

2015 EPIC Innovation Symposium

December 3, 2015

Lake Natoma Inn, 702 Gold Lake Drive, Folsom, CA 95630

PROGRAM

The California Energy Commission staff, Pacific Gas and Electric Company, San Diego Gas & Electric Company, and Southern California Edison Company, will host the first Electric Program Investment Charge (EPIC) Symposium on December 3, 2015. EPIC, an energy innovation funding program, seeks to drive efficient, coordinated investment in new and emerging energy solutions.

The Symposium will showcase a variety of EPIC projects, including energy efficiency, generation and integration, systems architecture, and data analytics. The Symposium will contribute to ongoing coordination and understanding among administrators, parties, and the California Public Utilities Commission (CPUC); raise awareness and visibility of EPIC investments; and promote EPIC program transparency. The EPIC Administrators will consider ideas generated by the discussion to inform development of future funding opportunities.

After the Symposium, Energy Commission staff will hold a workshop on “How to Apply for EPIC Funding.”

To select your preferred breakout topic, see <https://www.surveymonkey.com/r/SZLCW5L>. To learn more, see <http://www.energy.ca.gov/research/epic/documents/#12032015>, email Pamela Doughman at pamela.doughman@energy.ca.gov, or call (916) 445-5320.

Breakout Sessions

Choose one of three breakout session tracks for focused discussion and learn key points from the other two during the closing plenary session:

- Track 1: Energy Efficiency.
- Track 2: Generation and Integration.
- Track 3: Data Analytics and Systems Architecture.

The Symposium will begin at 9:00 am with a brief opening plenary, followed by three sessions for each track.

- 09:15-10:45 Session A
- 11:00-12:30 Session B
- 01:30-03:00 Session C

The Closing Plenary Session is scheduled to begin at 3:00, followed by a post-symposium workshop on “How to Apply for EPIC Funding” from 3:30-4:30.

Track 1: Energy Efficiency. This track will highlight research on energy efficiency technologies and strategies for new buildings, including ZNE, existing buildings, and energy efficiency for agriculture and water sectors. Issues to be addressed include:

- **Session 1A: Energy Efficiency in Existing Buildings.** This session will discuss current research addressing challenges and opportunities facing energy efficiency in existing buildings. The *Existing Buildings Energy Efficiency Action Plan* (September 2015) highlighted the following five pressing and persistent challenges:
 - Establishing a clear value proposition to consumers, business owners, and building managers.
 - Ensuring access to building energy usage and performance information and analysis.
 - Building consumer demand.
 - Opening pathways for investment.
 - Creating a robust set of tools and resources to support the variety of market actors who will stimulate increased energy efficiency activities.

Research discussed in this session will help advance energy efficiency to help achieve a cumulative doubling of statewide energy efficiency and natural gas savings in electricity end uses of retail customers by January 1, 2030, as required by SB 350 (2015).

- Who should attend: state and local government, energy efficiency service providers, builders, building owners, planners and designers, researchers, and utilities.
- What they'll learn: Current research addressing challenges and opportunities to achieving California's goals for energy efficiency in existing buildings.

Chair: Adel Suleiman, Energy Commission

Discussants:

Andrew McAllister, Commissioner, Energy Commission

Lisa A. Baker, Yolo County Housing

Joseph Oldham, San Joaquin Valley Clean Transportation Center

Projects:

1. Michael Siminovich, UC Davis California Lighting Technology Center (CLTC), *From the Laboratory to the California Marketplace: A New Generation of LED Lighting Solutions*. This project will design and develop innovative light-emitting diode lighting solutions for three key product categories: screw-base replacement lamps, linear tubular replacement lamps, and spectrally optimized dedicated LED luminaires. The research will focus on quality, performance, and longevity without increase in costs to consumers.
2. Ramachandran Narayanamurthy, EPRI, *Climate Appropriate HVAC Systems for Commercial Buildings to Reduce Energy Use and Demand*. This project will develop and demonstrate a climate-appropriate heating, ventilating and air conditioning system for commercial buildings that integrates variable refrigerant flow technology, indirect evaporative cooling and the building control system to reduce energy use and peak demand.

3. Edward Arens UCB, *Very Low Cost MEMS Based Ultrasonic Anemometer for use in HVAC Ducts*. This project will develop low-cost, lowpower, accurate, calibration-free, and compact airflow sensors (anemometers) for measuring: (1) room airflow in occupied commercial buildings; and (2) volumetric air flow in Heating, Ventilating, and Air Conditioning (HVAC) systems and laboratory fume hoods. The technology will save energy by using the collected data to correct current wasteful HVAC malfunctions that result in inefficient systems and uncomfortable buildings.
 4. Sharmila Ravula, Robert Bosch, LLC, *A Renewable Based Direct Current Building-Scale Microgrid*. This renewable-based DC microgrid proposes to connect on-site generation with loads and provides a low cost, high energy efficiency solution. Solar PV is planned to be directly connected to energy efficient DC lighting, DC energy storage systems, and ventilation on a 380 V DC bus to form a DC building microgrid.
- **Session 1B: Energy Efficiency in New Buildings.** Energy efficiency is a major strategy for reducing the state's energy costs and greenhouse gas (GHG) impacts. Innovations in technology, construction practices, and building operations are needed to meet the state's aggressive goals for energy efficiency and ZNE buildings, in addition to GHG emission reduction targets. This session will also discuss technologies and strategies to help meet these goals and to overcome barriers and data gaps.
 - Who should attend: state and local government, energy efficiency service providers, builders, planners and designers, researchers, and utilities.
 - What they'll learn: Current research addressing challenges and opportunities related to achieving California's ZNE goals.

Chair: David Hungerford, Energy Commission

Discussants:

George Koertzen, Habitat for Humanity San Joaquin County

Brandon De Young, De Young Properties

Projects:

1. Ronnen Levinson LBNL, *Solar-Reflective "Cool" Walls: Benefits, Technologies, and Implementation*. This project will evaluate the benefits of solar reflective "cool" walls, assess existing cool wall technologies, develop new cool wall solutions, and create the infrastructure needed to implement cool walls to save energy, reduce peak power demand, and improve air quality in California.
2. Jonathan Slack, LBNL, *Comparing Attic Approaches for Zero Net Energy Homes*. This project will develop alternative attic construction practices that contribute to lower residential heating, ventilation, and air conditioning system energy consumption.
3. Robert Hammon, BIRA Energy, Inc. *Cost- and Energy-Efficient Attic Designs for CA Homes*. This project will develop new approaches to home attic design using novel construction and materials that have lower incremental cost compared to current accepted methods for sealing and insulating attics.
4. Ammi Amarnath, EPRI, *Development and Testing of the Next Generation Residential Space Conditioning System for California*. This project will develop and test the next generation residential space conditioning system by combining and integrating several advanced technologies into a single space conditioning system that cost-effectively fits California's climate conditions.

5. Rich Brown, LBNL. *Direct Current as an Integrating and Enabling Platform*. This project will research direct current (DC) and alternating current (AC)-DC hybrid power applications in buildings and develop resource information, end-use templates, and building guidelines that could improve the ability to achieve zero net energy buildings.
- **Session 1C: Energy Efficiency in Agriculture and Water Sectors.** In response to the fourth year of a severe, multi-year drought, the Governor ordered a 25 percent mandatory water reduction for California's local urban water supply agencies. Farmers have also seen cutbacks in deliveries of surface water. Groundwater levels have dropped in much of the Central Valley, causing land to subside in some locations. This session will discuss current research to reduce water-related energy use. This research will help advance pre-commercial technologies and strategies to save water and save energy in California.
 - Who should attend: state and local government, water agencies, water districts, wastewater districts, irrigation districts, food processors, farmers, growers, planners, researchers, and utilities.
 - What they'll learn: Current research addressing challenges and opportunities related to reducing water-related energy use in California.

Chair: Michael Lozano, Energy Commission

Discussants:

Carolyn Cook, California Department of Food and Agriculture.

Rob Neenan, California League of Food Processors

Projects:

1. PowWow Energy, Inc., *Irrigation Optimization and Well Pump Monitoring to Reduce Energy and Water Consumption*. This project will deploy innovative data analytics software that will allow growers to automate water measurements and record keeping to help achieve water and energy savings through irrigation optimization without adversely impacting crop yields.
2. Wexus Technologies, *Wexus Energy and Water Management Mobile Software for the Agricultural Industry*. Deploy Wexus (Water-Energy Nexus) mobile, cloud-based software for commercialization in California's agricultural industry. The software will allow farmers to access their on-farm energy, water and cost information from any mobile device and to quickly respond to changes in energy usage, adjust and optimize equipment in the field and reduce operational expense due to energy costs.
3. Erik Desormeaux, Porifera, *Water and Energy Savings Utilizing Innovative Forward Osmosis Systems for Irrigation and Indirect Potable Reuse*.
 - a. *Demonstration of Forward Osmosis to Produce Juice Concentrate, Purify and Reuse Wastewater and Reduce Energy Use*. This project will deploy Porifera's Forward Osmosis (PFO) Concentrator in the food and beverage industry. The PFO Concentrator uses unique membrane technology to make high quality juice concentrates, and purifies wastewater for on-site reuse. The demonstration will quantify the energy savings and increase water reuse at selected sites.
 - b. *Advance Wastewater Treatment Using Forward Osmosis to Produce High Quality Water*. This project will deploy advanced wastewater treatment with Porifera's Forward Osmosis Recycler. This process concentrates the hard-to-treat industrial wastewater and produces high quality water for reuse. The demonstration will determine the energy savings, emission reductions and maintenance savings associated with the technology.

4. Onder Caliskaner, Kennedy Jenks Consultants. *Raw Wastewater Filtration to Increase Organic Removal Efficiency and Achieve Significant Electrical Savings*. Deploy the use of cloth depth filtration for raw wastewater filtration to increase the organic removal efficiency and reduce secondary treatment electrical energy demand.
5. Sadrul Ula, UC Riverside, *Bringing Energy Efficiency Solutions to California's Water Sector with the use of Customized Energy Management System and Supervisory Control and Data Acquisition System*. This project will deploy energy management and other control strategies to improve energy efficiency and reduce costs in the delivery and treatment of wastewater in California.
6. John Maulbetsch, Maulbetsch Consulting, *Evaluation of Cost, Performance and Water Conserving Capability of Hybrid Cooling*. This award will fund an analysis of the design, performance and cost of optimized hybrid cooling systems at utility power plant scale to illustrate the potential benefits of hybrid cooling in California.

Track 2: Generation and Integration. This track will highlight research on technologies and strategies for generating and integrating renewable energy. Issues to be addressed include:

- **Session 2A: Bioenergy and High Fire Risk Areas.** This session will discuss current research and demonstration projects addressing high priority challenges and opportunities facing electricity generated from biomass and biogas. Discussion will focus on: bioenergy from fire prevention and related activities; low-emission bioenergy generation; and dairy digester systems.
 - Who should attend: state, regional, and local government, bioenergy service providers, forest restoration providers, fire prevention service providers, air pollution control equipment manufacturers, planners, orchard and tree farm growers, landfill operators, dairy farmers, researchers, and utilities.
 - What they'll learn: Current research addressing challenges and opportunities related to achieving California's bioenergy goals.

Chair: Gina Barkalow, Energy Commission

Discussants:

Kim Carr, CalFire

Claire Jahns, California Natural Resources Agency

Megha Lakhchaura, CPUC

Projects:

1. Matt Hart, West Biofuels LLC. *Modular Biomass Power Systems to Facilitate Forest Fuel Reduction Treatment*. This project will develop a pilot-scale modular biomass gasification system integrated with a high-efficiency lean-burn engine in order to convert forest residues into renewable grid power. This project aims to reduce the cost and increase the benefits of forest fuel reduction projects in California's high fire risk regions.
2. Angie Lottes, The Watershed Research and Training Center, *North Fork Community Power Forest Bioenergy Facility Demonstration*. This project will install and demonstrate a community-based, commercial-scale gasification-to-electricity facility that converts wood waste from forest management activities to renewable electricity while providing reduced fire risk, watershed protection, improved air quality, other environmental benefits, and local jobs.

3. Thomas Del Monte, Interra Energy, Inc., *Interra Reciprocating Reactor for Low-Cost and Carbon Negative Bioenergy*. This project will research, install and demonstrate a pilot-scale advanced modular bioenergy technology that aims to generate high quality biomethane gas, directly usable in existing engine and turbine technologies, while producing a high fixed carbon biochar co-product.
 4. Camille Swezy, Sierra Institute for Community and Environment, *Advancing Biomass Combined Heat and Power Technology to Support Rural California, the Environment, and the Electrical Grid*. This project will deploy a community-scale biomass-fired CHP system to power Plumas County health facilities, and use the waste heat to boost performance of heat pumps for heating college dormitories.
 5. Vincent McDonell, UC Irvine. *Pollution Control and Power Generation for Low Quality Renewable Fuel Streams*. This project will demonstrate a gradual oxidizing technology for generation of electricity from low quality biogas generated by landfills.
 6. Ross Buckenham, ABEC #4, LLC. Db a CE&S Dairy Biogas, *Dairy Renewable Combined Heat and Power Project*. This project will design, build, and demonstrate an innovative, community-scale renewable power generator that includes combined heat and power and a heat-driven absorption chiller system for onsite milk cooling at a California dairy.
- **Session 2B: Distributed Energy Future.** This session will discuss grid integration of renewable distributed generation at high penetrations, focusing on smart inverters, community microgrids, and advanced energy management systems. The results of this research will help guide the implementation of the Governor's goal of 12,000 MW of renewable distributed generation by 2020 and updates recommended by California's Rule 21 smart inverter working group.
 - Who should attend: state and local government, distributed photovoltaic energy equipment manufacturers and service providers, inverter manufacturers, researchers, and utilities.
 - What they'll learn: Current research addressing challenges and opportunities related to achieving California's renewable distributed generation targets.

Chair: Linda Spiegel, Energy Commission

Discussants:

Peter Klauer, California ISO.

Frances Cleveland Xanthus Consulting International.

Projects:

1. Tom Tansy, Sunspec Alliance, *Smart Inverter Interoperability Standards and Open Testing Framework to Support High-Penetration Distributed Photovoltaics and Storage*. This project will test the functionality of smart invertors at high level of PV penetration, assess the potential of integrated storage systems participating in ancillary service markets, and evaluate the market potential of a standardized communication interface.
2. Walter Johnson, EPRI, *Assessing the Ability of Smart Inverters and Smart Consumer Devices to Enable More Residential Solar Energy*. The project will identify, implement, and test optimal methods by which smart inverters can mitigate the grid issues that otherwise would limit local high penetrations of residential PV.
3. Janie Page, LBNL *Demonstration of integrated photovoltaic systems and smart inverter functionality utilizing advanced distribution sensors*. The research will develop, demonstrate, and evaluate the ability of an integrated, advanced PV, storage system, and smart inverter control to enhance and optimize grid support and system performance.

4. Ryan Wartena, Growing Energy Labs, Inc., Subcontractor with Bay Area Climate Collaborative, *College of San Mateo Internet of Energy*. This project will demonstrate integrated solar photovoltaic, energy storage, and advanced power electronics within a single module to reduce community energy load variability.
 5. Bruce Rich, Chabot-Las Positas Community College District, *Las Positas Community College Microgrid*. This project will demonstrate the ability of a commercial-scale microgrid to optimize distributed energy resources for customers, distribution utilities and the California ISO by using advanced energy management tools to coordinate a high penetration of customer renewable energy assets with multiple energy storage mediums on a community college microgrid.
 6. Alfredo Martinez-Morales UC Riverside, *Demonstration of Community Scale Generation System at the Chemehuevi Community Center*. This project will deploy and demonstrate two pre-commercial solar technologies with flow-battery energy storage at the Chemehuevi Indian Tribe Community Center to reduce peak energy and provide an uninterruptable power for the center when it is used as an Emergency Response Center for the tribe.
- **Session 2C: Renewable Generation and Advanced Energy Storage.** This session will discuss research and development to help manage high levels of variable and intermittent renewable generation, focusing on solar and wind forecasting, large-scale energy storage, and the potential for geothermal to operate as a flexible resource. The results of this research will help support the 50 percent renewable energy by 2030 goal (SB 350, 2015) and the 1,300 MW of energy storage target set by the CPUC pursuant to AB 2514 (2010).
 - Who should attend: State and local government, California Independent System Operator, renewable energy technology developers and providers, independent power producers, advanced energy storage system developers and vendors, electricity generation forecast providers, researchers, and utilities.
 - What they'll learn: Current research addressing challenges and opportunities related to flexible and predictable renewable generation and advanced energy storage in support of achieving 50 percent renewable energy by 2030.

Chair: Mike Sokol, Energy Commission

Discussants:

Jim Blatchford, California ISO

Erik Desrosiers, ARPA-e

Projects:

1. Stephan Barsun, Itron, Inc., *Improving Solar & Load Forecasts: Reducing the Operational Uncertainty Behind the Duck Chart*. This project plans to improve solar forecasts for grid-connected photovoltaics in California, use those improved forecasts to create enhanced net-load forecasts, and apply these enhanced forecasts to reduce scheduling errors for utilities and the California Independent System Operator (CAISO).
2. Carlos Coimbra, UC San Diego, *High-Fidelity Solar Power Forecasting Systems for the 392 MW Ivanpah Solar Plant (CSP) and the 250 MW California Valley Solar Ranch (PV)*. This project will develop solar resource and power forecasting tools for concentrated solar power, concentrated PV and PV tracking technologies and validate these models at existing utility-scale solar plants, including the 392 MW Ivanpah Solar Power Facility and 250 MW California Valley Solar Ranch.

3. Case P. van Dam, UC Davis, *Improving Short-Term Wind Power Forecasting through Measurements and Modeling of the Tehachapi Wind Resource Area*. This project will make use of coordinated atmospheric field measurements and advanced computational models to improve the accuracy of short-term forecasting of wind power production ramps at the Tehachapi Pass Wind Resource Area in California.
4. Steve Eney, Geysers Power Company, LLC, *Investigating Flexible Generation Capabilities at the Geysers*. This project will investigate the methods, risks and costs associated with flexibly operating the Geysers geothermal power plants to facilitate the integration of other intermittent renewable resources onto the California grid.
5. Parker Wells, UC Los Angeles. *Low-Cost Thermal Energy Storage for Dispatchable CSP*. This project will demonstrate a new approach to utility-scale thermal energy storage that enables low system costs, long lifetime, and scalability for a wide range of concentrating solar power applications in California.
6. Philippe Bouchard, EOS Energy Storage, LLC, *Utility Demonstration of Znyth™ Battery Technology to Characterize Performance and Grid Benefits*. This project will perform a pilot test of an integrated energy storage system incorporating Eos' advanced Znyth™ zinc hybrid cathode battery technology, including an evaluation of the technical and economic performance for various use cases.

Track 3: Data Analytics and Systems Architecture. As the electric utility industry continues to focus on grid modernization efforts to achieve a more flexible, reliable, and efficient “integrated grid”, the expanded deployment of new sensing and measurement, management and control, and communications technologies will produce a multitude of new information. Billions of new data points will need to be collected, processed, and synthesized into actionable information to support system operations. This track will highlight research and demonstrations on technologies and strategies related to real-time data analytics, data-driven asset management, and standardized efficient information exchange for grid operations.

- Who should attend: All stakeholders involved in the integration of new advanced grid technologies, devices, and interoperability solutions for future power systems, researchers, and utilities.
- What they’ll learn: Current trends in advancing power systems, including the associated supporting evolution of data analytics and systems architecture.
- **Session 3A: Real-time Data Analytics for System Operations.** This session will discuss advances in real-time monitoring, analysis, and data visualization tools to better identify and respond to potential safety, reliability, and operational issues.
 - Who should attend: All stakeholders in integration of new technologies, devices, and interoperability solutions into future power systems, distribution operators, engineers and emergency response, data analysts, regulators, researchers, and utilities.
 - What they’ll learn: Current trends in advancing power systems, including the associated supporting evolution of data analytics, including PG&E’s Grid Operations Situational Intelligence (GOSI) Project which integrates multiple sources of data (network model, loading, smart meters, outages, fire, weather, etc.) and provides a real-time data visualization platform for Distribution Operations, as well as SDG&E’s Data Analytics in Support of Advanced Planning and Systems Operations Project that plans to demonstrate how data collected from sensors and devices can be processed, combined, and presented to system operators in a way that enhances power system monitoring and situational awareness.

Chair: Merwin Brown, CIEE

Projects:

1. Yvette Oldham, SDG&E. *Data Analytics in Support of Advanced Planning and System Operations*. This project will address the anticipated “data tsunami” associated with more widespread system monitoring and more widespread use of controllable devices in the power system. It will help create better data management. It will also demonstrate solutions for the data management issues and challenges expected to accompany the extensive amount of real-time and stored data being archived from field devices.
 2. Tom Martin, PG&E. *Grid Operations Situational Intelligence (GOSI) - Real-time Data Visualization*. The objective of this project is to develop and pilot a real-time data visualization software platform for use by Electric Distribution Operations end users. The project will demonstrate the integration of traditionally isolated data, which can include near real-time awareness on circuit loading, weather, fire, crew locations, solar generation, electric vehicle usage, circuit loading and other key data sources.
 3. Neal Bartek, SDG&E. *Borrego Springs – A Renewable-Based Community Microgrid*. This project will demonstrate a utility operated high-penetration, renewable-based community-microgrid at Borrego Springs in Southern California.
- **Session 3B: Data-Driven Asset Management.** The proliferation of advanced sensing and measurement technologies coupled with new power system applications present innovative and exciting asset management opportunities for the electric utility industry. This session will discuss advances in new technologies and data solutions for asset management that enhances system safety, reliability, and affordability.
 - Who should attend: All stakeholders in integration of new technologies, devices, and interoperability solutions into future power systems, including asset strategists, risk analysts, investment planners, data analysts, regulators, researchers, and utilities.
 - What they’ll learn: Current trends in advancing power systems and the associated supporting evolution of data-driven asset management, including PG&E’s System Tool for Asset Risk, which demonstrates a more effective way to calculate and visualize asset risk scores for electric assets and systems, as well as SCE’s Outage Management and Customer Voltage Data Analytics Project, which demonstrates how voltage and consumption data is best collected, stored, and integrated with T&D applications to provide new analytics and visualization capabilities.

Chair: Andy Coleman, EPRI

Projects:

1. Austen D. Lima, SCE, *Outage Management and Customer Voltage Data Analytics*. This project will demonstrate how voltage and customer energy usage data from SCE’s smart meter network can be best collected, stored, and integrated with T&D applications to provide analytics and visualization capabilities. Further, this project will demonstrate how smart meter outage and restoration event data can be leveraged to improve customer outage duration and frequency calculations.

2. John Carruthers. PG&E. *System Tool for Asset Risk (STAR)*. The objective of the project was to demonstrate a visualization and decision support system to improve PG&E's asset risk management, planning, and operational practices, as well as public safety and quality of service. STAR integrates electrical asset and system data from multiple sources to calculate individual asset and system risk scores based on severity of risk and probability of occurrence.
 3. Rajit Gadh UCLA, *Demonstration of PEV Smart Charging to Support Grid Operational Needs*. This project will install and demonstrate electric vehicle charging stations with bi-directional capabilities using new algorithms.
- **Session 3C: Advancements in Systems Architecture.** This session will discuss advances in electrical and communications system architectures for enabling coordinated operation of multiple new device types to achieve effective interoperability and optimize system operations.
 - Who should attend: All stakeholders in integration of new technologies, devices, and interoperability solutions into future power systems, system architects, Department of Energy, cyber security specialists, policy makers, researchers, and utilities.
 - What they'll learn: Current trends in advancing power systems, including the associated supporting evolution of electrical and communications system architecture for coordinated operation of multiple systems and devices. Examples projects include SDG&E's Monitoring, Communication, and Control Infrastructure for Power System Modernization, as well as SCE's Substation Automation 3 Phase 3 demonstration which utilizes the IEC 61850 communications standard.

Chair: Walt Johnson, EPRI.

Projects:

1. Bryan Pham. SCE. *Substation Automation 3 -- Phase 3 Demonstration*. This project will apply the findings from the Substation Automation Three (SA-3) Phase II (Irvine Smart Grid Demonstration) project to demonstrate real solutions to automation problems faced by SCE today. For this phase of the project, SA-3 standards for distribution substations (66kV) will be leveraged to demonstrate IEC 61850 platform capabilities on transmission substations (220kV).
2. Hilal Katmale.SDG&E. *Monitoring, Communication, and Control Infrastructure for Power System Modernization*. This project will demonstrate advanced monitoring, communication and control infrastructure needed to operate an increasingly complex power system infrastructure. It will test system controls to "sort" data and use what is helpful and useful.
3. Sunil Chhaya, EPRI, *Distribution System Aware Vehicle to Grid Services for Improved Grid Stability and Reliability*. This project will develop integrated vehicle-to-grid (V2G) system that can be tested and demonstrated to be distribution-aware, self-regulating, interoperable, secure and open as well as scalable and flexible. These real-world test and demonstrations will provide confidence into the V2G systems that provide grid support functions and can inform investor owned utilities (IOUs) to add them to their Assembly Bill 2514 Storage Mandate compliance plan. The data gathered will also enable validation of cost effectiveness models through direct engagement with the IOUs' existing infrastructure and distribution networks, combined with simulated independent system operator interaction.