

San Diego Gas & Electric Company EPIC Update



Frank Goodman, Program Manager



**2019 EPIC Fall Workshop
November 8, 2019**

**SDG&E EPIC Public Website
www.sdge.com/epic**

Overview



- Highlights of EPIC-1 and EPIC-2 Accomplishments
- Overall EPIC-3 Implementation Status
- EPIC-3 Project Overviews and Accomplishments to Date
- Discussion

EPIC-1 Highlights



Accomplishment: Demonstrated tools and operating capabilities for advanced distribution system automation to support grid modernization and integration of distributed energy resources.

Project	Primary Strategy and Policy Touchpoints
Smart Grid Architecture Demonstrations	Distribution System Modernization, DER Integration
Visualization and Situational Awareness Demonstrations	Distribution System Modernization, DER Integration
Distributed Control for Smart Grids	Distribution System Modernization, DER Integration
Demonstration of DER Grid Support Functions	Distribution System Modernization, DER Integration
Smart Distribution Circuit Demonstrations	Distribution System Modernization, DER Integration

Comprehensive final project reports on www.sdge.com/epic

EPIC-2 Highlights



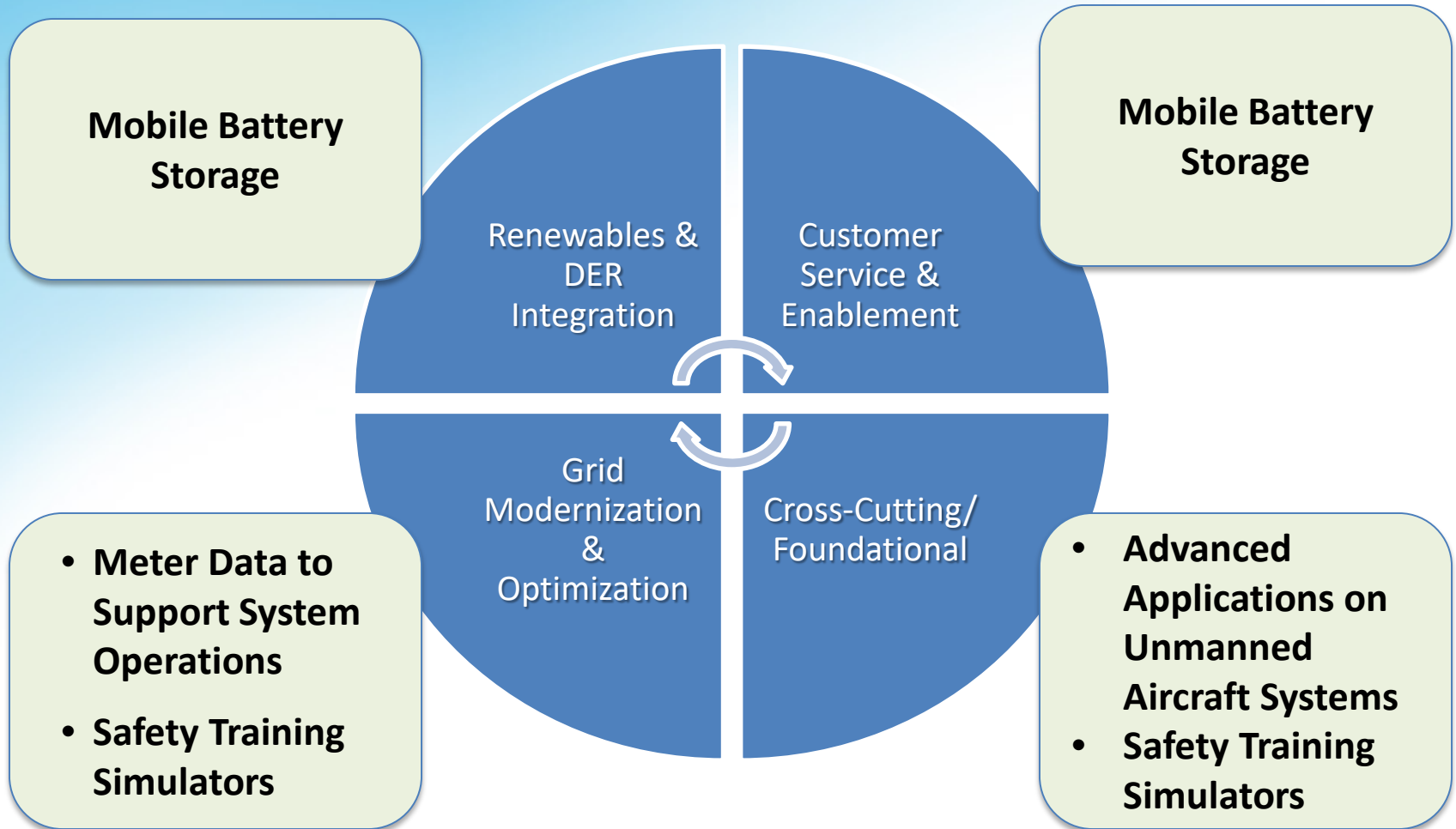
Accomplishment: Demonstrated and evaluated capabilities for data analytics, interoperability of new technologies, emerging standards for communications infrastructure.

Project	Primary Strategy and Policy Touchpoints
Modernization of Distribution System and Integration of DER	Substation and Distribution System Modernization, DER Integration
Data Analytics in Support of Advanced Planning and System Operations	Distribution System Modernization, Asset Management
Monitoring, Communication, and Control Infrastructure for Power System Modernization	Distribution System Modernization, DER Integration
System Operations Development and Advancement	Distribution System Modernization, DER Integration
Integration of Customer Systems into Electric Utility Infrastructure	Customer-Focused Services, Distribution System Modernization

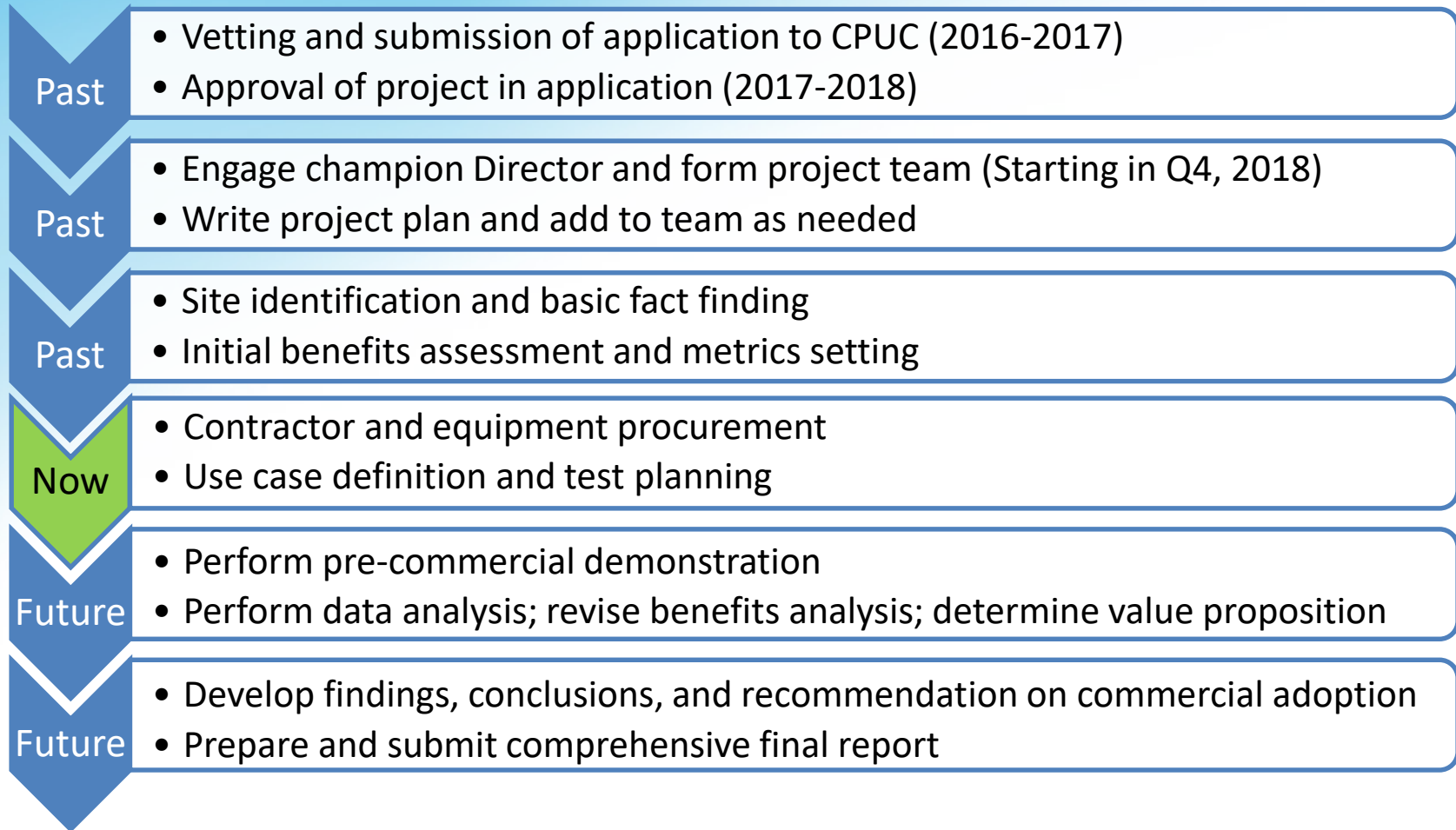
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EPIC-3 Wave 1: In Progress

Mapping to EPIC Framework



EPIC-3 Project Life Cycle



EPIC-3 In-Flight Projects

Key Focus Issues-1



- **AMI for Operations Demonstration (Lead: Amin Salmani)**
 - Reliability, resiliency, and improved system operations
- **Safety Training Simulator Demonstration (Lead: Mike Colburn)**
 - Customer and employee safety
 - Wildfire mitigation and response
- **UAS-Related Demonstrations (Lead: Christine Asaro)**
 - Asset life and asset management
 - Vegetation management
 - Wildfire mitigation and response
 - Support for power system operations

EPIC-3 In-Flight Projects

Key Focus Issues-2



- **Mobile Battery Demonstrations (Lead: Chequala Fuller)**
 - **Module 1:** Port and related applications
 - Customer demand management
 - Reliability and resiliency
 - GHG emissions reduction
 - **Module 2:** Application at community resource centers
 - Customer support during wildfire and other high-risk events
 - Reliability and resiliency
 - **Both Modules:**
 - Safety and transportability issues (weight, size, toxicity of battery chemistry)
 - Simple and safe docking capability
 - Costs and benefits: Valuation proposition

Application of AMI Data to Advanced Utility System Operations



1 Objective

- Demonstrate capabilities for leveraging advanced metering infrastructure (AMI) to provide actionable secondary voltage data and analysis to support utility operations.
- Provide improved operating practices that contribute to better power quality, higher reliability, reduced electrical losses in the power system, increased safety, and reduced cost.

2 Overview

AMI is a rich source of data that could be of significant value in enhancing distribution system operating practices. Capabilities for accessing and applying the data to solving operating problems need to be demonstrated. This project will demonstrate critical capabilities of the AMI system, such as use as a voltage sensor network and as a phase identification tool.

3 Profile

Timing

Launched Q1 2019

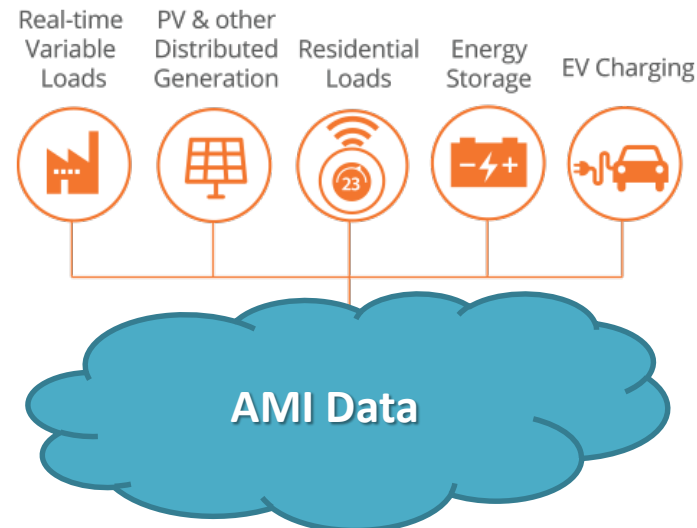
Primary Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
✓	✓	✓

Project Type | Value Chain

Grid Modernization & Optimization | Distribution

Demonstrating a data-driven paradigm for power system operations



Application of AMI Data to Advanced Utility System Operations



Module 1

Leverage existing AMI infrastructure to provide a secondary voltage monitoring network solution (Collaborative funding with NREL).

- Identify network model discrepancies
- Develop AMI data-based insights
- Demonstrate novel visualization tools
- Enable AMI-based controls



Possible EV Locations

Module 2

Application of AMI data to automatically identify phasing information within the distribution system.

- Demonstrate use cases to support the following analytical work
- Compare analytical methods and other potential alternatives for phase identification
- Demonstrate analytical algorithms that use SCADA, Geographic Information System (GIS), and AMI data for automated phase identification
- Identify challenges for commercial deployment of the proposed methods
- Make recommendations regarding prospective commercial adoption

Example Application of AMI Data to Advanced Utility System Operations



Location of Voltage Exceedances (Duration >10 min.)



Safety Training Simulators with Augmented Visualization



1 Objective

Demonstrate and evaluate training capabilities for field focused design, operations, and asset monitoring and management solutions.

Demonstrate the ability of the latest simulator technologies to train utility industry **personnel** on safety related issues, such as electric potential zones and wildfire risks.

2 Overview

Safety training is important to every job, and its importance is elevated when dealing with high voltage power equipment used by utilities.

Advanced training simulators can help electric utility crews train and improve worker safety, proficiency, and productivity.

3 Profile

Timing

Launched Q1 2019

Primary Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
✓	✓	✓

Project Type | Value Chain

Grid Modernization & Optimization | Distribution

Project Consists of Two Modules:

- Personal Protective Grounding/Equipotential Zone Work Methods
- Focused Patrol for Distribution Line Outages

Module for Personal Protective Grounding / Equipotential Zone Work Methods Simulator Demonstration



- A key safety element for utility lineworkers
- Effective initial and refresher training is key for competency
- Special attention is required for underground



Module on Personal Protective Grounding / Equipotential Zone Work Methods



- Use virtual reality goggles and other visual and tactile feedback devices in training
 - Available from multiple vendors, at various levels of maturity
 - No vendor is known that has fully developed this particular use case
- Build a physical “test yard”, as the basis for performing the precommercial demonstration

Project approach – test the student before and after the completion of simulator-based training.

The improvement in work performance is a metric on the effectiveness on the training

Compare to conventional training methods



“Focused Patrol” Demonstration Module



There are many potential causes of faults!

Animal Contact

Severe Weather

Party Balloons

Customer Problem

Wire Slap

Vehicle Contact

Tree/Vegetation Contact

Undetermined

Equipment Failure

Human Error

Foreign Object in Lines

High Winds

“Focused Patrol” Demonstration Module



Finding Where the Fault Has Occurred Can be a Challenge!

Often, in rural settings, nobody sees the fault occur, so no initial reports arrive

- Some circuits are over 100 miles long
- Physical access is sometimes a problem
- These things can delay restoration of customers

Need to use all available data to locate faults

- Fault distance data from relays
- Wireless fault indicator targets
- Targets from contemporary SCADA equipment
- Possible use of contingency voltage from AMI
- Apply algorithm to narrow the search
- Assess accuracy compared to conventional “divide and conquer” approach

Unmanned Aircraft Systems (UAS) with Advanced Image Processing for Electric Utility Inspection and Operations



1 Objective

Define, demonstrate, and evaluate concepts for instrumentation and monitoring of power system equipment using enhanced imaging and sensor technologies on UAS.

Determine the potential to increase reliability, safety, and cost efficiency to improve power system operations.

2 Overview

SDG&E has done extensive past work on UAS applications. Analysis of high quality images and data from UAS has been effective in aiding time-sensitive decisions in operations in many applications.

This project seeks to expand capabilities of UAS in asset aging issues and wildfire mitigation.

3 Profile

Timing

Launched Q1 2019

Primary Customer Benefits

Increase Safety	Improve Reliability	Reduce Costs
✓	✓	✓

Project Type | Value Chain

Grid Modernization & Optimization | Distribution

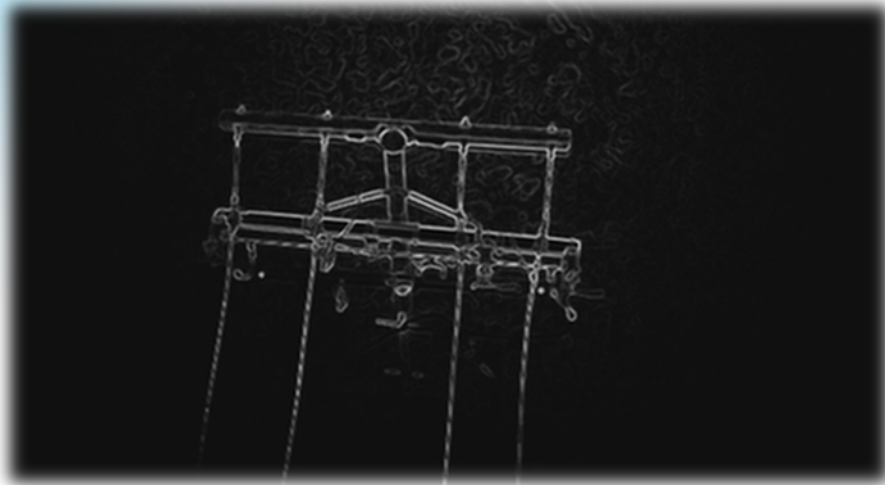
Supports and increases staff efficiencies of 7 departments including:

- o Aviation Services Department
- o Electric Distribution Engineering
- o Distributed Energy Resources
- o Fire Risk Mitigation
- o Fire Science and Coordination
- o Transmission, Construction & Maintenance
- o District Operations & Engineering

Example: UAS Application after Public Safety Power Shutoff (PSPS)



- During extreme weather events, to mitigate the risk of a potential ignition source, SDG&E has implemented PSPS.
- Created a red flag UAS operations procedure to include duty day schedule due to the PSPS.
- After the PSPS, UAS crews will support inspecting overhead power lines to check for debris on infrastructure and equipment damage prior to re-energizing lines.



Example: UAS-Based Corona Camera



- SDG&E is the first company in the US to fly a corona camera on a UAS
- Completed 5 successful test flights on Aug 19 & 20, 2019



***UAS Test Team in Action:
Christine Asaro, Brian Yates & Teena Deering***

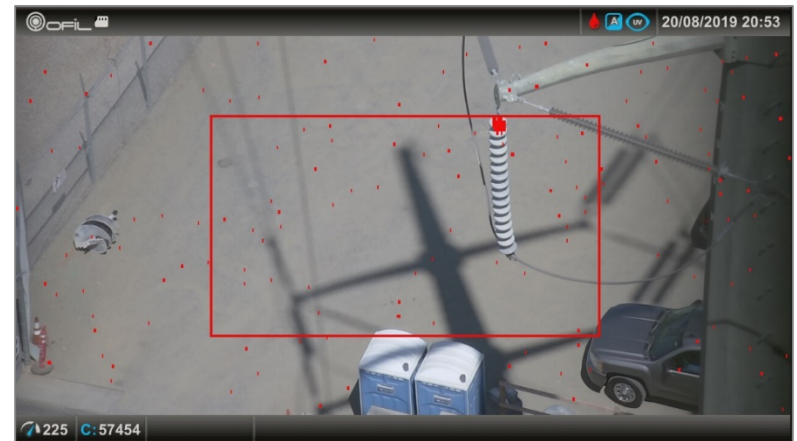


Image captured from UAS flight on Aug 20, 2019

Demonstration of Multipurpose Mobile Battery for Port of San Diego and Other Applications--Module 1



1 Objective

Demonstrate a mobile battery system at the Port of San Diego's cruise ship terminal during the peak cruise ship season and in other applications at other locations during nonpeak season

Evaluate stacking of various benefits that can be derived from the mobile battery at multiple locations.

2 Overview

Pre-commercial demonstration, showcasing the concept of utilization of a containerized, mobile battery energy storage system for various locations and use cases.

Evaluate the stacking of benefits when rotated between applications, identifying preferred applications and feasibility for commercialization.

3 Profile

Timing

Launched Q1 2019

Primary Customer Benefits

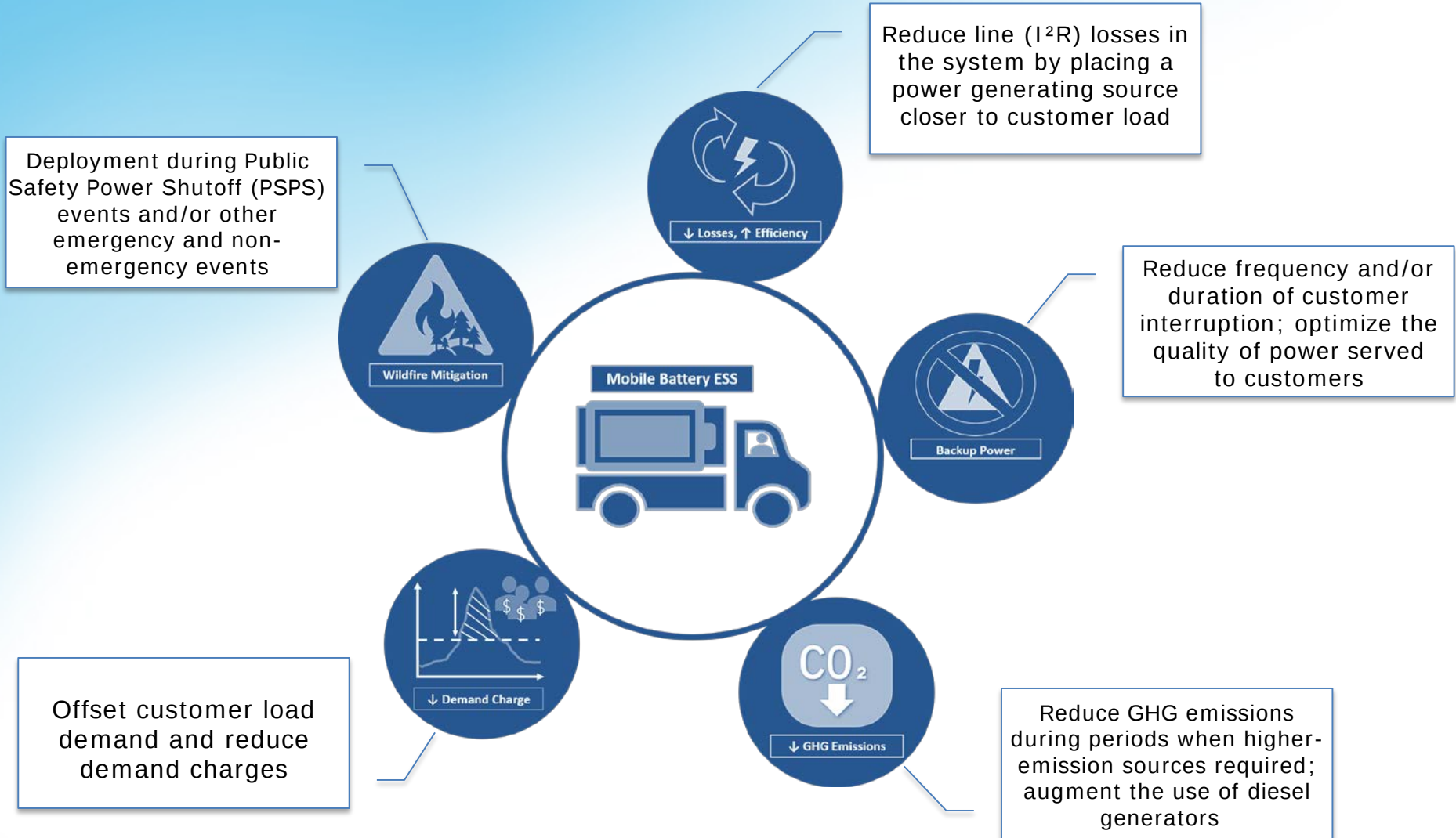
Demand Charge ↓	GHG Emissions ↓	Back Up Power
✓	✓	✓

Project Type | Value Chain

Renewables & DER
Integration/Customer Service & Enablement | Distribution



Mobile Battery--Use Cases and Prospective Benefits



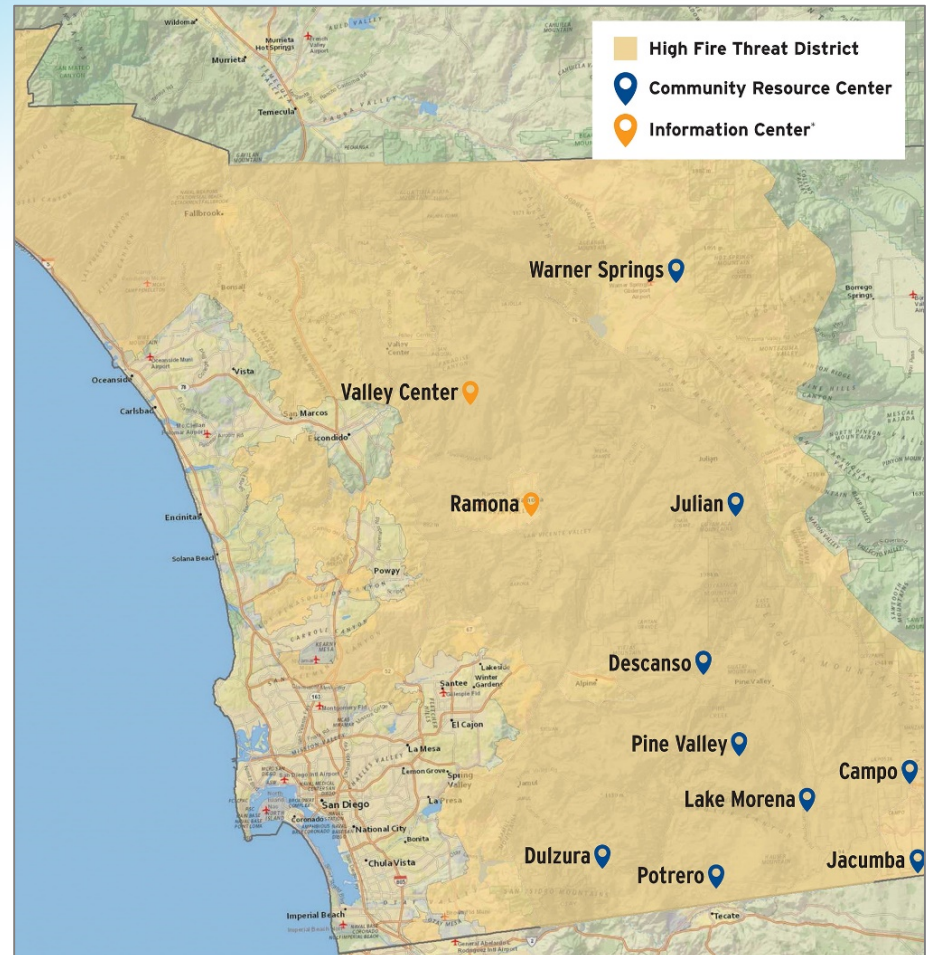
EPIC-3 Second Wave

Requires CPUC release of remaining EPIC-3 funds



Module 2 of Mobile Battery Project

- Powering critical loads at Community Resource Centers (CRCs)
- CRCs activated during emergencies
- Reliable power need to support vital activities in the CRCs
- Batteries provide an emission-free alternative to diesel generation
- Batteries can be moved to other applications, when there is no emergency event



Discussion

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Thank you for your participation