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TN #:	216526
Document Title:	Actions and Planned EPIC DER Research Activities
Description:	Presentation for Distributed Energy Resources Scoping Workshop
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CALIFORNIA ENERGY COMMISSION

Distributed Energy Resources Scoping Workshop

Actions and Planned EPIC DER Research Activities

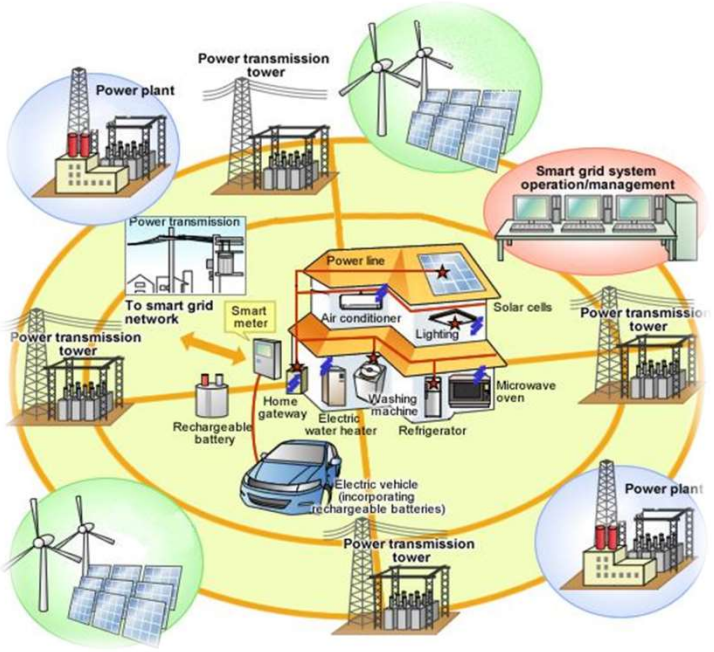
Mike Gravely

March 13, 2017

EPIC Funding

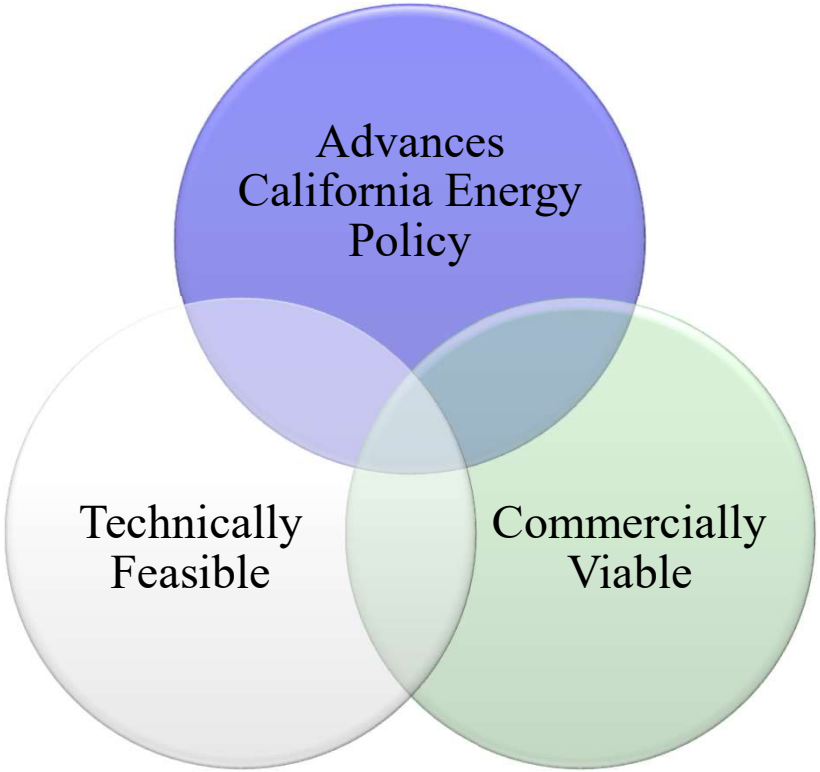
EPIC Funding: Approximately $120 M/year

- **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**
  - Regulatory Assistance
  - Workforce Development
  - Supporting Entrepreneurs



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

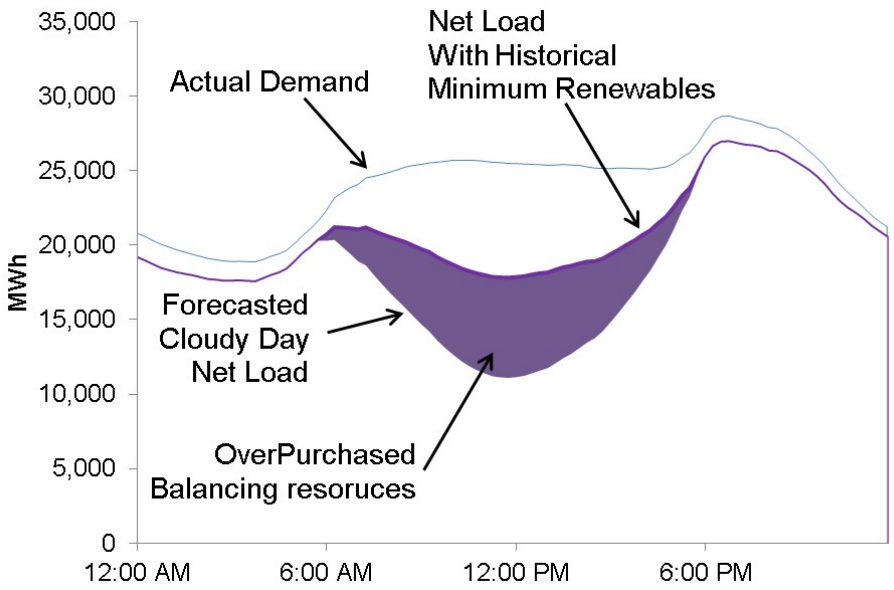
Advancing California's Energy Innovation Ecosystem



EPIC First and Second Triennial Investment Plans DER Activities

Value of Grid Services

Itron, Inc. dba IBS- *Improving Solar & Load Forecasts: Reducing the Operational Uncertainty Behind the Duck Chart*

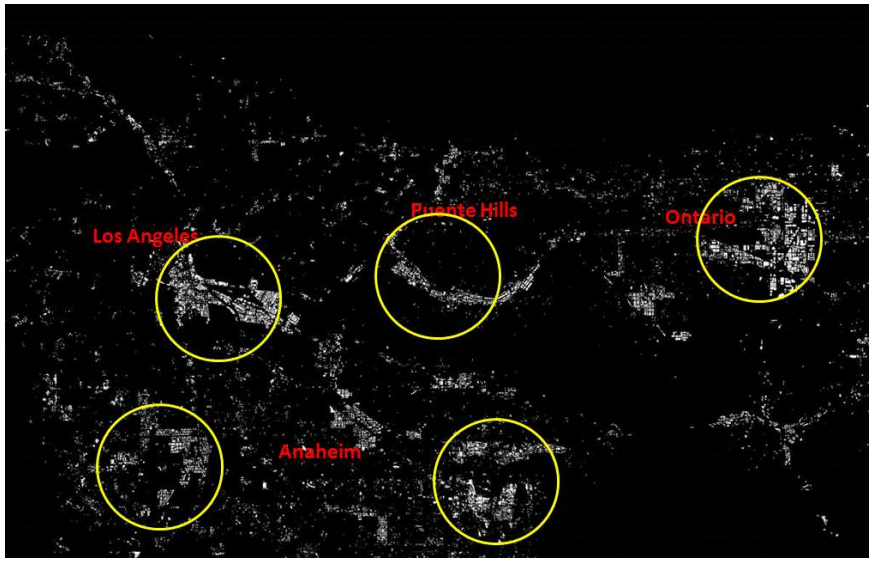


Over purchase of balancing resources due to forecast error on a cloudy day in 2020

- Improve solar PV and net load forecasts to reduce operational uncertainty for CAISO
- Produce high accuracy forecasts and link them to net load forecasts at higher temporal resolutions
- Enable better integration of intermittent PV generation and lead to savings in regulation and spinning reserve costs

EPIC Funding: $998,926
Match Funding: $453,462

Regents of the University of California, San Diego- *Solar Forecast Based Optimization of Distributed Energy Resources in the LA Basin and UC San Diego Microgrid*



View of LA Basin with warehouses highlighted in black. Yellow circles represent typical field of views of a sky imager

EPIC Funding: $1,000,000
Match Funding: $164,710

- Integrate solar forecast tools with DERs to increase value
  - Energy storage
  - EV charging integration
  - Demand response
- Utilize ground instrumentation, such as sky imagery, in short-term forecasting
- Provide high ramp-forecasting accuracy with rapid-update and high resolution data features

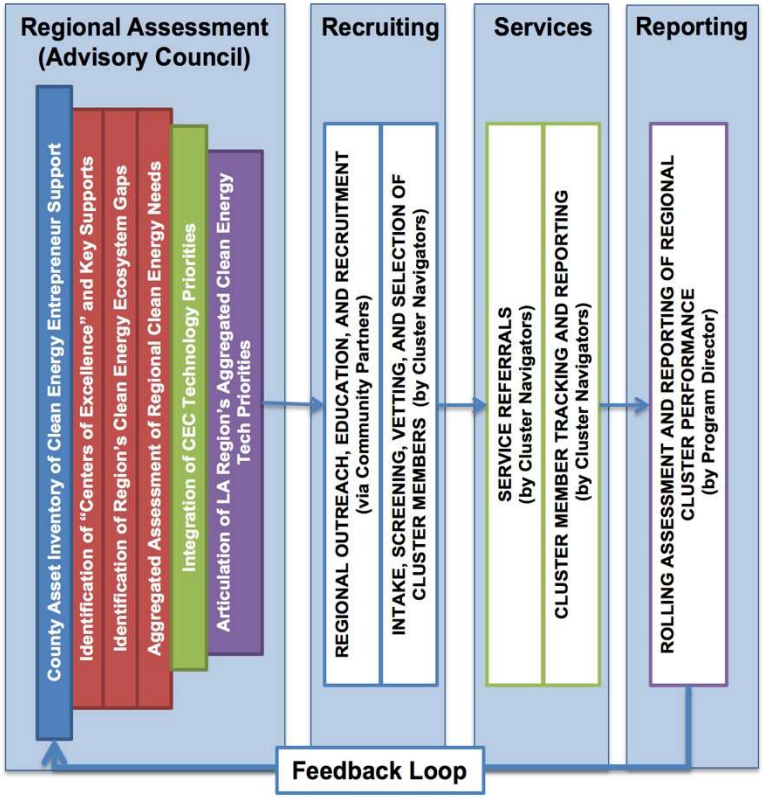
The College of San Mateo Internet of Energy (IoE) Project- *The Next Generation of Community Grid Control Services*

The College of San Mateo campus where the networked energy system will be deployed

EPIC Funding: $2,999,601
Match Funding: $2,315,960

- Development of a networked energy system, integrating solar PV, electrical storage, and power electronics into a single module with College of San Mateo (CSM) grid control services.
- "Internet of Energy" describes the seamless operation of components on the CSM grid.
- PVS Module features leveraged solar (PV) + storage + power electronics functions over conventional PV and external battery storage

Los Angeles Cleantech Incubator, Inc.- *Los Angeles Regional Energy Innovation Cluster (LA REIC)*

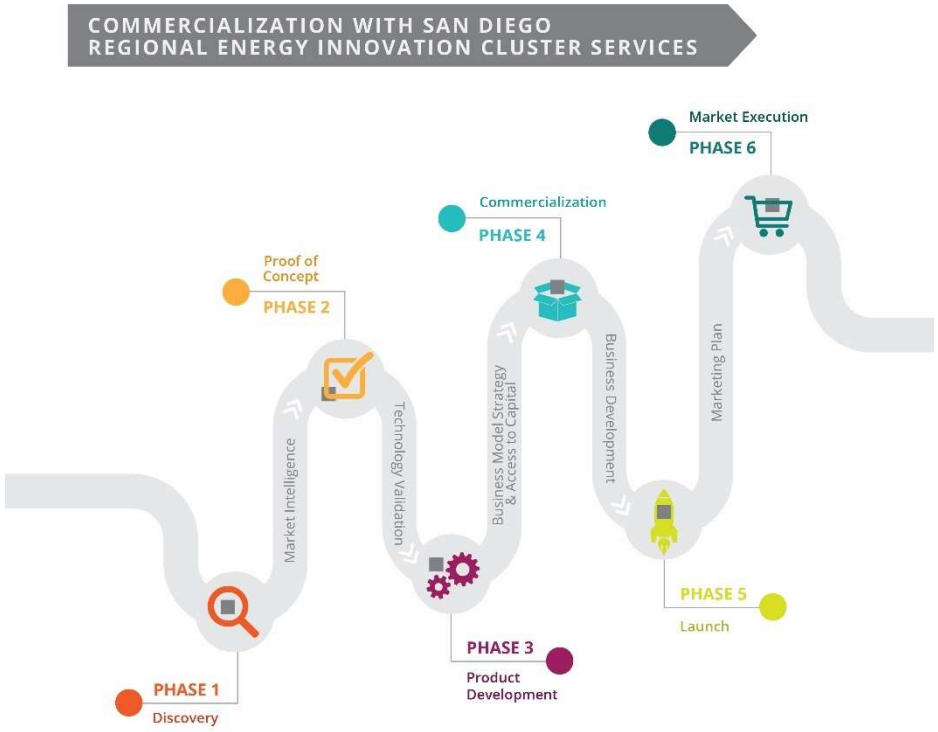


LA REIC service model relies heavily on the feedback loop.

- Conduct research and document region's energy needs
- Develop and commercialize clean energy technology
- Develop an outreach and commercialization support program for clean energy entrepreneurs
- Overcome region's barriers to achieving California's statutory energy goals

EPIC Funding: $4,999,247
Match Funding: $3,658,099

Cleantech San Diego- *San Diego Regional Energy Innovation Cluster*



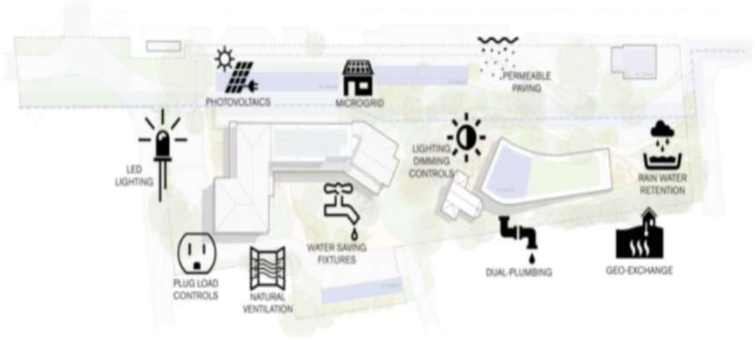
Pathway to commercialization with cluster services.

- Organize existing resources to deliver custom service plans to energy entrepreneurs in San Diego
- Overcome critical limitations to the development and commercialization of energy innovations
- Promote economic growth
- Help region meet statutory energy goals

EPIC Funding: $5,000,000
Match Funding: $3,087,760

Energy Commission Microgrid Experience
EPIC Challenge Projects

Berkeley Energy Assurance Transformation (BEAT) Project

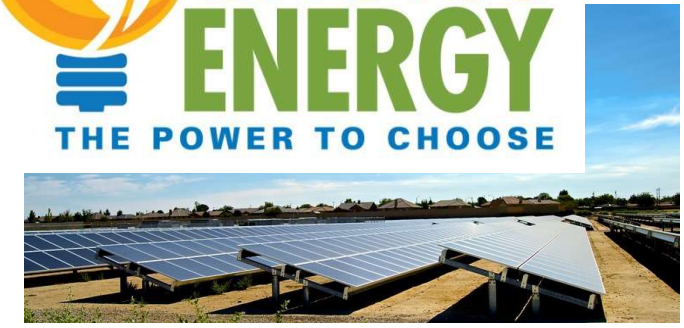


Peninsula Advanced Energy Community

Huntington Beach Advanced Energy Community Blueprint

Santa Monica Advanced Energy District

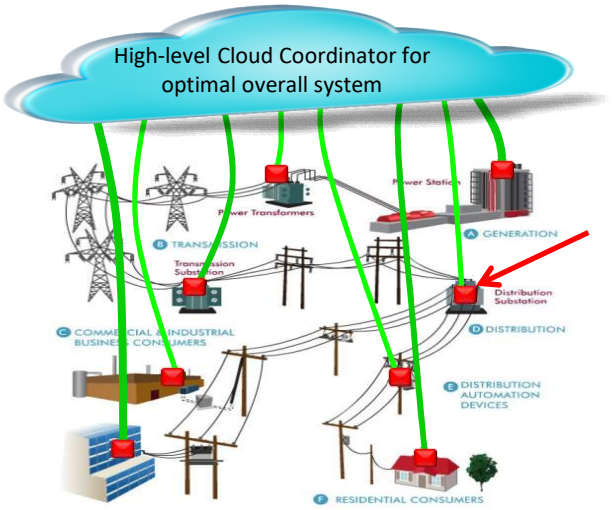
LANCASTER Choice ENERGY
THE POWER TO CHOOSE



Lancaster Advanced Energy Community (AEC) Project

DER Management Systems

Assessing the Capability and Value of Distribution Energy Resource Management Systems (DERMS



Low-level Hub: networked embedded intelligence to measure and control power flow, voltage, VAR and other grid attributes

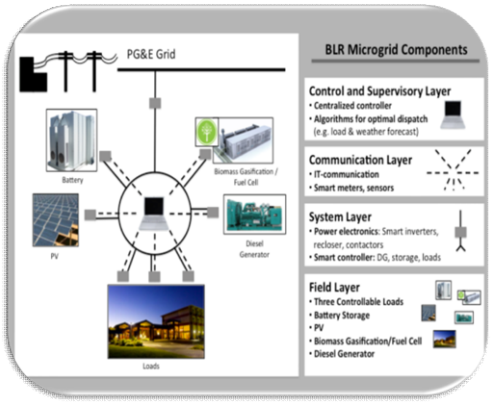
Powernet

Irvine DERMS

Energy Commission Microgrid Experience

Hospital Microgrid

Borrego Springs



Blue Lake Rancheria

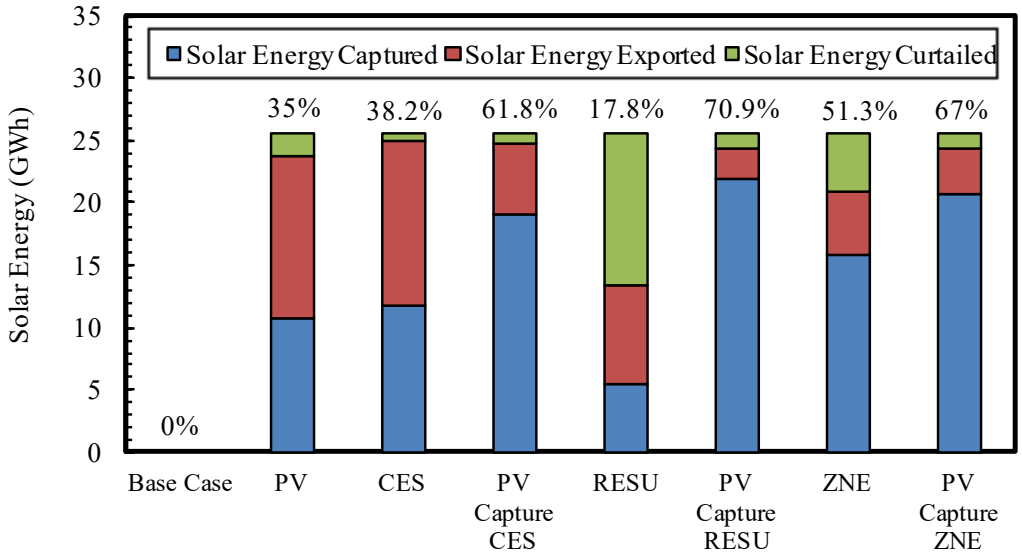
Bosch DC Microgrid

Las Positas Campus

City of Fremont Fire Station

Where and how to use DER to avoid or defer generation or grid investments

Regents of the University of California, Irvine- *Substation Automation and Optimization of Distribution Circuit Operations*



Breakdown of annual energy generated by PVs installed in smart residential buildings for various cases

EPIC Funding: $932,718
Match Funding: $112,281

- Explore implementation of a Generic Microgrid Controller at the substation
  - Enhance substation capabilities
  - Improve distribution system management
- Maximize the penetration of renewable resources and DERs
- Simulate and assess the deployment of fuel cells at the substation

The Zero Net Energy (ZNE) Alliance-

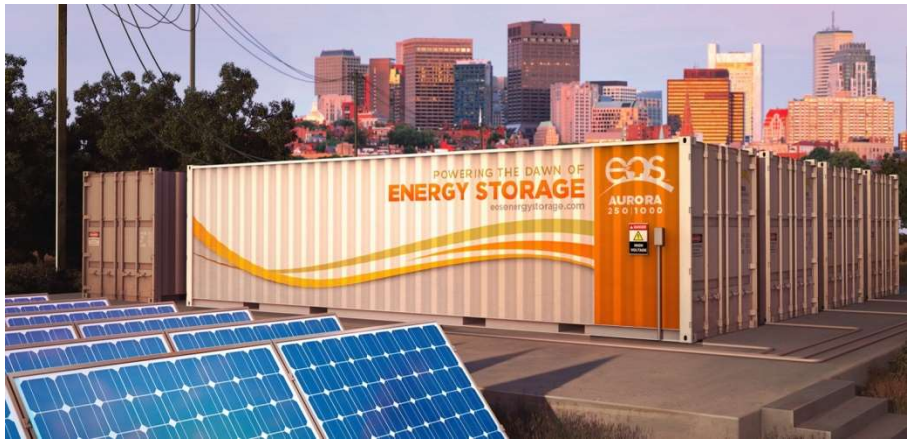
Lancaster Advanced Energy Community Project

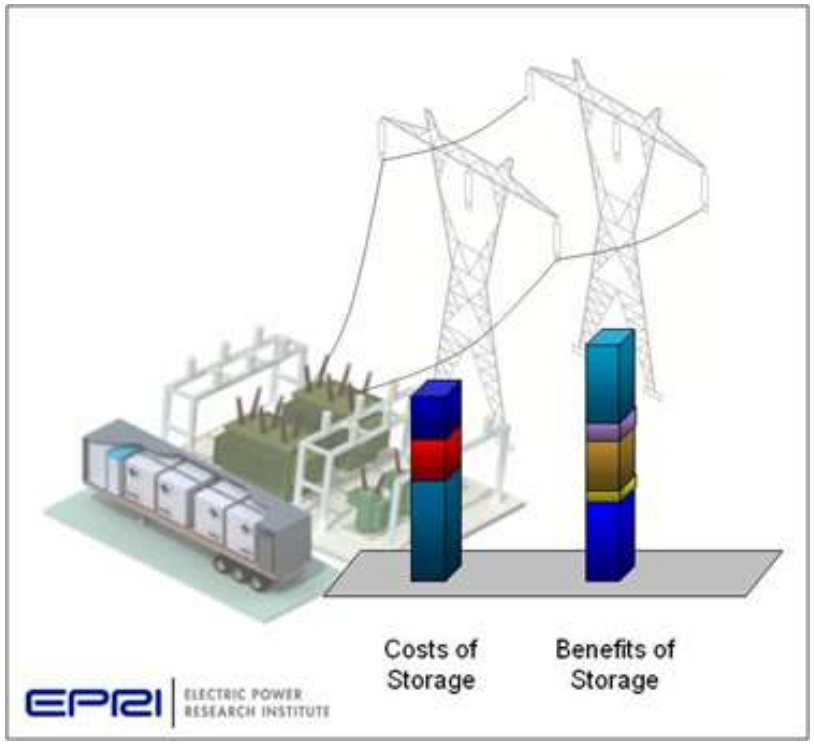
Identified sites for ZNE community and community DER demonstrations

- Address capital barriers facing stationary storage and EV adoption
- Develop a community DER valuation framework
  - Plan and permit:
  - Affordable housing project to be a ZNE microgrid
  - Public/private partnership community DER project
    - 4+ MW energy storage
    - 9+ MW solar
    - 30+ electric-buses

EPIC Funding: $1,469,779
Match Funding: $1,500,000

Moving Grid Storage from Emerging Technologies to Commercialization

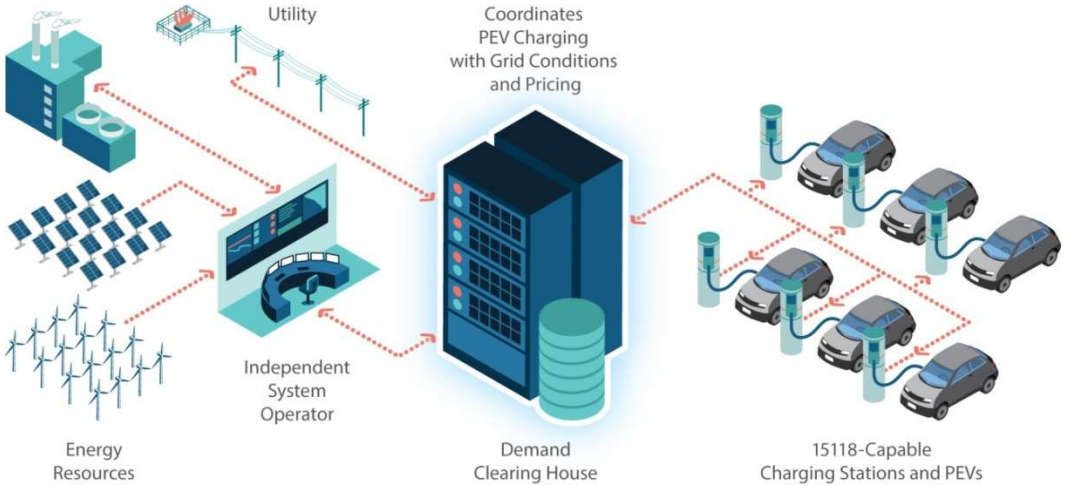




Assessing where and how DERs may be used to avoid or defer generation or grid investments

Electric Vehicles

Center for Sustainable Energy- *Vehicle-Grid Integration in California Using the ISO/IEC 15118 Global Interoperability Standard*

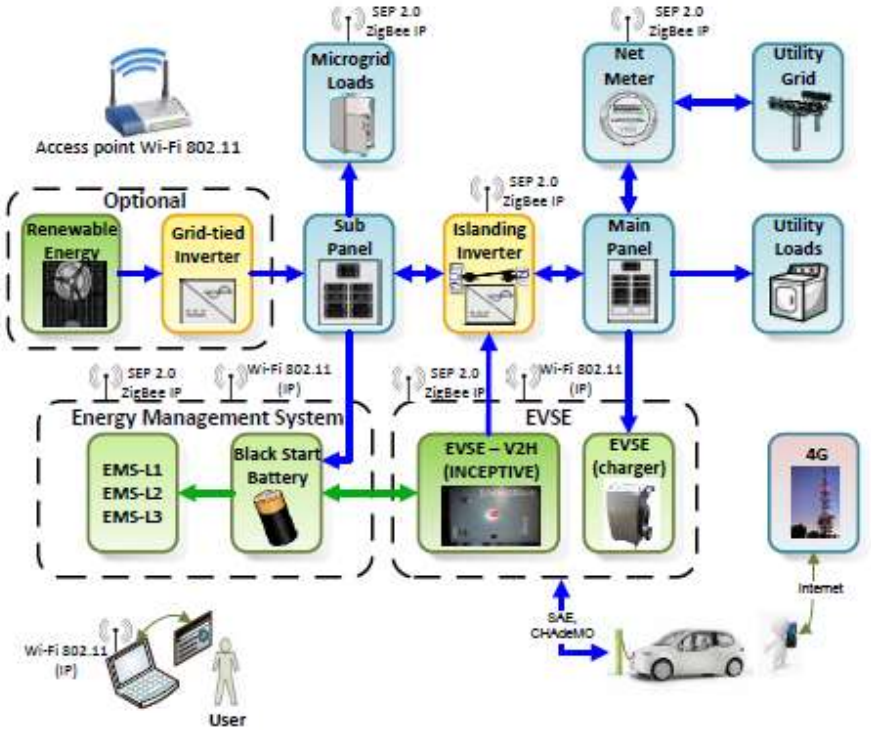


Demand Clearing House (DCP) schematic

EPIC Funding: $1,499,999
Match Funding: $100,000

- Develop the world's first standards-based communication platform that directly incorporates the internationally recognized ISO 15118 standard
- Provide the mechanism necessary to successfully manage millions of PEVs
- Consolidate data from multiple inputs and generate grid profiles based on pricing and system constraints

Andromeda Power, LLC- *Grid Communication Interface for Smart Electric Vehicle Services Research and Development*



InCISIVE bidirectional infrastructure

- Develop a communication interface that allows utilities to send dispatch signals to PEVs of any standard in "real time"
- Design communication interface to accommodate the value of current and future grid services
- Develop a data warehouse strategy for the collection of data from applicable sources

EPIC Funding: $681,693
Match Funding: $465,000

What Plug-In Electric Vehicles (PEVs) and Plug-In Hybrid Electric Vehicles (PHEVs) are in the V2G fleet?

U.S.ARMY U.S. AIR FORCE

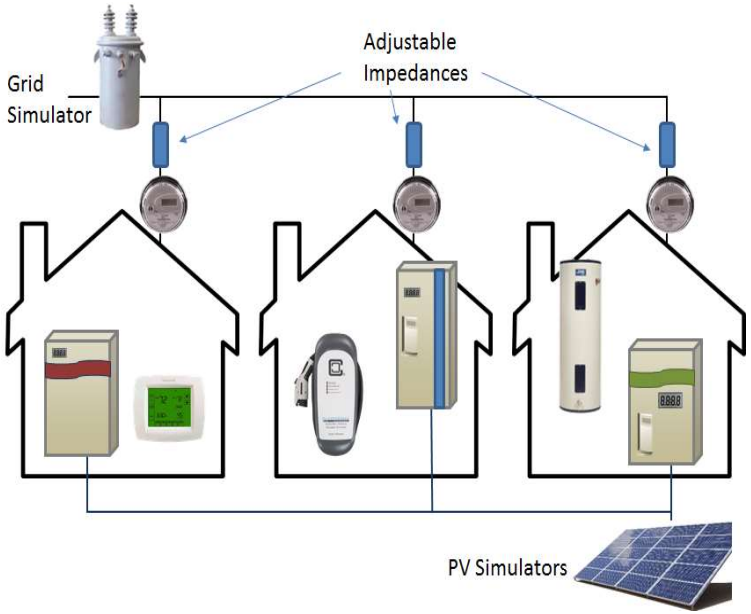
	 Nissan LEAF Sedan	 Ford F-Series Trucks with EVAOS PHEV kits	 VIA Motors VTRUX Van	 Electric Vehicle International (EVI) Range Extended Electric Vehicle (REEV)	 Phoenix Motorcars Electric Shuttle
Range Description 	PEV electric range: 75 miles fuel efficiency: 99 MPGe	PHEV electric range: N/A fuel efficiency: 45 MPG**	PHEV* electric range: 31 miles fuel efficiency: 38 MPG**	PHEV* electric range: 40 miles fuel efficiency: 43 MPG**	PEV electric range: 100 miles fuel efficiency: 32 MPGe
General Purpose Fleet Role 	23.6 cubic feet cargo capacity	1500 to 2800 lbs payload	2650 lbs payload (cargo van only)	5300 lbs payload	116 cubic feet cargo capacity
	5 seats	3 seat standard cab 6 seats crew cab	2 seat cargo 12 seat passenger	2 seats	visitor transport: 12 passengers + driver
Battery Capacity 	24 kWh	27 kWh	21 kWh	54 kWh	102 kWh
# at Locations 					
LAAFB	13	5	9	4	1
Fort Hood	5	14	---	---	---
JB Andrews	4	5	---	---	---
JB MDL	---	8	---	---	---

Miles per gallon (MPG), Miles per gallon equivalent (MPGe), Kilowatt-hours (kWh)
Los Angeles Air Force Base (LAAFB), Joint Base Andrews (JB Andrews), Joint Base McGuire-Dix-Lakehurst (JB MDL)

*Fuel used only when electric range exceeded
**Averaged over 60 miles

Smart Inverters

Electric Power Research Institute- *Assessing the Ability of Smart Inverters and Smart Consumer Devices to Enable More Residential Solar Energy*



Project configuration to be set up at ATS Laboratory

- Test optimal methods by which smart inverters can mitigate issues that limit local high penetrations of residential PV
  - Lab testing and field testing
- Identify how CA Rule 21 can be configured so that multiple smart invertors can work in harmony
- Identify how other consumer devices, EV charging, and storage can coordinate with smart inverters to further enable high-levels of PV penetration

EPIC Funding: $1,705,478
Match Funding: $891,414

SunSpec Alliance- *Smart Inverter Interoperability Standards and Open Testing Framework to Support High-Penetration Distributed Photovoltaics and Storage*

SunSpec certified smart inverter with open communication interface

EPIC Funding: $2,000,000
Match Funding: $2,066,875

- Transpose and implement a collection of smart inverters from seven different manufacturers into the grid to standardize smart inverter functions
- Operate 50 residences with PV, storage, and smart inverters in aggregate as a grid resource
- Develop CA Rule 21 test framework and test scripts as described in SIWG Phase 1 & 2 recommendations and open source software tools to enable product development and safety testing

Lawrence Berkeley National Laboratory-

Demonstration of Integrated Photovoltaic Systems and Functionality Utilizing Advanced Distribution Sensors

FLEXLAB simulator facility

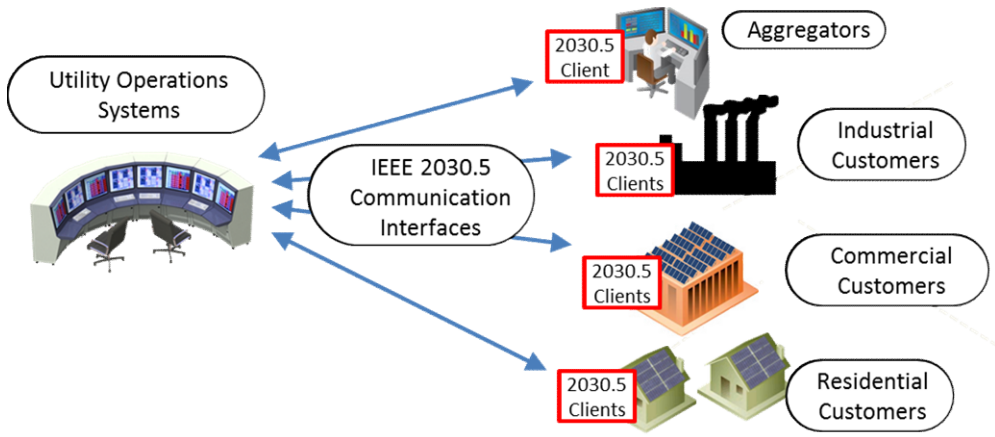
EPIC Funding: $1,000,000
Match Funding: $25,000

- Use smart inverter control to optimize generation and grid support with Phase 1 functions
- Test advanced PV and storage system at LBNL's FLEXLAB facility microgrid
  - 13-15 kW PV system
  - 14 kW battery storage
- Use micro-synchrophasor data to support visualization and control applications on distribution circuits, verify functions and how system is working

Data Communications

Electric Power Research Institute- *Certified*

Open-Source Software to Support the Interconnection Compliance of Distributed Energy Resources



IEEE 2030.5 Communication Client Plan in California

EPIC Funding: $816,539
Match Funding: $243,722

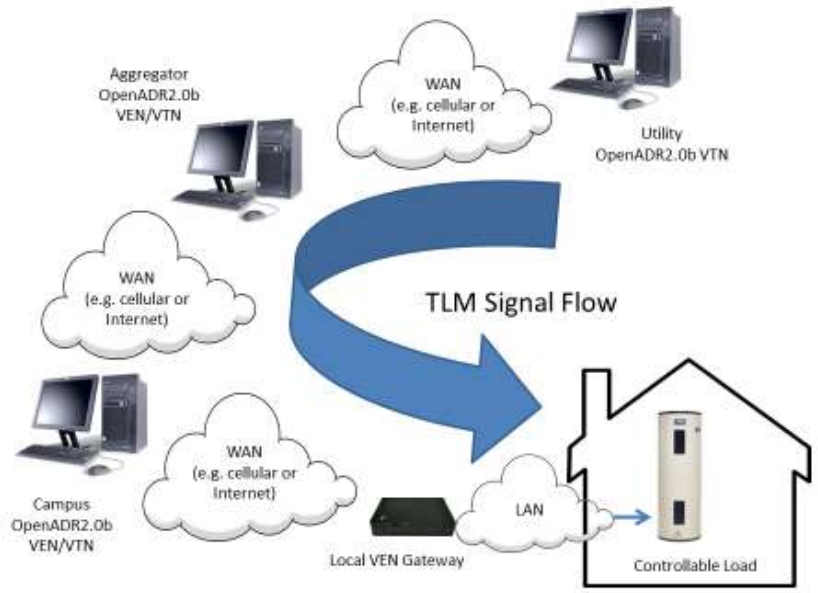
- Develop a free, open source communication software that is an IEEE P2030.5 client for smart DER meeting the Rule 21 requirements

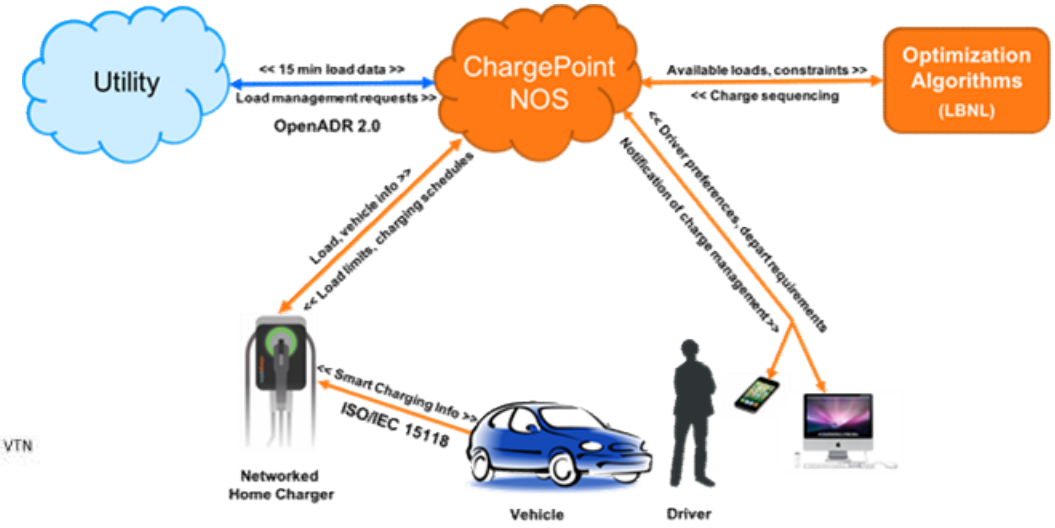
- Develop a IEEE 2030.5 certification test procedure associated test software/harness to make compliance testing available for the California Rule 21 Phase 2 requirements

Standardizing Communication Architectures Between the Grid and Electric Vehicles

Data Communications

Transactive Load Management for Demand Response





Electric Vehicles Next-Generation Grid Communication for Residential PEVs

EPIC Third Triennial Investment Plan Proposed Initiatives Supporting DER

Value of Grid Services

- S2.2: Push Low-Carbon Microgrids Closer to Commercial viability
- S2.3: Improve the business Proposition of Integrated Distributed Storage
- S3.2: Enable Electric Vehicle Grid Services
- S3.3: Increase the Value of Distributed Energy Resources and Renewables to the Transmission and distribution System
- S3.4: Define and Demonstrate the Locational Benefits and Optimal Configurations of Grid-Level Storage as the California Grid transitions to More Distributed Energy Resources
- S4.3 Increase the Strategic Value of Flexible CSP and Geothermal to the Electric System
- S8.2 Demonstrate Emerging Clean Energy Technology Solutions in Disadvantaged Communities

DER Management Systems

- S2.3: Improve the business Proposition of Integrated Distributed Storage
- S3.3: Increase the Value of Distributed Energy Resources and Renewables to the Transmission and distribution System

Where and how to use DER to avoid or defer generation or grid investments

- S2.2: Push Low-Carbon Microgrids Closer to Commercial viability
- S2.3: Improve the business Proposition of Integrated Distributed Storage
- S2.4: Incentive DER Adoption through Innovative Strategies at the local level
- S3.1: Accelerate Broad Adoption of Automated Demand Reponses Capabilities that Provide the Grid Flexible Response Services
- S3.3: Increase the Value of Distributed Energy Resources and Renewables to the Transmission and distribution System
- S3.4: Define and Demonstrate the Locational Benefits and Optimal Configurations of Grid-Level Storage as the California Grid transitions to More Distributed Energy Resources

Smart Inverters

- S2.3: Improve the business Proposition of Integrated Distributed Storage
- S3.3: Increase the Value of Distributed Energy Resources and Renewables to the Transmission and Distribution System

Electric Vehicles

- S2.3: Improve the business Proposition of Integrated Distributed Storage.
- S3.2: Enable Electric Vehicle Grid Services

Data Communications

- S3.1: Accelerate Broad Adoption of Automated Demand Reponses Capabilities that Provide the Grid Flexible Response Services
- S3.2: Enable Electric Vehicle Grid Services
- S3.3: Increase the Value of Distributed Energy Resources and Renewables to the Transmission and distribution System

New Technologies to Reduce Costs of IOU/CAISO Telemetry and Metering Requirements

- S2.3: Improve the business Proposition of Integrated Distributed Storage
- S3.1: Accelerate Broad Adoption of Automated Demand Reponses Capabilities that Provide the Grid Flexible Response Services
- S3.2: Enable Electric Vehicle Grid Services

CALIFORNIA ENERGY COMMISSION

Development of Energy Commission EPIC 2018-2020 Investment Plan Workshops

Joint EPIC Workshop – March 14th

California Energy Commission

Written comments:

This workshop is using an electronic commenting system for submitting written comments.

Stakeholders wishing to submit proposed funding initiatives for consideration should complete the form provided on the EPIC docket

webpage at:

http://energy.ca.gov/research/epic/17-EPIC-01/comment_directions.html

Written comments should be submitted by **5:00 p.m. on March 20, 2017.**

All written comments will become part of the public record of this proceeding.

Discussion