Previous Speakers

- -Andres Carvallo (**Austin Energy**)
- -Vikram Budhraja (**Electric Power Group**)
- -Dave Chassin (**PNNL**)
- -Susan Covino(**PJM Interconnection LLC**)
- -Kshamit Dixit (**Toronto Hydro**)
- -Aloke Gupta (**California Public Utilities Commission**)
- -Livio Gallo (**Enel Distribuzione**)
- -Kevin Garrity (**LADWP**)
- -John Garrity (**GE Global Research**)
- -Josh Gerber (**SD Gas/Electric**)
- -Crit Harrison (**Duke Energy Co.**)
- -Marie Hattar (**Cisco**)
- -Mark Hura (**GE Energy T&D**)
- -Efran Ibrahim (**EPRI**)
- -Joel Ibarbia (**PG&E SmartMeter Engineering and Planning**)
- -Jack McGowan (**Galvin Perfect Power**)
- -Michael Montoya (**Southern California Edison**)
- -John Nelson (**Defense Energy Support**)
- -Scott Pugh (**Dept. Of Homeland Security**)
- -Weston Sylvester (**Siemens Energy Inc.**)
- -David Wollman (**NIST**)
- -Malcolm Unsworth (**Itron, Inc.**)

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periods such as during the night, and become a source of electrical power during high-load periods such as a hot summer's afternoon. This ability can help substantially with Demand Response which is a key and yet challenging problem for the utilities. This source of energy can also provide buffer power for smoothing out frequency fluctuations resulting from mismatched demand (generation versus consumption) - and therefore could be used for Demand Dispatch by the utilities. All of these needs and capabilities will require the integration of sophisticated technologies including communications, wireless, sense-and-control, Internet, mobile computing, cloud computing, Lithium Ion and other battery technology, superconductors, etc.

This forum will bring together researchers, utilities (distribution and transmission), technology providers, service providers, EV and automotive companies, renewable generation companies, and government together to create Thought Leadership around the field of electric vehicles and their integration into the Smart Grid of the Future.

Speakers

Scott Backhaus	Staff Scientist	Los Alamos National Laboratory
Luke Clemente	General Manager, Metering & Sensing Systems	GE Energy - Digital Energy
Mike Coop	Founder	heyCoop, LLC
Marcelo Dipaolo	Full Engineer	LADWP
Rajit Gadh	Professor & Director	UCLA - WINMEC & Smart Grid Energy Research Center
Phil Gow	Vice President, Battery Systems	CODA Automotive
Krishnan Gowri	Senior Research Engineer	Pacific Northwest National Lab.
Mike Gravely	Manager - Energy Systems Research Office	California Energy Commission
Stanton Hadley	Power and Energy Systems Group	Oak Ridge National Laboratory
Bruce Hamer	Principal Power Engineer	Burbank Water and Power
Paul Heitmann	Utility Stakeholder Services	ECOtality
Stephen Johnson	Sr Product Marketing Manager	Itron, Inc.
Doug Kim	Director, Advanced Technology	Southern California Edison
Andrew Martinez-Fonts	Product Manager	Silver Spring Networks
Ali Morabbi	Manager, Power System Information Technology	LADWP
Feng Pan	TSM	Los Alamos National Laboratory
Jason Rodriguez	CEO and Director of Research	Zpryme Research & Consulting, LLC
Kat Shoa	Founder / Principal	Kat Shoa Consulting
Commissioner Timothy Simon	Commissioner	California Public Utilities Commission
Peter Suterko	Manager, Fleet Services	LADWP

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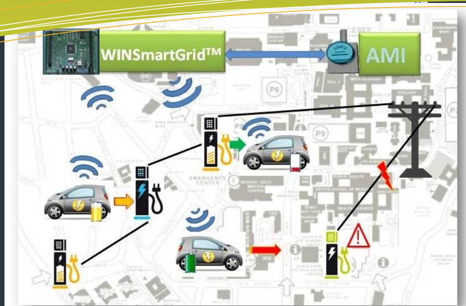
Electric Vehicle(EV) Integration into Smart Grid of the Future



this issue

UCLA WINSmartGrid™ Technology

California constitutes a significant automotive market - a place here demanding and energy-conscious consumers come together with creative designers from Hollywood, resulting in an environment rich in ideas on automotive innovation. As a result, California is home to some of the most significant innovations in EVs including Tesla and Fisker. As these innovations come on line their integration into the smart grid of the future becomes the next big challenge. We are developing a scalable and robust architecture utilizing wireless and RF-monitoring and control technologies derived from our REWINS™ research calledWINSmartGrid™ that allows smart vehicle and energy storage and consumption management for vehicles in home or in the office. As part of the challenging long-term research project, we are developing a series of demonstrations both at home and in the office. The first phase - developing an on-campus demonstration within UCLA - requires conducting research and demonstration on UCLA's internal electric vehicle (EV) fleet and charging stations at UCLA for its integration with our local utility's managed grid.

The objective of this project is to reduce energy cost and usage and to increase the stability of local power system by managing the charging operations of the EVs. This will be accomplished using the smart grid wireless system under development at UCLA called WINSmartGrid™.

In this project, EV usage information and electric grid status will be collected wirelessly to determine better efficient and economic charging operation of the EVs. Due to different grid stability/reliability, geographical location of the EVs and driving patterns of the EVs, effective management of charging and backfill operations may be used to lower electricity rates and flatten electric

Major Areas of this Research Include:

- WinSmartGrid™ Technology- WinSmartGrid™ platform is used as the infrastructure to i) connect to EV electric power sensors, GPS chips, and other EV data and ii) control and utilize the wireless network for communication iii) allow data filtration, aggregation and messaging, and iv) provide a portal for data integration and decision making.
- Smart Energizing - the management of EV batteries' charging rate and extent of the charge backfill based on various data from grid stability, energy cost, vehicle location, battery status, driver's preference, and driving patterns.
- Grid Balancing - grid management and prediction of peak and off-peak hours to store excess capacity, or to handle demands for large numbers of EVs charging efficient, economically and safely.
- UCLA-WINRFID™ Technology - including RFID tags/readers on the EVs and charging stations to track and identify usage and preference information of each EV. Automatic charge/discharge intelligence stored within smart RFID tags managed by UCLA-WINRFID Technology.
- Cyber Security - study and integration of cyber security technologies for secure wireless communication between battery and infrastructure or between two batteries, as part of the smart grid architecture.

load curve. Each EV will be equipped with a handheld device to allow the driver to receive instructions or seek advice to better manage his/her EV's battery charging/backfill process.

For example, an alert can be issued to the driver when the battery capacity is below a threshold level. The alert can include a list of near-by charging station's location, distance, current and projected energy cost based on the time of the day and use an intelligent cloud-computing the driver the optimum course of action.

The batteries on the EVs when not in driving status can also be collectively used to serve as the energy storage which can backfill into the local electric grid to prevent power outage during peak demand. In this scenario, an alert is issued to the driver when a predicted instability in the grid is detected.

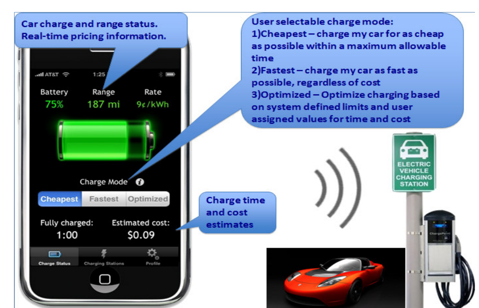
The alert can instruct the driver to bring the vehicle to the appropriate charging station to serve as backfill battery.

Existing EVs and charging stations usage patterns will be studied to determine the appropriate sensors and wireless communication modules to be installed. Communication and alerting systems will be implemented by integrating WINSmartGrid™ with our local utility's Advanced Metering Infrastructure (AMI) and the Demand Respond project.

The demonstration and results of this project will provide vast amounts of data, information and knowledge to allow an effective and large scale roll-out of grid-integrated EVs across the region and in the country.

Recent advances in information and communications systems and battery technologies, in combination with substantial importance given by society to reducing greenhouse gas/carbon emissions, have resulted in dramatic thrusts towards accelerated innovations in electric vehicles (EVs) and the smart and renewable energy infrastructure necessary to fuel and support them. Products such as the Nissan Leaf, Chevy Volt, and Ford Focus Electric, are in the process of creating mass markets for electric vehicles in the U.S. The utilities on their part are working towards enhancing their infrastructure through their own investments as well as those from the DOE Stimulus ARRA Grants, and this requires massive changes in their distribution as well as their transmission systems. If 25% of all vehicles were EVs today, the current infrastructure in the U.S. would have a difficult time supporting the charging of these EVs - substantial technological, infrastructure and behavioral changes would be required to do so in a scalable and efficient manner. Some utilities have reported numbers which indicate that even a single 220V EV charger may during peak consumption hours overload its transformer. Therefore, the current infrastructure needs to be upgraded both from a capacity standpoint as well as from a flexibility and power routing/control standpoint. Adding capacity is far more expensive than adding intelligence and smart power routing capability, and the eventual solution will require an innovation combination of both. Certainly, adding auxiliary power sources at the edge of the power network such as residential solar PVCs to feed into the grid would help from a capacity standpoint, but using such alternative fuels so as the move the energy around where it is needed from where it is produced will require a very sophisticated and smart grid.

While adding capacity and adding smartness are challenges - they are also opportunities. There are other unique opportunities that the growth of EVs can provide in the context of the Smart Grid. Due to the addition of a large number of batteries by way of these EVs there is the potential to aggregate them to create an energy storage buffer which can absorb excessive power during low-load



Current Research Topics and Demo Targets:

- Wireless and sensor-based infrastructure
  - Monitoring of battery status
  - Charge and discharge planning and execution
- V2G and G2V issues
- Within V2G, EV's to provide power to micro-grid during
  - High priced intervals
  - Emergency energy need situations
- Hierarchical and decentralized aggregation of battery resources
- Real-time two way integration with utility infrastructure and DR
- Integration with stochastic renewable sources to smooth micro-grid consumption
- Integration with micro-grid based community storage