

DOCKETED

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TN #:	216526
Document Title:	Actions and Planned EPIC DER Research Activities
Description:	Presentation for Distributed Energy Resources Scoping Workshop
Filer:	Doris Yamamoto
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Distributed Energy Resources Scoping Workshop Actions and Planned EPIC DER Research Activities

Mike Gravely

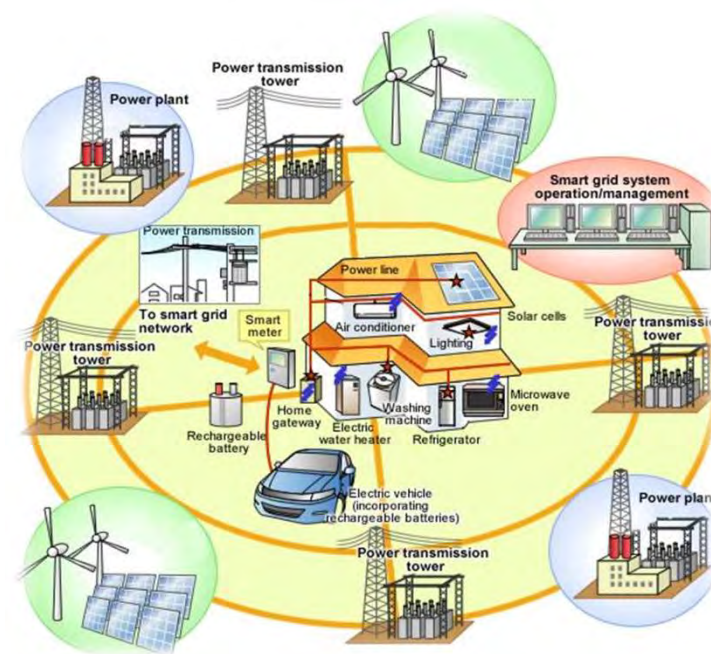
March 13, 2017



EPIC Funding

EPIC Funding: Approximately \$120 M/year

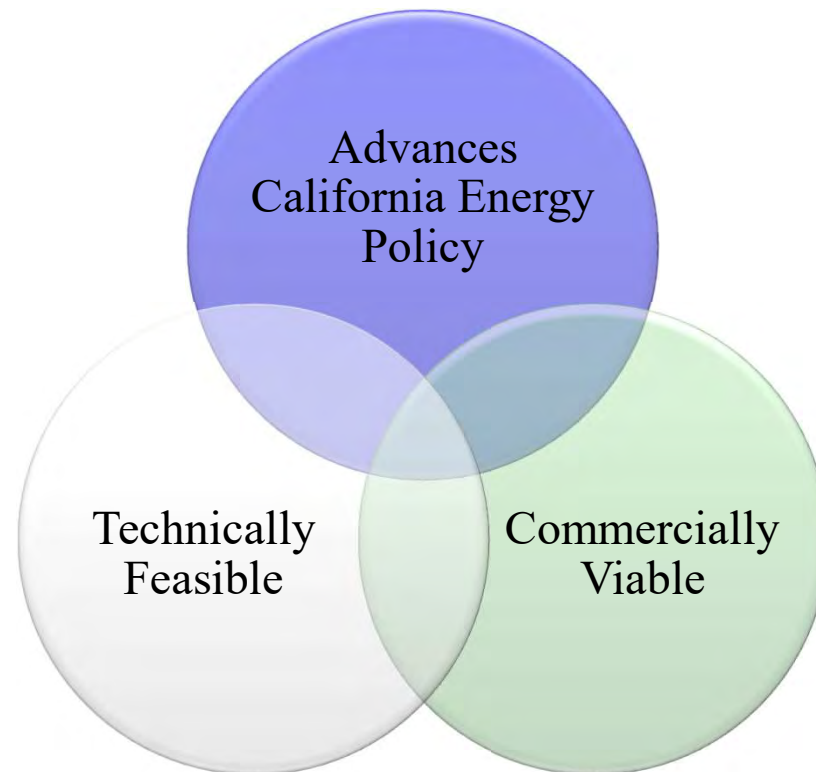
- **Applied Research**
 - Energy Efficiency
 - Clean Generation
 - Smart Grid
 - Cost Share for Federal Awards
- **Technology Demonstration and Deployment**
 - Energy Efficiency and Demand Response
 - Clean Energy Generation and Deployment
 - Integration of EE, DR, DG and Smart Grid
 - Cost Share for 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





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EPIC First and Second Triennial Investment Plans DER Activities

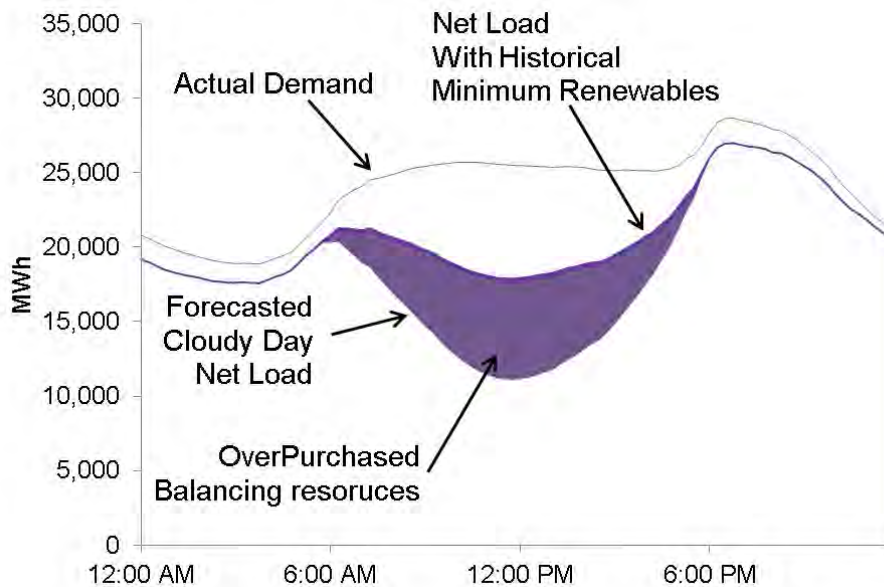


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Value of Grid Services



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



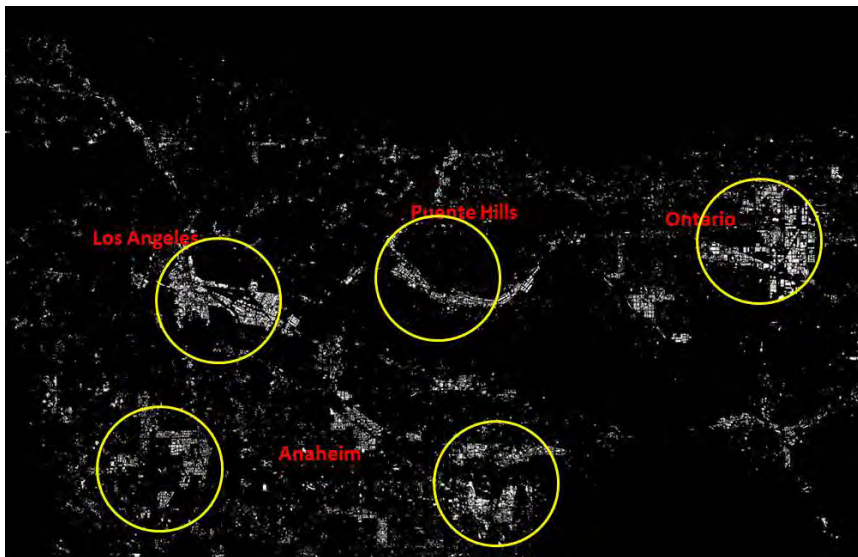
Over purchase of balancing resources due to forecast error on a cloudy day in 2020

- 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*



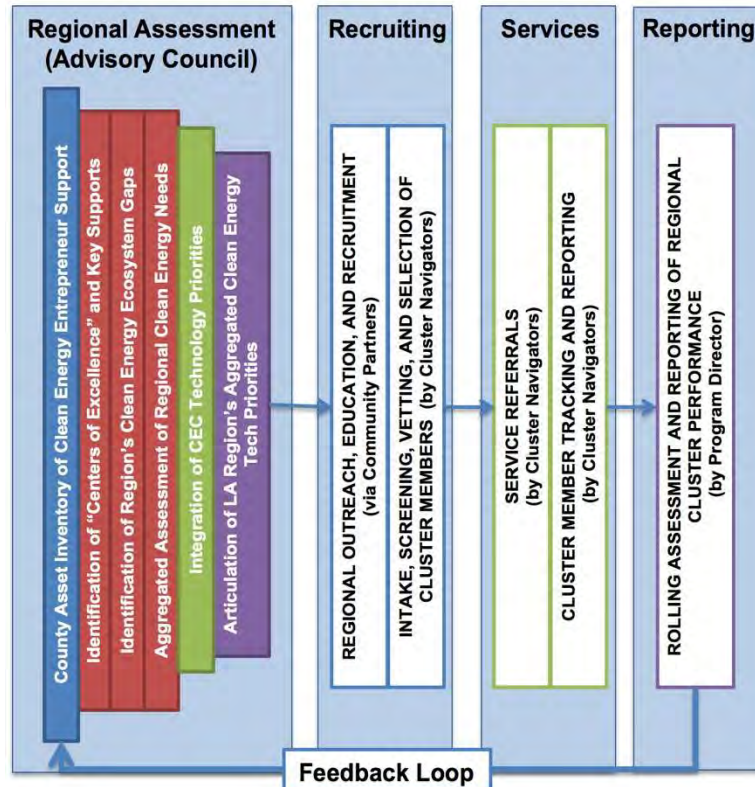
The College of San Mateo campus where the networked energy system will be deployed

- 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

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



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



LA REIC service model relies heavily on the feedback loop.

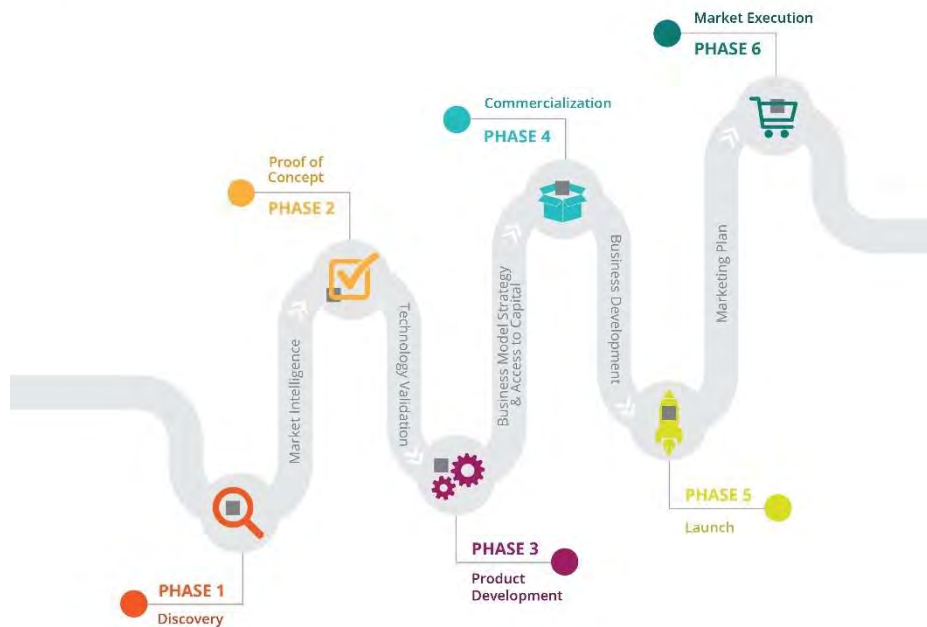
EPIC Funding: \$4,999,247
Match Funding: \$3,658,099

- 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



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

COMMERCIALIZATION WITH SAN DIEGO REGIONAL ENERGY INNOVATION CLUSTER SERVICES



Pathway to commercialization with cluster services.

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

- 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

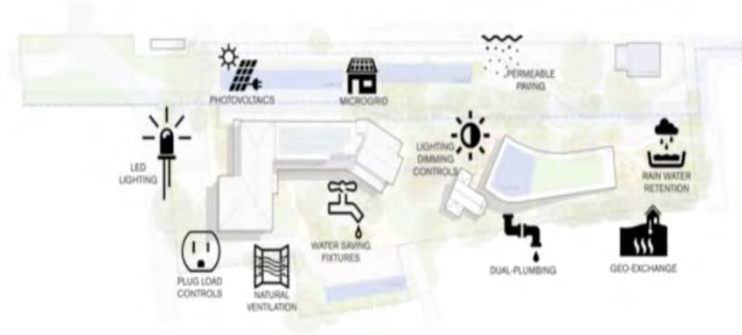


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Energy Commission Microgrid Experience EPIC Challenge Projects



Berkeley Energy Assurance Transformation (BEAT) Project



Peninsula Advanced Energy Community



Huntington Beach Advanced Energy Community Blueprint



City of Santa Monica Bergamot Area Map

Total potential project area: 170 acres

- Bergamot Transit Village - Private development (35 acres)
- Bergamot Art Center - 5.8 acres are City owned land, remaining 18 acres is private development
- Mixed-Used Creative - Private Development (86 acres)
- City Yards - City owned and controlled (14.7 acres)
- Stewart Street Park - City owned and controlled (3.8 acres)
- Mountain View Mobile Home - City owned and controlled (4.8 acres)

0 1,000 2,000 Feet

Santa Monica Advanced Energy District



Lancaster Advanced Energy Community (AEC) Project

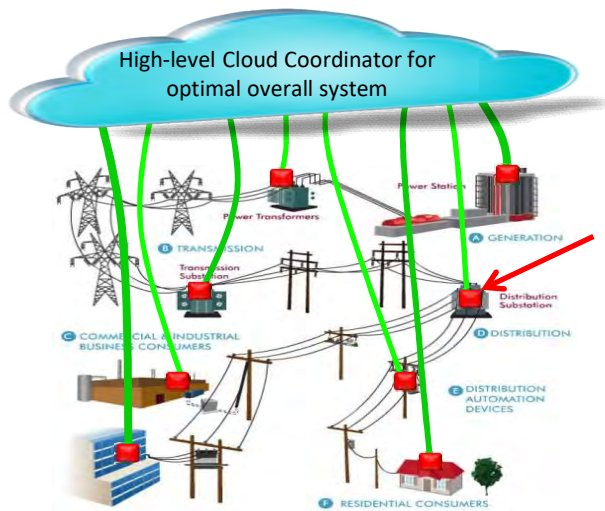


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DER Management Systems



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



Powernet



Irvine DERMS



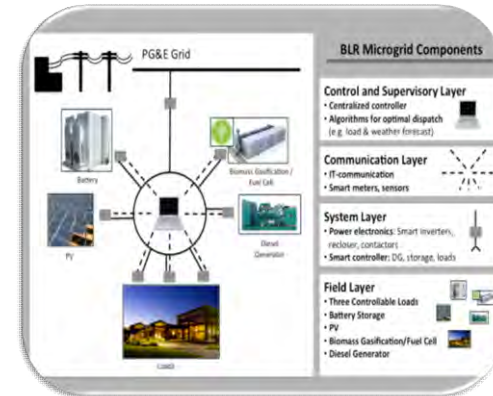
Energy Commission Microgrid Experience



Hospital Microgrid



Borrego Springs



Blue Lake Rancheria



Bosch DC Microgrid



Las Positas Campus



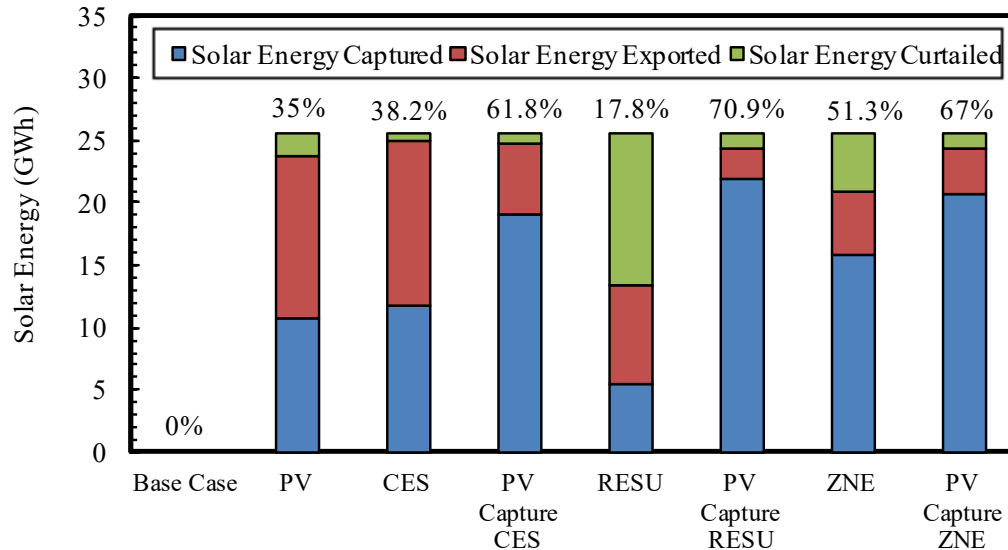
City of Fremont Fire Station



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*



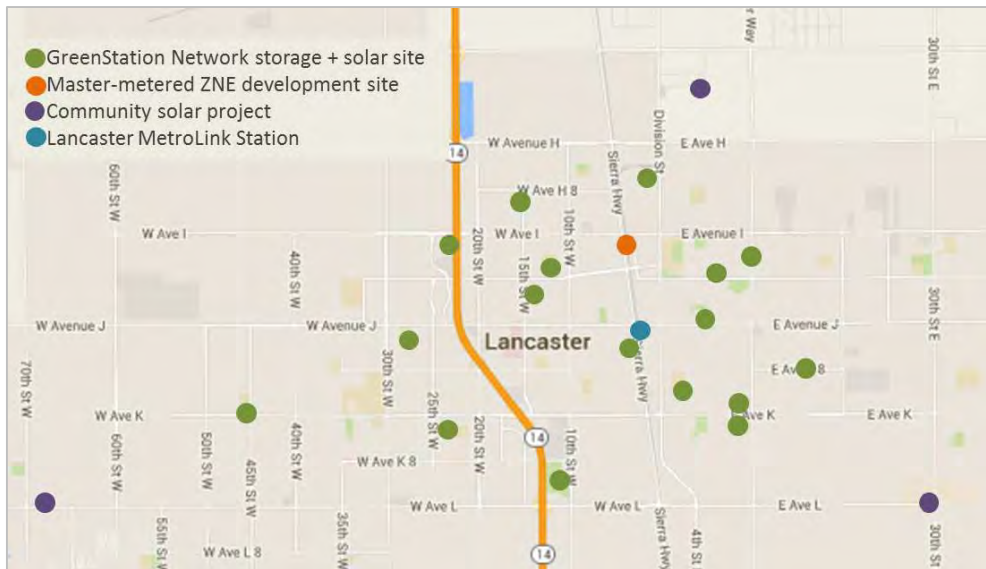
Breakdown of annual energy generated by PVs installed in smart residential buildings for various cases

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*



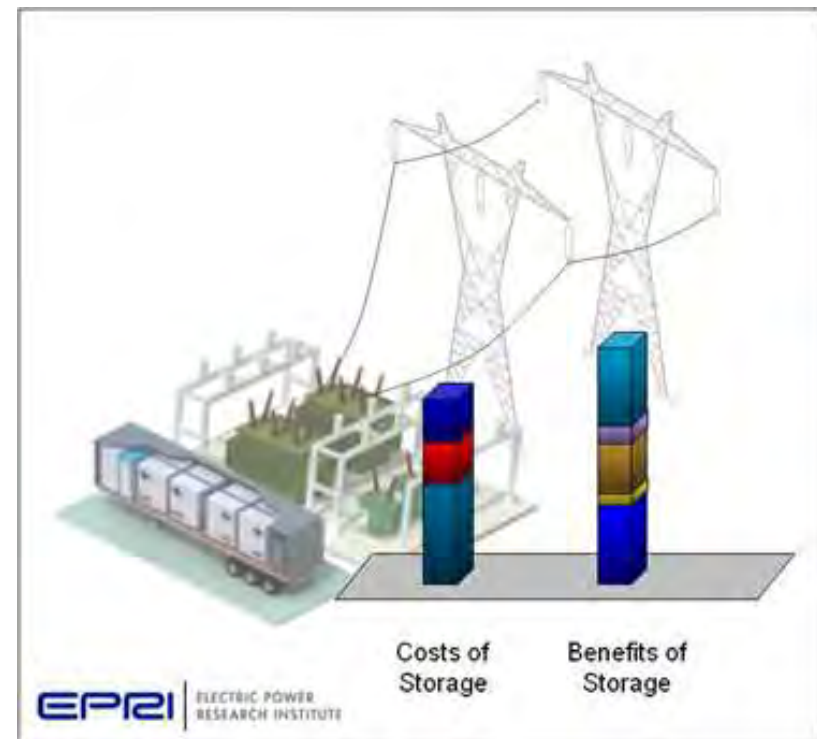
*Identified sites for ZNE community and community
DER demonstrations*

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

- 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



Moving Grid Storage from Emerging Technologies to Commercialization



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

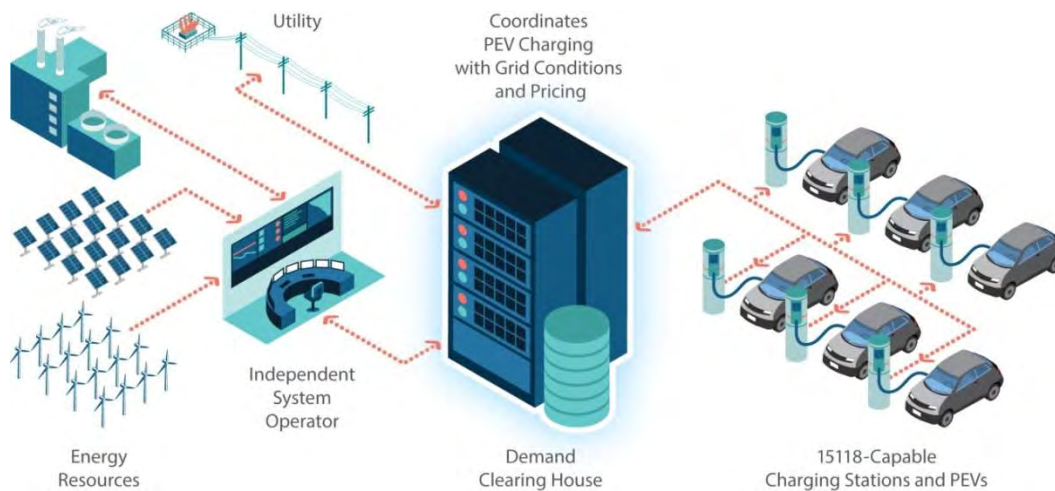


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Electric Vehicles



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



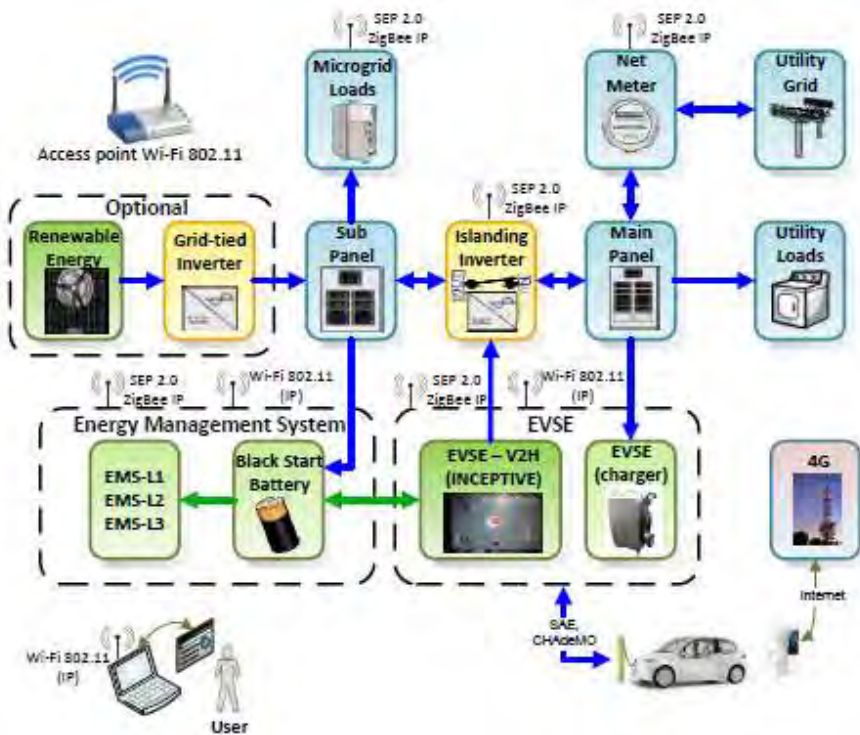
Demand Clearing House (DCP) schematic

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

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

- 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



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



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

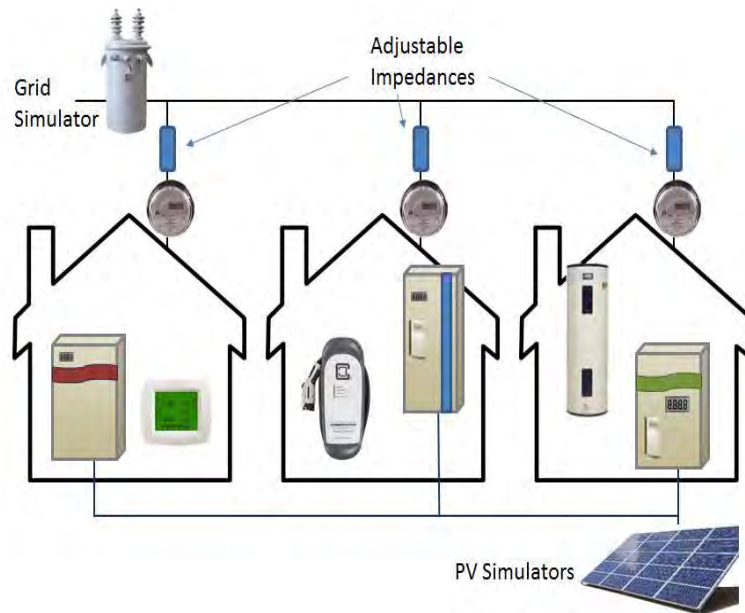


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Smart Inverters



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

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

- 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



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

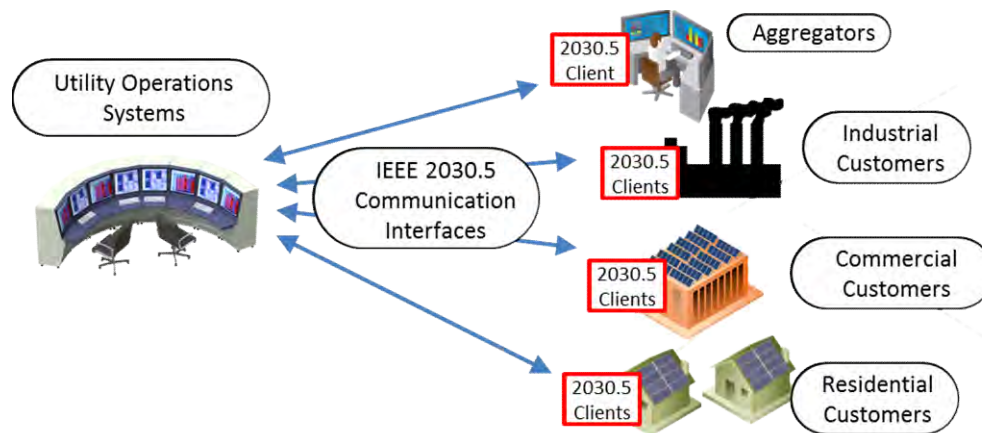


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Data Communications



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

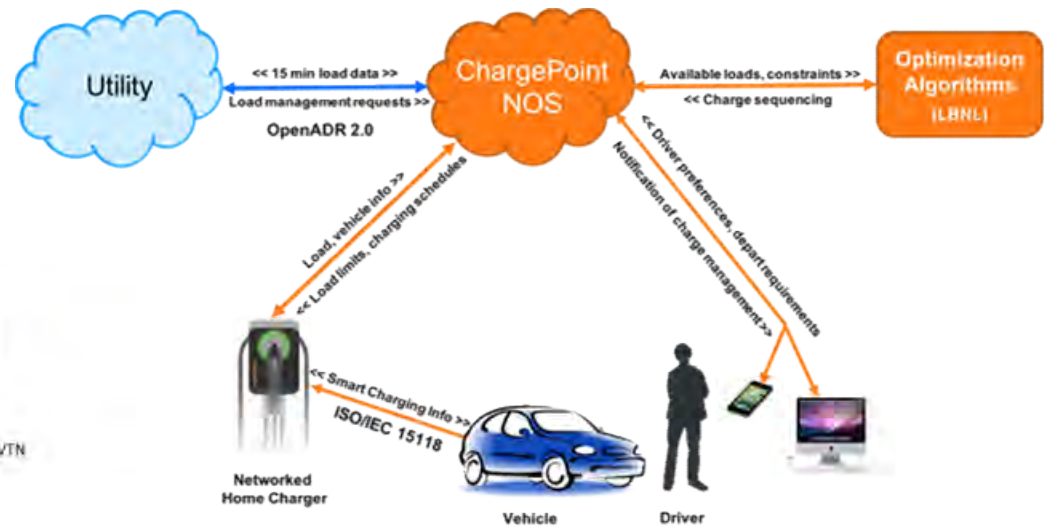
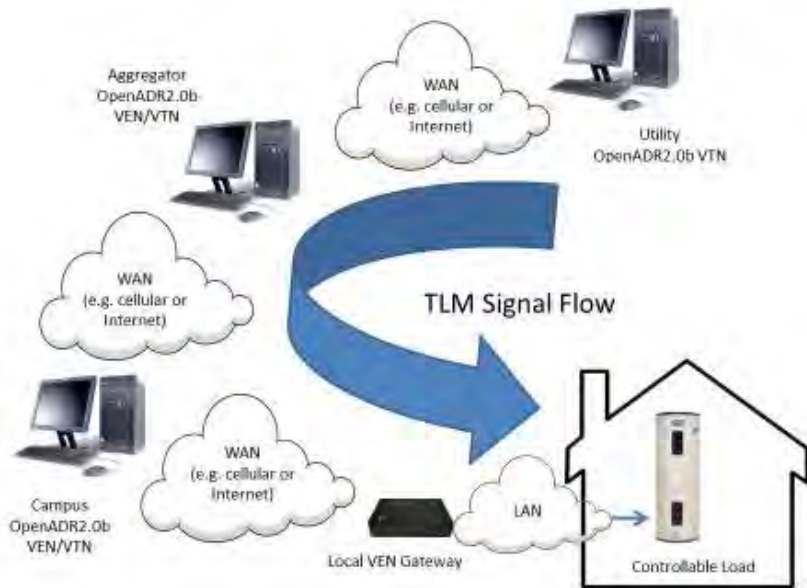
EPIC Funding: \$816,539
Match Funding: \$243,722

- 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



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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 Responses 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 Responses 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 Responses Capabilities that Provide the Grid Flexible Response Services
- S3.2: Enable Electric Vehicle Grid Services



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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