

SCE is focused on increasing asset flexibility and reducing operating costs

Project Name	Description & Benefits	Updates
Next-Gen Distribution Automation III	Demonstrate new FAN wireless radio for automation devices and improve control functionalities. Provide greater situational awareness through integration of advanced control systems, modern wireless communication systems and new distribution equipment and sensing technology. Future GRC requests will be determined through the course of the project. Potential to improve reliability via improved grid management capabilities.	Request for information to be released to vendors in early Nov. '21 for identifying availability/roadmaps for software and hardware. Started developing software configuration tools evaluation plan and cost estimates for software licenses.
SA-3 Phase III Field Demonstrations	Demonstrate modern substation automation systems for compliance with NERC CIP and IT cybersecurity requirements. The validated design, once approved by SCE's standards group, will be used as the basis of all new and remodeled transmission substations, with funding requested as a part of the normal GRC process. SCE estimates potential cost savings of 10-20% on digital substations using process bus technology (each of which costs approximately $2-$3 million). Since SCE annually replaces relays on 20-30 substations, this could potentially result in cost savings of $9.4 million per year.	On schedule to complete IEC 61850 programmable automation controller (PAC) demonstration by the end of 2021. The Resonant-Grounded Substation construction at Arrowhead Substation is 95% complete. The system will be installed by the end of the year and demonstration will begin in 2022. The Virtual Substation Relays request for information was released in Oct. '21 with vendor responses due in Nov. '21.

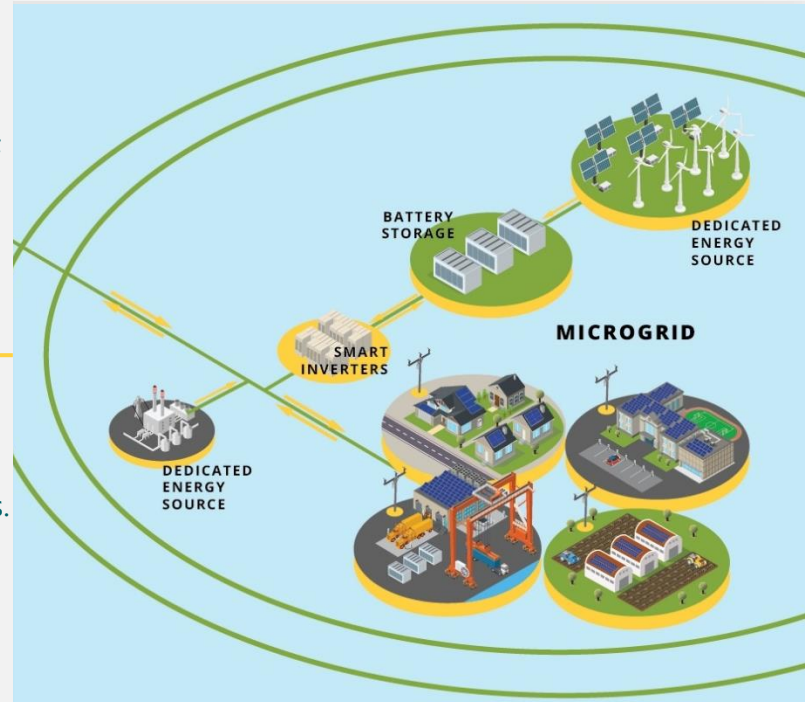


We're evaluating new energy storage technologies and applications that will help us integrate more renewables and DERs

Project Name	Description & Benefits	Updates
Storage-Based Distribution DC Link	Demonstrate a novel energy storage architecture connected between two distribution circuits, using a bi-directional power flow control device in conjunction with a battery storage system. Enable energy storage support for one or both circuits and dynamic power exchange between circuits. This project supports the Commission's DRP proceeding by attempting to identify reliability needs and projects that can be met by distributed energy resources (DER) services. This demonstration could further DERs as a viable grid solution compared to traditional wires solutions. Eventually, this could be integrated into possible DER projects included in the annual Distribution Infrastructure Deferral Framework. The project has the potential to improve reliability because the connected battery could reduce outage times. By utilizing this system, capital upgrades could be deferred by reducing circuit overloads. Also, DER hosting capacity could be increased by routing power in a controlled manner between 2 circuits.	Completed job walk and obtained proposal for design of electrical distribution equipment to support DC Link installation. The DC Link vendor has been selected and on-boarded. Work has begun and they are actively designing mechanical/electrical package. The project team is refining scope of power system study/simulations and enhancing grid simulator with new firmware and capabilities. *Challenges: The qualified vendor raised concerns about existing and new intellectual property (IP) regarding their existing DOE contracts and sub-contractor IP rights.*
Beyond Lithium-ion Energy Storage Demo	Demonstrate non-lithium-ion energy storage systems (NoLess) against a variety of traditional use cases (i.e., in accordance with the CPUC's energy storage use cases outlined in D13-10-040), and emerging use cases (e.g., regional/community resiliency, etc.). This demonstration will support the OIR to Modernize the Electric Grid for a High DER Future. Some new battery technologies are less prone to thermal runaway than lithium-ion, and some may use safer or more plentiful raw materials. NoLess technologies may offer better capacity and power degradation characteristics, reducing upgrade and maintenance costs.	Presented at Public Outreach Meeting Oct. 20, 2021

We're evaluating and demonstrating how we can integrate operation of DERs and the distribution system to enhance resiliency and reliability for our customers

Project Name	Description & Benefits	Updates
Control and Protection for Microgrids and Virtual Power Plants	Demonstrate control and protection schemes for safe and reliable operation of customer-owned nested microgrids and virtual power plants. Develop standard operations to support grid integrity in high-DER environments. This demonstration will identify challenges and protection requirements to enable safe microgrid operation, supporting the Commission's Microgrid rulemaking. The project will examine the potential to improve reliability by decreasing the number of outages through temporary islanding.	Vendor procurement for the microgrid control system to support design and testing is in negotiations; design of the lab testbed is underway.
Smart City Demonstration	Demonstrate the electric utility role in a Smart City initiative, including coordination with urban planning, streamlined interconnection, efficient utilization of energy resources and resiliency for critical city operations. This demonstration will support the Commission's Microgrid Rulemaking by providing technical learnings on limitations currently creating barriers to microgrid deployment. A clean energy and storage-based microgrid can replace gas-burning generators that emit GHGs. Additionally, project results could improve the ability to create powered community shelter locations during PSPS and other events, which is especially important for protecting our customers in disadvantaged and vulnerable communities.	Procurement for the microgrid controller is currently in negotiations. Detailed engineering design work is underway with the vendor. Field site is identified, customer agreement covering the microgrid system is in progress. Project team is actively performing microgrid technical consultation work with support from local agency and stakeholders.



We're exploring how vehicle to grid enabling technologies, such as batteries, act as storage devices that supply power back to the grid

Project Name	Description & Benefits	Updates
Vehicle to Grid Integration Using On-Board Inverter	Evaluate new interconnection requirements, utility and third-party controls for charging/discharging and overall function of automaker OEM battery/inverter systems to support vehicle to grid reverse power flow implementation and application. This project helps to support the DRP's goal of having electric vehicles be identified as DERs to be analyzed as grid solutions. Charging of light-duty vehicles is expected to reach 6.9% of peak load by 2030. Proper control can mitigate acute system issues caused by bus/medium duty fleet charging (e.g., feeding the grid by turning off 100 buses at 150 kW can produce up to 15 MW of grid support).	Completing trial-use agreements as planned with automakers to begin lab configuration and testing. Procurement of electric vehicle supply equipment (EVSE) and aggregator services also underway. Tech Advisory Board in flight. Cyber vendor assessment and distributed energy resources management system (DERMS) aggregator cyber requirements delivered to first aggregator.
Distributed Plug-In Electric Vehicle Charging Resources	Demonstrate plug-in electric vehicle (PEV) fast-charging stations with integrated energy storage, used to control grid system impact of fast charging, costs of fast charging demand and function as a distributed energy resource when not in use. This project supports the Commission's DRIVE Rulemaking, Transportation Electrification Framework, and DRP proceedings by providing crucial information on the integration of fast chargers with energy storage and the potential use of second-life batteries. The capability to shift charging from evening peak to late night could reduce emissions by over 33%, while shifting from early morning to noon could reduce emissions by up to 73% due to the difference in CO2 from grid power sources at different times. Shifting load could save over 27,000 metric tons of CO2 per year, which equates to approximately $2.1 million in CO2 equivalent (CO2e) reduction benefits annually by 2030.	Vendor RFQ responses received for Specialty Engineering Services. The project team is still negotiating with the selected vendor to finalize the schedule for the Engineering Services. SCE negotiated NDA with Ohio State University to discuss usage of secondary battery technology.

Customer-Focused Products & Services

This effort integrates EV fleet and electric distribution operations in order to facilitate transportation electrification

Project Name	Description & Benefits	Updates
Service and Distribution Centers of the Future	Demonstrate an advanced fleet service center housing controllable electric vehicles and submetering technologies, energy storage, building electrification and management, and DC service elements, while using a control system connected to a local service area with high DER and PEV penetration. This project will support the Commission's Transportation Electrification Framework, DRIVE Rulemaking, DRP proceeding and Microgrid proceeding by providing crucial data on improving the value of fleet electrification, while maintaining safe and reliable grid operations. This project saves costs on both customer and utility side. These costs vary but have recently been measured between $7 million and $15 million, and the space required could be costly or even impossible for the customer.	Microgrid control system (MCS) vendor negotiations are underway. Conceptual design work underway for the microgrid integration with battery storage and building electrification. Completed site walks and analysis of electric bus EVSE and charge management platform.

Energy Resources Integration

We continue to assess future DER integration opportunities and challenges

Project Name	Description & Benefits	Updates
Distributed Energy Resources Dynamics Integration Demonstration	This project performs a power hardware-in-the-loop (PHIL) demonstration for the distribution feeder protection impact due to the high penetration of DER using smart and legacy inverters. This knowledge enables the continued evaluation of expected and unexpected DER integration challenges. This demonstration assists with the DRP proceeding's goal of ensuring the grid can accommodate a seamless interconnection of DERs and utilize them to meet grid needs by understanding the protection requirements on feeders with various types of generation. Learnings from this demonstration may also inform future Grid Modernization Plans required to be filed in conjunction with each of the Utilities' GRCs. This project helps to ensure proper operation of protection systems on circuits with high penetration of DERs, which helps to prevent outages and electrical equipment damage.	Developed EMT models of inverter connected DERs and completed the PSCAD and CYME model validation of the Pronghorn feeder. Completed design of the PHIL testbed and use cases to investigate the protection impact. Published an IEEE conference paper based on the preliminary modeling, simulation and experimental results.

Our cyber team is adopting new technologies to improve operation efficiencies and reduce cybersecurity risks

Project Name	Description & Benefits	Updates
Cybersecurity for Industrial Control Systems	Cybersecurity for Industrial Control Systems will demonstrate adaptive security controls (AC) and dynamic re-zoning (DZ) of operational networks while the Industrial Control System (ICS) is under cyberattack or increased threat level. • AC/DZ has the potential to benefit the national grid and ROI to ratepayers by bolstering a more resilient and secure grid through the ability to identify and isolate core grid operational functions while under a cyber attack or incident. • The benefits are also cross cutting in that AC/DZ will drive grid operations and cybersecurity together for collaboration to address controls for zones to be defined risk impact mitigations.	Completed connectivity, installation and wiring diagrams for all test cases in the project. Final demonstration scenario in progress, with each technology silo having completed its most basic demonstration.
Distributed Cyber Threat Analysis Collaboration	The Distributed Cybersecurity Threat Analysis Collaboration (DCTAC) will demonstrate standardized utility cybersecurity threat analysis through collaboration with utility peers and national analysis centers. • The DCTAC project will provide a detailed framework to support identify and propose automation of information sharing opportunities and enhance information sharing and collaboration initiatives among various internal and external stakeholder groups from utilities the U.S. Government. • The benefits are also cross cutting in that DCTAC twill bring grid operations and cybersecurity together for collaboration to address threats, vulnerabilities and risk impacts.	End to end intelligence sharing defined with security focus completed. Front- and back-end integration completed, external sharing risk controls in development.