



Electric Program Investment Charge Joint IOU EPIC 3 Planning Workshop

Third Triennial Investment Plan Cycle

SCE Advanced Technology Laboratories
Westminster, CA
March 24, 2017

PG&E, SCE, SDG&E, CEC



Agenda

Topic	Speaker	Time	Duration
Welcome & Safety	Ryan Blaney, SCE	9:00 -9:15	15 min.
CPUC Introduction to EPIC	David Huang, CPUC	9:15 – 9:25	10 min.
CEC Introduction to EPIC 3 Planning Process	Fernando Pina, CEC	9:25 -9:35	10 min.
EPIC Program Overview	Aaron Renfro, SCE	9:35 – 9:50	15 min.
Break		9:50 – 10:05	15 min.
SCE EPIC 3 Proposed Investment Plan Overview	Ryan Blaney, SCE	10:05 – 10:35	30 min.
PG&E EPIC 3 Proposed Investment Plan Overview	Julie Cerio, PG&E	10:35 – 11:05	30 min.
SDG&E EPIC 3 Proposed Investment Plan Overview	Frank Goodman, SDG&E	11:05 – 11:35	30 min.
Open Q&A	All	11:35 – 12:00	25 min.
Meeting Adjourns	Ryan Blaney, SCE	12:00	

SAFETY FIRST!

LSC by Area

1 LSC: J. Stubblefield
Alt.: C. Floyd

2 LSC: B. Jones
Alt.: A. Vallejo

3 LSC: A. Guerra
Alt.: S. Robles

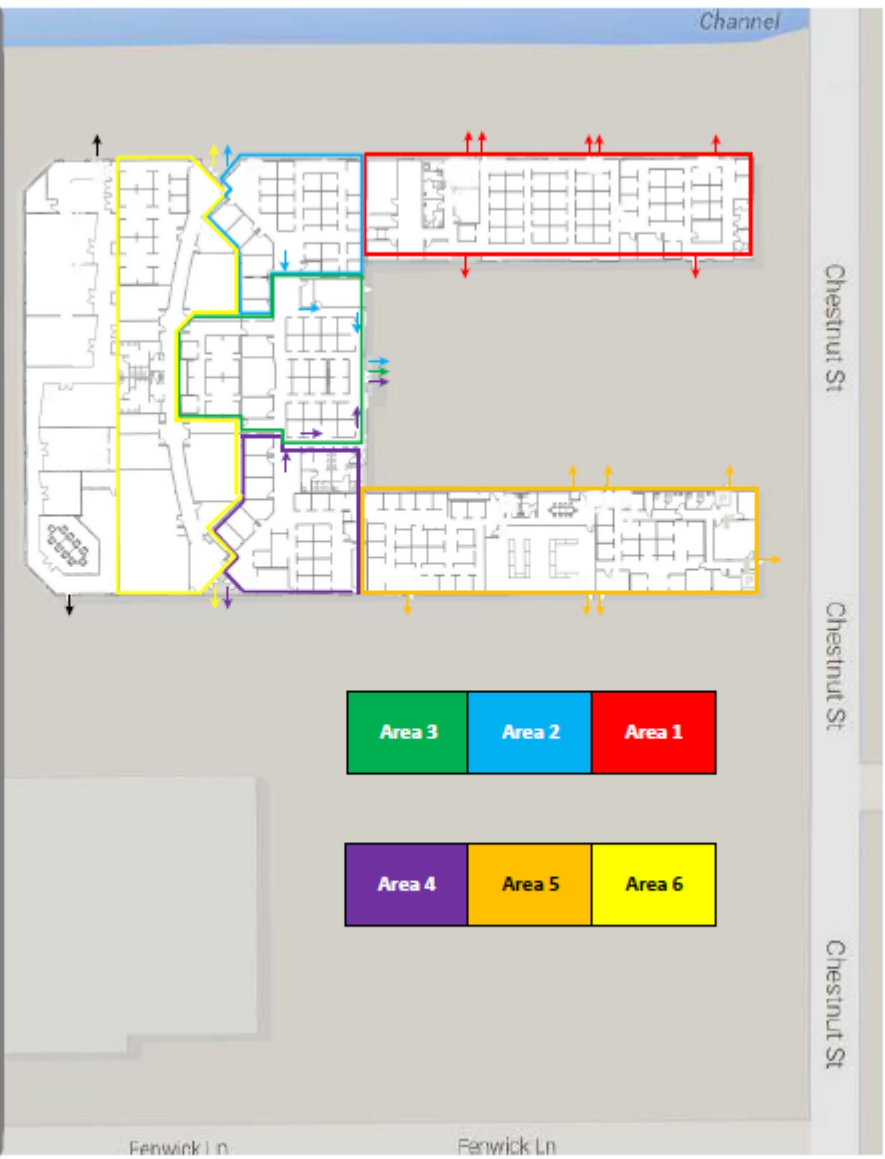
4 LSC: N. Coldivar
Alt.: N. Badayos

5 LSC: J. Davis
Alt.: J. Palma

6 LSC: TBD
Alt.: TBD

AT Labs LSC: T. Henricks
WCF Labs LSC: C. Clarke / J. Hernandez
Lead LSC: B. Baradaran
Backup Lead: J. Davis

Emergency Response Coordinator (ERC)
L. O'Neill
Alt:
K. Garcia / D. Wong / D. Bauren



FENWICK PLAZA EVACUATION ROUTE

SAFETY FIRST!

PLEASE JOIN ME IN A
MOMENT OF SILENCE
TO REMEMBER OUR
FALLEN COLLEAGUES

Meeting Purpose

Review draft IOU investment plans for proposed EPIC 3 projects to be filed to the CPUC in the Third Triennial EPIC Investment Plan Application by May 1, 2017

Gain informal, oral public stakeholder comments to be considered in the EPIC 3 Applications during meeting

Contribute to ongoing coordination and understanding among administrators, stakeholders, interested parties, and the California Public Utilities Commission (CPUC), while also raising awareness and visibility of EPIC investments and promoting EPIC program transparency

CPUC INTRODUCTION

Presented by

David Huang, Lead Analyst

California Public Utilities Commission

CEC EPIC 3 INVESTMENT PLAN PROCESS

Presented by

Fernando Pina, Manager

*California Energy Commission, Energy Research and
Development Division*



California Energy Commission Research & Development EPIC Program Overview

Fernando Pina

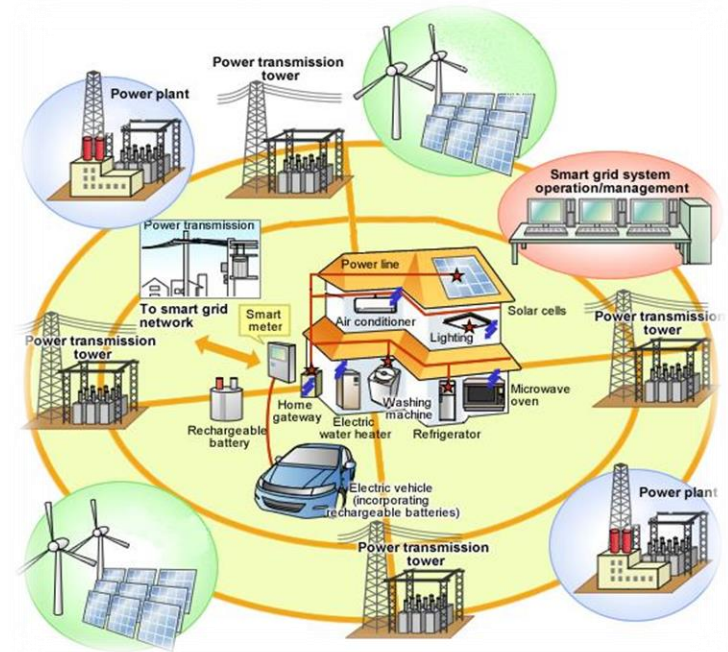
March 24, 2017



CEC Administered EPIC Funding

Approximately \$120 M/year

- **Applied Research**
 - Energy Efficiency
 - Clean Generation
 - Smart Grid
 - Cost Share for Federal Awards
- **Technology Demonstration and Deployment**
 - Energy Efficiency and Demand Response
 - Clean Energy Generation and Deployment
 - Integration of EE, DR, DG and Smart Grid
 - Cost Share for Federal Awards
- **Market Facilitation**
 - Entrepreneurial support and assistance
 - Innovative local strategies
 - Streamlined customer adoption



More info at:
www.energy.ca.gov/research/epic/index.html



Development of Energy Commission EPIC 2018-2020 Investment Plan Workshops

- **Distributed Energy Resources – March 13th**
California Energy Commission
- **Joint EPIC Workshop – March 14th**
California Energy Commission
- **Climate Change – March 16th**
California Energy Commission
- **Targeted R&D for Disadvantaged Communities – March 20th
and March 27th**
Fresno (20th); Los Angeles Cleantech Incubator Campus (27th)



EPIC Resources

Filing Comments for EPIC 2018-2020 Investment Plan:

<https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=17-EPIC-01>

EPIC Innovation Showcase:

<http://innovation.energy.ca.gov/>

Listserve Sign-up (to receive program updates via email):

<http://www.energy.ca.gov/research/epic/>

EPIC Funding Opportunities:

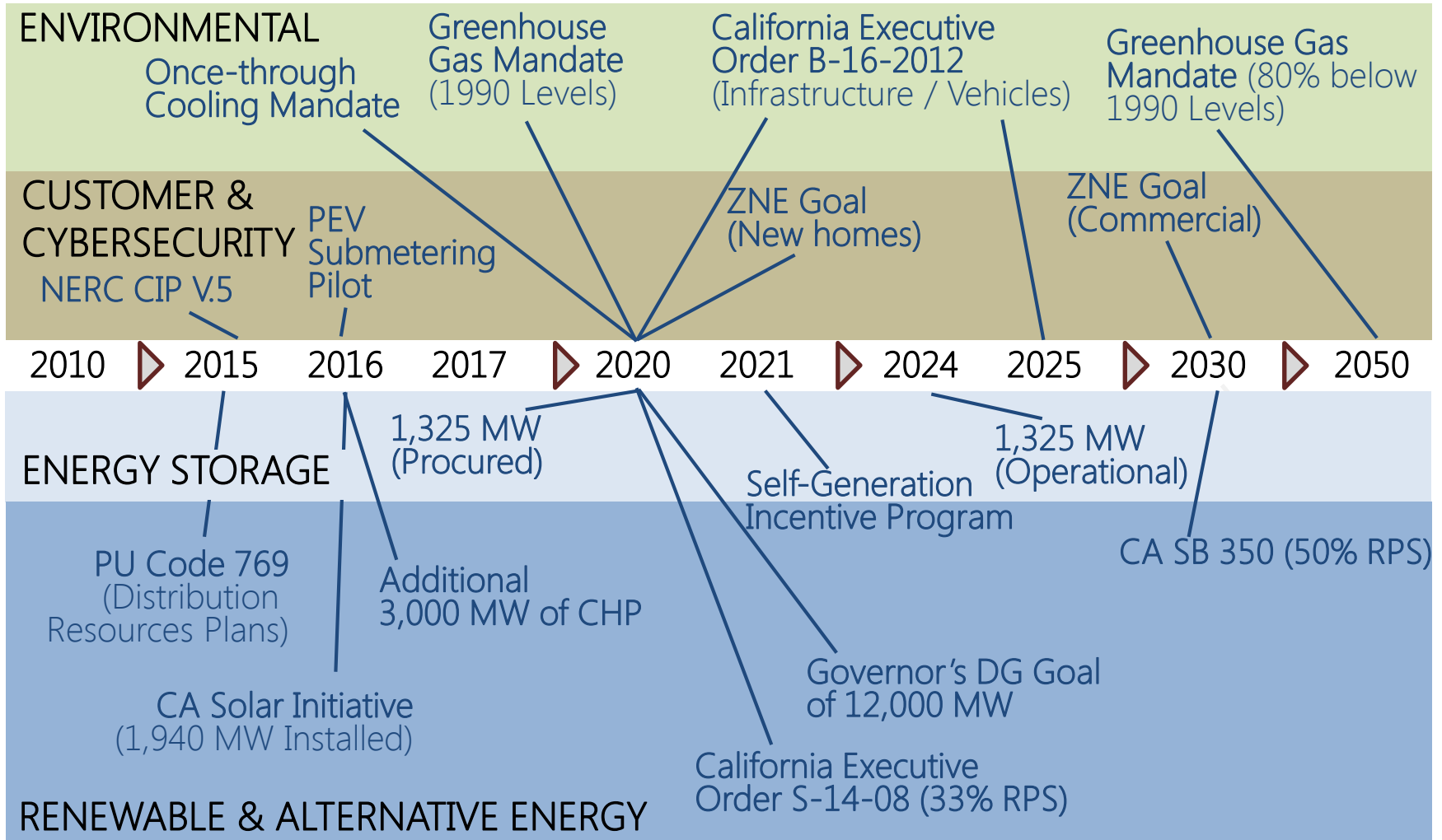
<http://www.energy.ca.gov/contracts/epic.html>

EPIC PROGRAM & POLICY OVERVIEW

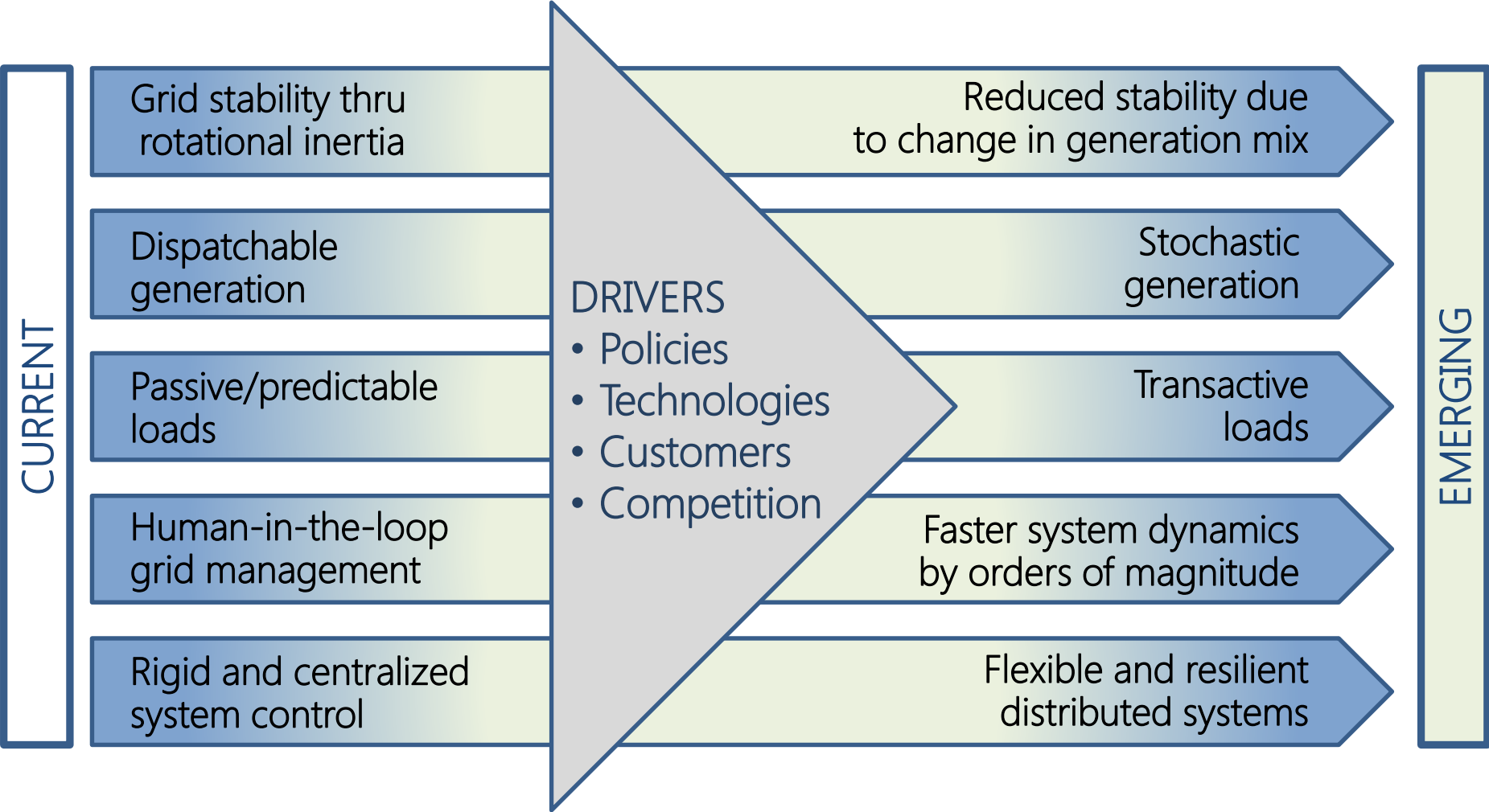


Presented by
Aaron Renfro, Regulatory Affairs
Southern California Edison

A Survey of California's Energy Goals



Electric Systems Face Fundamental Changes



The Electric Program Investment Charge

Funding & Allocation

- \$162M/yr in ratepayer funding (2013-2020)
- CEC administers 80% of the authorized budget; IOUs administer 20%

Approved Investment Areas

- Applied Research: \$55M/yr (CEC only)
- Technology Demonstration & Deployment
 - CEC \$45M, PG&E \$15M, SCE \$13M, SDG&E \$3M (/yr)
- Market Facilitation: \$15M/yr (CEC only)

Electricity System Value Chain

- Grid Ops / Mkt. Design
- Generation
- Transmission
- Distribution
- Demand-Side Mgmt

Select EPIC Requirements

- **EPIC Annual Report & Project Final Reports** – The EPIC Administrators’ annual report must include a final report on every project completed during the previous year, including a comprehensive description of the project, present detailed findings and results, a summary of all data collected and how the data may be accessed (D.13-11-025, OP 14)
- **Project Specific Approvals** – EPIC Administrators may only fund projects or initiatives that have been approved by the Commission (D.15-04-020, COL 11)
 - IOU Administrators must file a Tier 3 Advice Letter to make material scope changes or add new projects (D.15-09-005, OP 1)
- **Workshops & Symposiums** – EPIC Administrators shall hold workshops twice a year, both during the development of each investment plan and during its execution, to contribute to ongoing coordination and understanding among administrators, stakeholders, interested parties, and the California Public Utilities Commission (CPUC), while also raising awareness and visibility of EPIC investments and promoting EPIC program transparency (D. 12-05-037)
- **Intellectual Property** – Except when valid reasons exist for confidentiality, the EPIC Administrators must make available upon request all data, findings, results, computer models and other products developed, consistent with the treatment of intellectual property requirements (D.13-11-025, OP 13)
 - IOU Administrators must file a Tier 3 Advice Letter to request a project-specific intellectual property waiver (D.15-04-020, OP 18)

Investor Owned Utility EPIC Framework

	Safety	Affordability	Reliability	Key Drivers & Policies
Cross Cutting/Foundational Strategies & Technologies Smart Grid Architecture, CyberSecurity, Telecommunications, Standards	Renewables and Distributed Energy Resources Integration <ul style="list-style-type: none"> Demonstrate Strategies & Technologies to Increase Renewable Resources on the Grid Adaptive Protection Strategies Demonstrate Grid-Scale Storage Strategies & Technologies 			<ul style="list-style-type: none"> 33% RPS CSI Gov's 12,000 MW DG Plan OTC retirements SB 32 Storage Mandate
	Grid Modernization and Optimization <ul style="list-style-type: none"> Demonstrate Strategies and Technologies to Optimize Existing Assets Prepare for Emerging Technologies Design and Demonstrate Grid Operations of the Future 			<ul style="list-style-type: none"> Aging Infrastructure Workforce Development CA Economic Resiliency
	Customer Focused Products and Services Enablement <ul style="list-style-type: none"> Leverage the SmartMeter Platform to Drive Customer Service Excellence Provide Greater Billing Flexibility & Visibility Integrate Demand Side Management for Grid Optimization 			<ul style="list-style-type: none"> SB 350 CSI Peak Reduction Electric Transportation Vehicle-to-grid integration

EPIC Investment Plan Timeline

Timeline	Date
CEC & IOU Scoping Workshop/Webinar	February 3, 2017
EPIC Stakeholder Workshops	<u>PG&E</u> - March 9, 2017 <u>CEC</u> - March 14, 2017 <u>SCE</u> - March 24, 2017
File 3 rd Triennial EPIC Investment Plan	May 1, 2017

Questions



EPIC 3 SCE PROPOSED PROJECTS

Presented by

Ryan Blaney, EPIC Program Manager
SCE Emerging Technology Programs

Overview of SCE EPIC 3 Goals

Project proposals have been aligned with EPIC areas of focus. These include:

RENEWABLES & DER INTEGRATION:

(9) Project Proposal

GRID MOD & OPTIMIZATION

(10) Project Proposals

CUSTOMER PRODUCTS & SERVICES ENABLEMENT:

(3) Project Proposals

CROSS-CUTTING FOUNDATIONAL STRATEGIES:

(4) Project Proposals

Moreover, **Project Alignment** is sought with still developing SCE corporate strategies including:

- ❑ Clean Energy
- ❑ Electrification
- ❑ Grid/Grid Edge
- ❑ Customer Choice
- ❑ Departing Load
- ❑ Operational Excellence

SCE's Potential EPIC 3 Demonstration Projects

Renewables & DER Integration

- Storage Based Distribution DC Link
- Service Center of the Future
- Distributed Energy Resources Protection Demonstration
- Distribution State Estimation Under High DER Penetration
- DER Protection & Control of Distribution Networks
- Power System Voltage & VAR Control Under High Renewables Integration
- Predictive Distribution Reliability
- Grid Optimization of Advanced Technology with small hydro
- Tools & Technologies for Managing Secondary Systems

Grid Modernization & Optimization

- SA-3 Phase III Field Demonstration
- Reliability Dashboard
- Distribution Primary & Secondary Line Impedance
- Advanced Technology for Field Safety
- Next Generation Automation Distribution Automation, Phase III
- Distribution Optimal Power Flow
- Advanced Comprehensive Hazards Tool
- Reliability Dashboard Tools
- Control & Protection for Microgrids and Virtual Power Plants
- Next Generation Distribution Planning

Customer Focused Products & Services

- Vehicle to Grid Integration Using On-Board Inverter
- Energy Management Circuit Breaker
- Distributed PEV Charging Resources

Cross Cutting & Foundational Technologies

- Distributed Cyber Threat Collaboration
- Energy System Posturing
- Smart City Integration Platform Demonstration
- Integrated Grid Project Phase 3

Substation Automation (SA) 3 Phase III Field Demonstration

Concern, Problem, or Gap to be Addressed

- The goal of this project is to successfully demonstrate a modern substation automation systems for transmission substation by adopting scalable technology that enables advanced functionality to meet NERC CIP compliance and IT cybersecurity requirements.

Technology or Strategy to be Demonstrated

- Peer to Peer communications for protection schemes (GOOSE Messaging)
- High Availability network design for devices
- Demonstrate a new substation annunciator system (among others).

EPIC Primary or Secondary Principles Met

- This project provides electricity ratepayer benefits and supports EPIC's primary principles of promoting greater reliability and lower costs by utilizing newer technologies to reduce wiring, installation cost, and automating manual processes where possible.

Reliability Dashboard Tools (Reliability Analyzer & Outage Explorer)

Concern, Problem, or Gap to be Addressed

- Increasing the quality, accuracy, speed, ease of use, and accessibility of reliability analytic tools will lead to improve reliability, as measured by SAIDI and SAIFI metrics and reduction in CMI.

Technology or Strategy to be Demonstrated

- This project will demonstrate methods to optimize existing reliability dashboard tools (Reliability Analyzer and Outage Explorer) including: 1) the addition of internal data sets; 2) exploring the addition of internal or external algorithms or signatures; 3) automating data feeds; and 4) improving access to SCE users, such as through a web or portal link.

EPIC Primary or Secondary Principles Met

- This project provides electricity ratepayer benefits and supports EPIC's primary principles of promoting greater reliability and lower costs by providing SCE with a tool that can inform the optimal design and mitigation strategies to make the grid more reliable.

Distributed Cyber Threat Collaboration

Concern, Problem, or Gap to be Addressed

- Current cyber practice is for individual Security Operations Centers (SOCs) to gather data and perform the analyses with almost no external collaboration due to analysts needing to be on-site to have access to investigatory data.

Technology or Strategy to be Demonstrated

- This project will leverage the new STIX v2 standard data structure by the Department of Homeland Security and being advanced by the Organization for the Advancement of Structured Information Standards to automate the exchange of investigatory data and improve the response to cyber events.

EPIC Primary or Secondary Principles Met

- This project supports EPIC's guiding principle to provide electricity ratepayer benefits (i.e., improved system reliability and increased safety) by demonstrating the effectiveness of shortening the response time to address cyberattacks.

EPIC 3 PG&E PROPOSED PROJECTS

Presented by

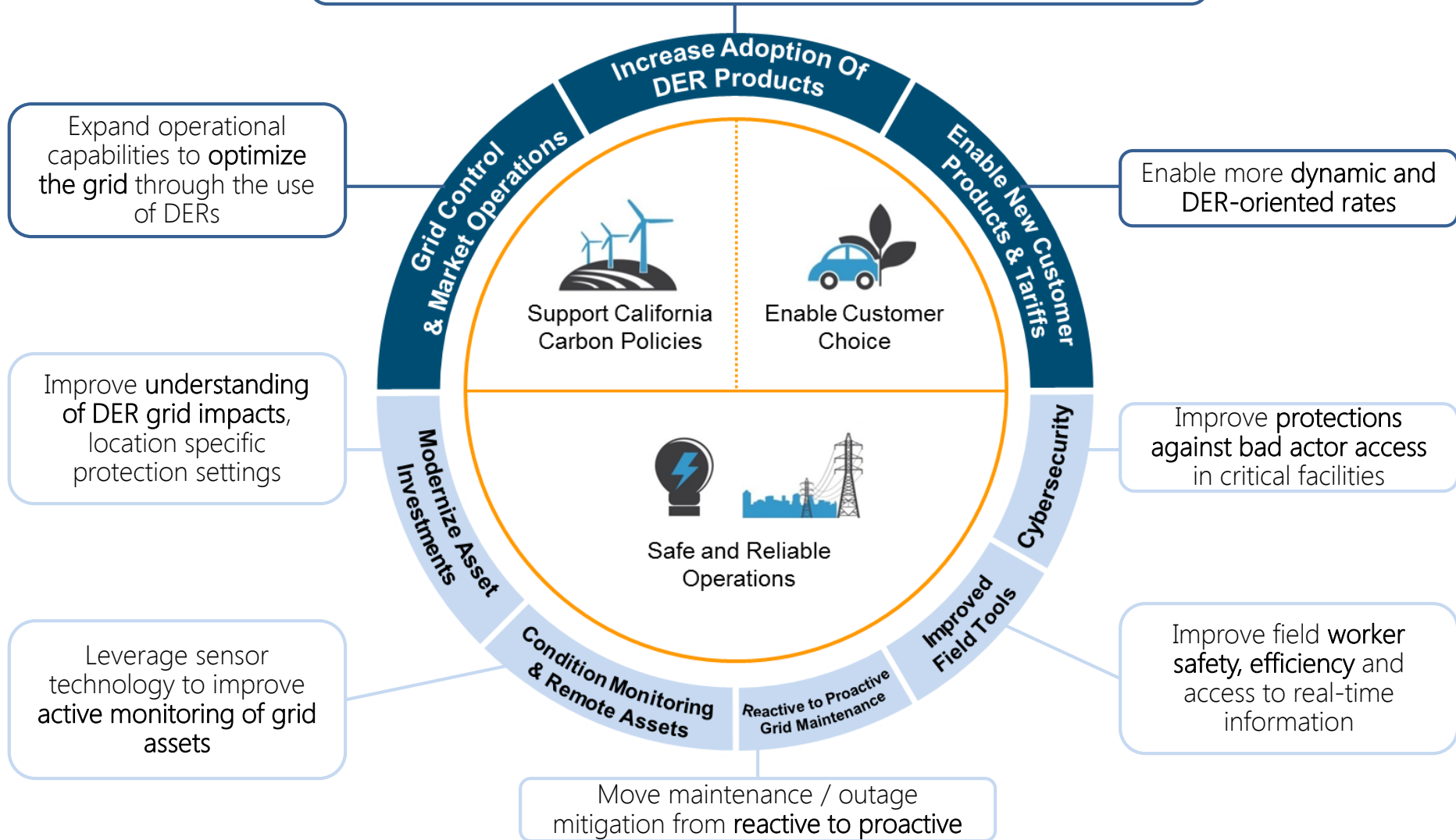
Julie Cerio, EPIC Portfolio Manager

PG&E Electric Operations Emerging Technology Programs



PG&E EPIC 3 Portfolio Overview

Enhance program targeting and combinations of DER technologies to enable easier IDER / IDSM adoption; Increase adoption of EV and Storage



PG&E's Potential EPIC 3 Demonstration Projects

Renewables & DER Integration

- DERMS and/or ADMS Advanced Functionality
- Distribution Market Services Technology, incl. Utility Aggregated Resources with Market Participation
- Volt-Var Optimization w/Automatic Smart Inverter Control & for Transmission Reactive Power Needs
- Person to Person Transactive Energy Market
- Auto Identification of Behind-the-Meter Storage
- Utility Scale Storage For Load Balancing
- Second Life Batteries For Grid Needs

Grid Modernization & Optimization

- Field Area Network (FAN) with Transformer Health & Equipment Monitoring
- Drone-based Field Asset Inventory & Condition-based Monitoring
- Micro-Phasor Measurement Units (PMUs) for Enhanced DER Support and Grid Operations
- Adaptive Voltage & Protection Settings
- Dynamic DER Forecasting / High DER Grid "What If" Engine
- Short Term Risk Based Asset Planning

Customer Focused Products & Services

- Real Time Pricing & DER Rate
- DER Tariff With Advanced Metering
- Proactive Meter Replacement
- Community Energy Resilience Service (CERS)
- Single Meter Multiple DER Controls

Cross Cutting & Foundational Technologies

- Cyber-Physical Integrated Security
- Local Wireless Security For Critical Facilities
- Advance Security of IoT Communications
- Augmented Reality for Asset Investigation/Maintenance
- Voltage Checks for Field Workers
- Advanced Field Reference Tool
- Utility Drone Flight Management/Charging
- Address System Harmonics Due to Inverter-Based DG
- Automatic Detection & Reporting of Distance to Fault
- Outage for Restoration Work Plans
- Abnormal State Configuration Risk & Mitigations
- Predictive Maintenance to Detect Cable Failure / Loose Neutrals
- Reactive to Proactive Vegetation Management

Reactive to Proactive Vegetation Management

Concern, Problem, or Gap to be Addressed

- PG&E service territory spans great diversity in vegetation, weather patterns, and terrain
- Current processes use historical data to allocate vegetation management resources, and arborists to physically patrol power lines to identify vegetation maintenance needs

Technology or Strategy to be Demonstrated

- Prescriptive data analytics tool for modeling tree growth rate and historical vegetation related outages to recommended proactive, targeted mitigations
- Leverage LiDAR and other remote sensing data for reliability planning, vegetation management and resource allocation

EPIC Primary or Secondary Principles Met

- Reliability
- Affordability
- Safety

Distributed Energy Resource Management System (DERMS) and/or Advanced Distribution Management System (ADMS) Advanced Functionality

Concern, Problem, or Gap to be Addressed

- DERMS is currently limited to subset of Distributed Energy Resources (DERs), including Behind-the-Meter Storage and Smart Inverters (PV)
- Limited scalability of current partially-automated processes for load shedding, curtailing generation, and dispatching field crews for increasing penetration of DER and Demand Response (DR) assets (requiring human monitoring and analysis)

Technology or Strategy to be Demonstrated

- Leverage DERMS to facilitate enhanced visibility and control over DERs and other grid assets
- Incorporate additional technologies into DERMS and increase DER coordination through aggregation for optimized dispatch that supports reliability and cost deferral efforts

EPIC Primary or Secondary Principles Met

- Reliability
- Affordability
- The Loading Order

Drone Enablement – Utility Drone Flight Management & Drone Charging

Concern, Problem, or Gap to be Addressed

- Unmanned fleets could improve the efficiency and safety of grid surveillance; however, protocols and supporting technology needed to control high volume drone operations do not yet exist for utility use cases
- Unmanned aerial vehicles can travel unobstructed, but cannot travel long distances without needing to recharge.
- Automated flight patterns are needed to pre-plan and automatically deploy drones for utilities maintenance and operations

Technology or Strategy to be Demonstrated

- Drone Flight Management System (FMS) to design flight operations for utility use cases (such as patrol, inspection, security and repair of utility assets), improving the safety and efficiency of these operations
- Unmanned aerial vehicles with transmission line power harvesting capabilities (such as line based charging stations or magnetic field charging) to enable long-line inspection

EPIC Primary or Secondary Principles Met

- Safety
- Reliability

EPIC-3 SDG&E PROPOSED PROJECTS

Presented by

Frank Goodman, SDG&E EPIC Program Manager
SDG&E Electric Transmission and Distribution
Engineering Department



Overview of SDG&E's Approach for EPIC Projects

Fundamental Approach for All Projects

- Obtain CPUC approval of projects
- Write project plan, perform the work, and document in final report
- Three options for doing demonstrations that meet budget constraints of EPIC:
 - Perform work in a laboratory
 - Piggyback on existing or planned capital assets
 - Demonstrate system solutions that use existing data bases

EPIC-3 Project List

- Advanced metering infrastructure (AMI) as an operational tool
- Energy storage technology performance evaluation
- Integration of battery systems and photovoltaics in utility operations
- Port of San Diego—mobile battery project
- Safety training simulators and augmented network visualization
- Unmanned aircraft systems (drones) with advanced image processing
- Light rail integration with used EV batteries

SDG&E's Potential EPIC-3 Demonstration Projects

Shown by primary category; some projects map to more than one category.

Renewables & DER Integration

- Integration of battery/PV systems into utility operations
- Energy storage technology performance evaluation (Vanadium Redox Flow Battery vs. Lithium Ion)

Grid Modernization & Optimization

- AMI as an operational tool
- Safety training simulators with augmented visualization
- Unmanned aircraft systems (drones) with advanced image processing
- Light rail integration with used EV batteries

Customer Focused Services

- Port of San Diego—mobile battery project

Port of San Diego—Mobile Battery Project

Concern, Problem, or Gap to be Addressed

- The Port of San Diego has a strategic Port designation and must be ready to turn over facilities to the Army within 24 hours during emergencies. This battery system could offer support during these situations.
- The battery system could be mobile and transportable to other applications during other periods. This multi-use approach would create a “stackable” value stream for the battery to solve multiple problems in a cost-efficient manner.

Technology or Strategy to be Demonstrated

- This project will perform operational and staged testing of a battery system in the Port and other applications to develop and document alternative scenarios for viable multi-use battery applications.

EPIC Primary or Secondary Principles Met

- AB628 Energy Management Plan (EMP), clean energy, customer choice, operational excellence

Energy Storage Technology Performance Evaluation

Concern, Problem, or Gap to be Addressed

- Vanadium Redox Flow (VRF) Batteries are an alternative to more conventional battery technologies that are being deployed. VRF battery systems offer the prospect of better suitability for some use cases and duty cycles.
- A comparative demonstration is needed to determine the advantages and disadvantages of VRF and Lithium-Ion batteries in various situations.

Technology or Strategy to be Demonstrated

- This project will perform operational and staged testing of VRF and Li-Ion battery systems, using consistent test procedures to create a basis for performance comparison and understanding the differences for integration into utility operations.

EPIC Primary or Secondary Principles Met

- State energy storage, renewable portfolio, and distributed resource planning (DRP) mandates

Light Rail Integration with Used EV Batteries

Concern, Problem, or Gap to be Addressed

- Many Post-EV stationary energy storage applications require extensive refurbishment and integration costs to meet their non-transportation requirements. Also, dynamic electric rate communications pathways for EV charging can provide price signals for customer-owned stationary and V2G battery discharge optimization.

Technology or Strategy to be Demonstrated

- Stationary installation of used battery packs and existing OEM hardware will be tested to provide electric services for light rail, such as: Energy efficiently (downhill & arrival regenerative breaking); Demand mitigation (uphill and departure demand); and Renewables integration (dynamic price optimization).

EPIC Primary or Secondary Principles Met

- Reliability, Affordability, and Safety

Q & A

Written Comments

Please provide written comments by March 31st for both PG&E and SCE workshops to the following contacts:

- SCE : SCEEPICProgram@sce.com
- PG&E: EPIC_info@pge.com
- SDG&E : FGoodman@semprautilities.com

IOU Contact Information

- SCE EPIC Information and Contacts:

- EPIC Website: www.sce.com/epic
- Email: Advancedtechnology@sce.com

- PG&E EPIC Information and Contacts:

- EPIC Website: www.pge.com/epic
- Email: EPIC_info@pge.com

- SDG&E EPIC Information and Contacts:

- EPIC Website: www.sdge.com/epic
- Email: FGoodman@semprautilities.com