EPIC Project Status Update

Distributed Energy Resource Integration

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Distributed Energy Resource Integration

- CA's energy goals translate into adding ~ 15 GW of DER into the electric system
- Innovations enable expansive customer driven opportunities
- High penetration DER can be problematic on distribution grids designed for centralized, not highly variable, one-way energy flow
- Research to ensure implementation of DER results in cost effective improvements to grid reliability, stability and efficiency
- Customer and system solutions

Distributed Energy Resource Integration

- Energy Commission EPIC Investment Plans include:
  - Mitigate variability with forecasting and flexible generation
  - Energy storage to manage over- and under-generation
  - Increase inter-communication of multiple components (operations management, advanced metering infrastructure, customer choices)
  - Increase customer options and customer choice to improve local grid resiliency with microgrids and community-scale technologies
  - Smart vehicle charging to capture the benefits of electric vehicles
  - Technology advancements to increase operational efficiency and reduce costs
- Energy Commission has awarded ~ $69M to 43 EPIC DER projects

EPIC DER Reliability and Resiliency

Community-Scale Generation Demonstrations ($14.3M)	
Dairy Renewable Combined Heat and Power Project	Carlos Echeverria & Sons Dairy Biogas
Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid	Sierra Institute for Community and Environment
Demonstration of community scale low cost highly efficient PV and energy management system at the Chemehuevi Community Center	University of California, Riverside
College of San Mateo Internet of Energy	Bay Area Climate Collaborative
Demonstration of community scale low cost highly efficient PV and energy management system	University of California Davis

Microgrid Demonstrations ($25.6M)	
Renewable Microgrid for the John Muir Medical Center	Charge Bliss, Inc.
City of Fremont Fire Stations Microgrid Project	Gridscape Solutions
Demonstrating a Community Microgrid at the Blue Lake Rancheria	Humboldt State University Sponsored Programs Foundation
Laguna Subregional Wastewater Treatment Plant Advanced Microgrid	Trane U.S., Inc.
Borrego Springs – A Future Photovoltaic Based Microgrid	San Diego Gas & Electric Company
Las Positas Community College Microgrid	Chabot-Las Positas Community College District
Direct Current Building Scale Microgrid	Robert Bosch, LLC

EV Charging, Storage and Inverters

Plug-in Electric Vehicle Charging ($8.8M)	
Enable Standardized Vehicle-Grid Integration through Development of Universal Standard	Center for Sustainable Energy
Next-Generation Grid Communication for Residential PEVs	ChargePoint, Inc.
Distribution System Aware Vehicle to Grid Services for Improved Grid Stability and Reliability	Electric Power Research Institute
Optimized Electric Vehicle Fleet Management and Grid Transaction at Mountain View Army Reserve Base	Lawrence Berkeley National Laboratory
Smart Charging of Plug-in Vehicles and Driver Engagement for Demand Management and Participation in Electricity Markets	Lawrence Berkeley National Laboratory
Demonstration of PEV Smart Charging and Storage Supporting Grid Operational Needs	University of California, Los Angeles

Advanced Energy Storage ($7.8M)	
High Temperature Hybrid Compressed Air Energy Storage	UCLA
Isothermal Compressed Air System	Lightsail Energy/UC San Diego
Distributed Energy Storage Systems	Eos Energy Storage, LLC
Validated and Transparent Energy Storage Valuation and Optimization Tool	Electric Power Research Institute
Utility Demonstration of Znyth™ Battery Technology at $100/kWh or less to Characterize Performance and Model Grid Benefits	Eos Energy Storage, LLC

Smart Inverters ($4.7M)	
Smart Inverter Interoperability Standards	SunSpec Alliance
Assessing Smart Inverters and Consumer Devices to Enable more Residential Solar Energy	Electric Power Research Institute
Demonstration of Integrated Photovoltaic Systems and Smart Inverter Functionality Utilizing Advanced Distribution Systems	Lawrence Berkeley National Laboratory

Forecasting and Flexible Generation

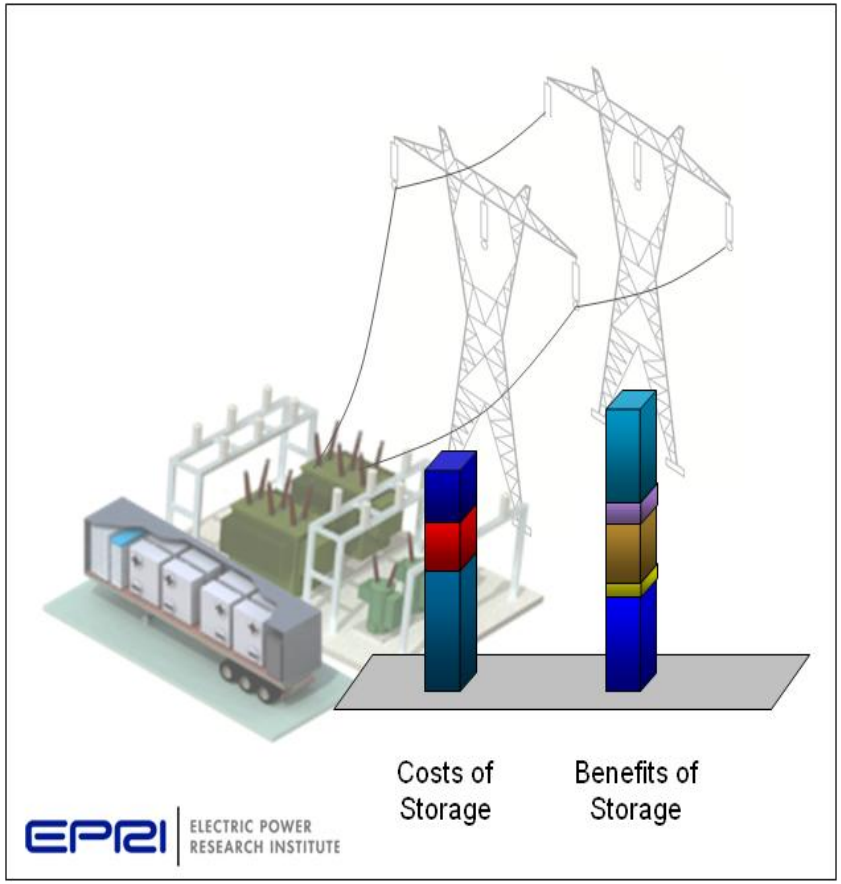
Renewable Resources Forecasting ($2M)	
Solar Forecast Based Optimization of Distributed Energy Resources in the LA Basin and UC San Diego Microgrid	University of California, San Diego
Improving Solar & Load Forecasts: Reducing the Uncertainty Behind the Duck Chart	Itron, Inc., dba IBS

Flexible Utility-Scale Renewable Generation ($6M)	
Investigating Flexible Generation Capabilities at the Geysers	Geysers Power Company, LLC
Systems Integration of Containerized Molten Salt Thermal Energy Storage in Novel Cascade Layout	Halotechnics Inc.
Low-Cost Thermal Energy Storage for Dispatchable Concentrating Solar Power	University of California, Los Angeles

Energy Commission DER Integration Project Highlights:

Validated and Transparent Energy Storage Valuation and Optimization Tool

- Help California achieve energy storage goals and benefit ratepayers
- Web based tool to demonstrate and quantify the costs and benefits of energy storage
- Methodology and tool will be publically developed with stakeholder input
- Optimize energy storage projects according to use, technology, size, and location



Energy Commission DER Integration Project Highlights:
Validated and Transparent Energy Storage Valuation and Optimization Tool

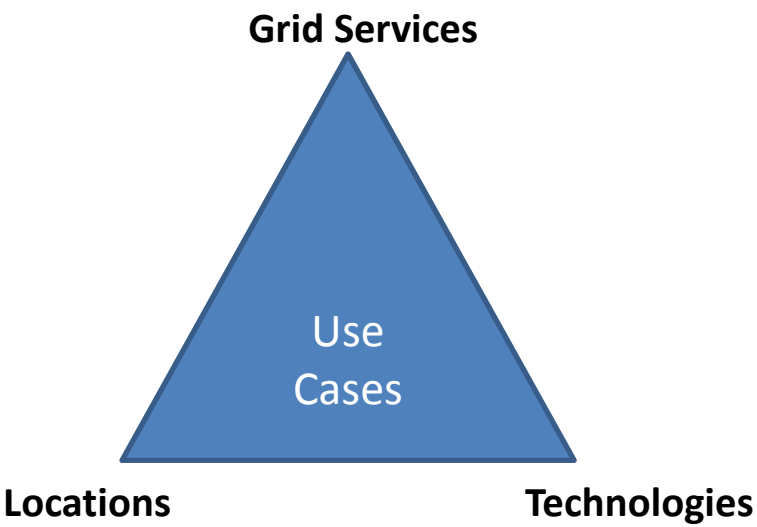
Who will use the tool and how might they use it?

- **Regulators**- program design, oversight, benchmarking and assessment of energy storage procurement and energy storage as a resource in other proceedings like RA and RPS.
- **Utilities**- resource planning and procurement and customer programs.
- **Independent System Operator**- evaluate storage in transmission planning and assess it's effects on wholesale markets.
- **Project Developers**- help guide optimal size and technologies for projects in certain locations and help design new product offerings.
- **Electricity Customers**- better understand energy storage products and how energy storage can benefit customers and the electric grid.
- **Researchers**- a common platform developed with stakeholder input that can be used to help answer research questions and select future research solutions.
- **Research Administrators-** target future demonstration projects.

Energy Commission DER Integration Project Highlights:

Validated and Transparent Energy Storage Valuation and Optimization Tool

- After defining how the tool should function and for who, EPRI will define use cases.



- EPRI has identified starting points for each of these components that make up use cases and stakeholder input is critical.

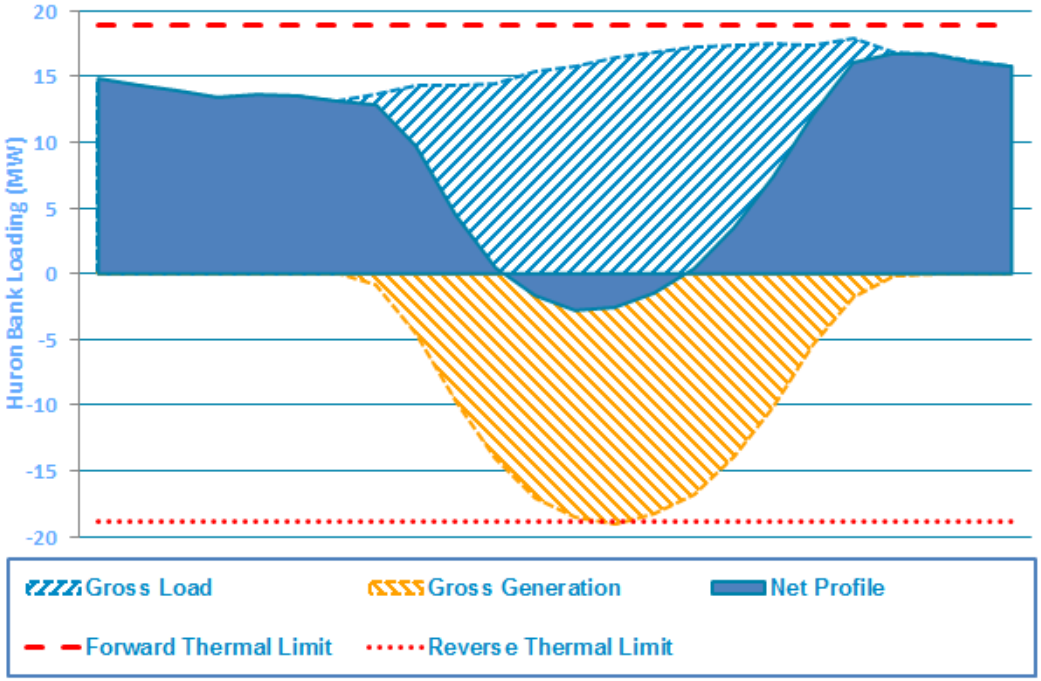
CPUC Energy Storage Use Cases

Grid Domain	Regulatory Function	Use-Case Examples
Transmission-Connected	Generation/Market	**Co-Located Energy Storage** Concentrated Solar Power, Wind + Energy Storage, Gas Fired Generation + Thermal Energy Storage
		Stand-Alone Energy Storage Ancillary Services, Peaker, Load Following
	Transmission Reliability (FERC)	**Voltage Support**
Distribution-Connected	Distribution Reliability	**Substation Energy Storage** (Deferral)
	Generation/Market	**Distributed Generation + Energy Storage**
	Dual-Use (Reliability & Market)	**Distributed Peaker**
Behind-the-Meter	Customer-Sited Storage	**Energy Management** Permanent Load Shifting, Power Quality, Electric Vehicle Charging

Energy Commission DER Integration Project Highlights:

Validated and Transparent Energy Storage Valuation and Optimization Tool

- Example of a scenario in which the tool can help select cost effective energy storage solutions
- Profile of a substation during a summer peak
- The "duck curve" is a phenomenon that occurs at disaggregated levels
- Storage is a solution to help manage local system issues



Source: Pacific Gas & Electric's "Distribution Resource Plan", July 1, 2015.

Energy Commission DER Integration Project Highlights:

Validated and Transparent Energy Storage Valuation and Optimization Tool

Key Milestones

- Remainder of 2015: EPRI interviewing stakeholders to identify functional users and uses as well as the use cases. Design model architecture.
- First half of 2016: Finalize functional users and uses and define the interface requirements to meet such uses.
- Second half of 2016: Alpha test and Beta test the model.
- End of 2016: Release the software and transfer the technology to agencies and the industry.

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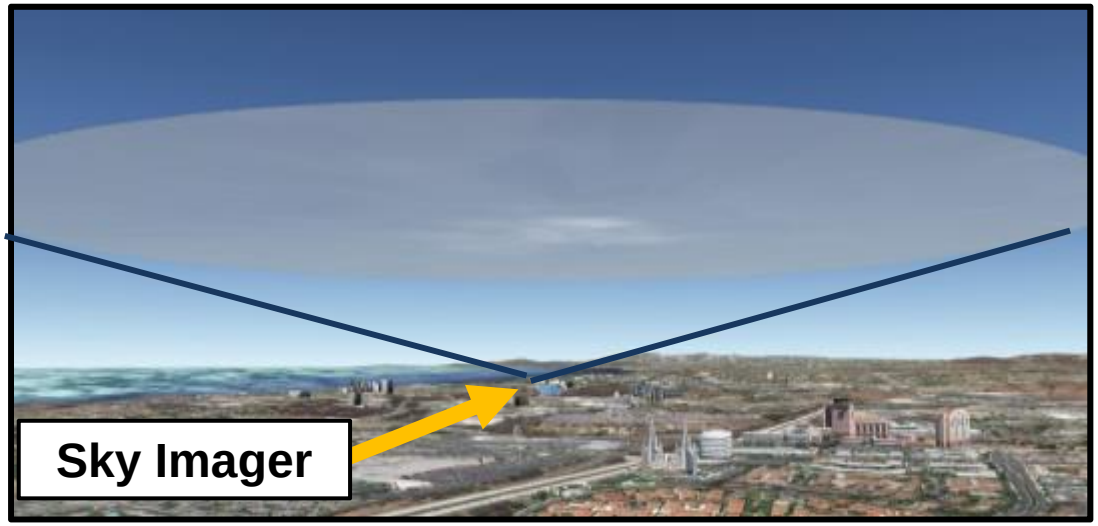
Energy Commission DER Integration Project Highlights:
Solar Forecast Based Optimization of Distributed Energy Resources in the LA Basin



- Integrate solar forecast tools with DERs that include energy storage, vehicle charging, demand response, and other functions, to increase their individual values.
- Demonstrate the role of sky imagery in short-term forecasting for utility operations.
- Rapid-update and high resolution data features will improve ramp-forecasting accuracy.

Energy Commission DER Integration Project Highlights: Solar Forecast Based Optimization of Distributed Energy Resources in the LA Basin

- IOU ratepayers benefit from lower costs per kWh, improved reliability and service quality
  - Communities in the LA-Orange-Riverside-San Bernardino County region: better public health, emergency preparedness in case of grid failure
- CAISO benefits by having more options in it's flexible ramping resource market
- CPUC and IOUs benefit from improved operation of the electric grid and better delivery of customer programs
- CA IOUs, CPUC, Energy Commission, CAISO benefit from technology and knowledge transfer

Energy Commission DER Integration Project Highlights:

Solar Forecast Based Optimization of Distributed Energy Resources in the LA Basin

Project Tasks	
Advance high fidelity solar forecast algorithms for minutes-ahead and day-ahead solar PV generation	Deliver in early 2017
Develop Use Cases	Deliver in early 2016
Optimization of controllable loads and aggregation to virtual power plants	Deliver in mid-2017
Pilot Testing and Simulation	Deliver in mid-2017
Evaluation of Project Benefits	Deliver in end of 2017
Technology/ Knowledge Transfer and Outreach	Deliver in end of 2017

Energy Commission's EPIC Participation Opportunities

www.energy.ca.gov

…and the Energy Commission's listserves.

Thank You!
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