EPRI Smart Grid Demonstration Update

An EPRI Progress Report **February 2012**

ABOUT THE NEWSLETTER

The EPRI Smart Grid Demonstration Initiative is a seven-year collaborative research effort focused on design, implementation, and assessment of field demonstrations to address prevalent challenges with **integrating distributed energy resources** in grid and market operations to create a "Virtual Power Plant." This newsletter provides periodic updates on the project, relevant industry news, and events.

PROJECT UPDATE

EPRI Smart Grid Demonstration Host-Site Updates

This issue features projects from nine host utilities: AEP, ConEd, Duke Energy, Southern California Edison, Exelon-ComEd, PNM, Sacramento Municipal Utility District, Southern Company, and Hydro-Quebec.

American Electric Power (AEP) Smart Grid Demonstration Update

The AEP demonstration is conducting another "Cross Technology" simulation in OpenDSS. This simulation includes a combination of community energy storage (CES) and plug-in electric vehicles (PEV). Interval data was obtained from the customer via the AMI system. Weather data measurements for Columbus, Ohio were included for the same period of time.

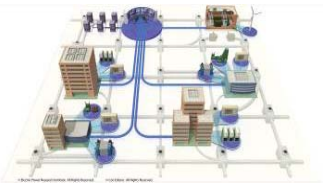
A transformer was selected for this study that is serving eight homes. The results in the table below are for adding three PEVs to this transformer load. Simulation Case Variables for the cross technology with CES and PEV are grouped as shown in the table below.

- Base Case for this transformer (No CES or PEV)
- PEV Only with full charging profiles of 2 PEV (240V-15A-8kWh) with given concurrent charging at 6pm each day
- Utilization of CES to shave the PEV peak (Localized limit of 25 kW)
- Using CES to load shift PEV charging (CES discharges to match PEV demand)
- PEV smart charging (One PEV starts at 1am followed by the second at 3am)

Preliminary results are presented in the table. Computations were done on peak demand, average demand, load factor, storage consumption, and aging that would impact thermal lifespan. Further modeling and simulation research is in process.

	Peak Demand (kW)	Average Demand (kW)	Load Factor	Consumption (kWh)	Storage Consumption (kWh)	Cummulative XFRM Aging (Total Hours)	Estimated Aging (%/year)
Base Case	42.58	12.53	0.29	51443	0	785.0	0.44
CES Peak Shaving	30.28	12.80	0.42	52523	1043	695.0	0.39
PEV	53.67	13.68	0.25	56126	0	6415.7	3.56
PEV & CES Peak Shaving	45.21	13.99	0.31	57409	1254	1735.1	0.96
PEV & CES Load Shifting	46.31	14.09	0.30	57821	1711	1541.0	0.86
PEV Smart Charging	42.58	13.67	0.32	56096	0	847.1	0.47
PEV & CES Smart Charging & PS	30.28	13.93	0.46	57177	1042	769.8	0.43

Consolidated Edison Smart Grid Demonstration Update



The Consolidated Edison project is developing the technology necessary to realize a Demand Response Command Center (DRCC) that links the utility's Distribution Control Center (DCC) to customer-owned distributed resources. This system provides the utility with visibility and control to treat distributed resources as a virtual generation source and will allow utilities and system operators to view the combined resources as a component of a virtual power plant.This system implementation allows a third-party aggregator access to multiple demand response and distributed generation resources that together could participate in ISO markets on par with generation.

User	Role
Utility Distribution Operator	- Identify targeted curtailment resources - Select and activate curtailments - Monitor and terminate curtailments
DRCC Administrator/Operator	- Enroll buildings - Monitor program calls and curtailments - Override curtailments - Audit trails, accounting, and billing
Facility Manager	- Schedule maintenance/unavailability - Monitor program calls and curtailments - View historical data/track earnings - Approve curtailment (as applicable)

As noted in the October 27th deep-dive webcast, dispatch involves three primary players, the utility distribution operator, the DRCC operator, and the facility manager. User interfaces have been designed and developed for each of these three system users and their roles are shown in the chart above right.

Con Edison is completing a case study on the remote dispatch of customer owned resources. The progress report (1024623) contains the case study and a corresponding use case. Members of the EPRI Smart Grid Demonstration Initiative can access the Con Edison deep dive webcast on the EPRI cockpits website.

Duke Energy Smart Grid Demonstration Update

Duke Energy has installed 60 Tollgrade LightHouse™ medium voltage sensors on the McAlpine substation as part of the Envision Energy Project in Charlotte, North Carolina. The sensors provide current, surge and fault current, conductor temperature and harmonic measurements and profiles. Duke Energy is also exploring the use of the sensors to relay local weather conditions. The sensor data is communicated back to the nearest communication node via Wi-Fi communications. Data backhaul to the control center is accomplished via cellular communications.

The ultimate goal is to feed the sensor data into the Distribution Management System so that the data can be used to automatically control the system to optimize the flow of electricity and to aide in possible reconfiguration of faulted circuits.

Some of the key features of the Tollgrade line sensor are an operating range from 4 kV - 35 KV, ability to use a standard hot stick to install the sensor, inductive coupling to provide power under normal operations and super capacitors to supply power during a power outage. The sensor fits conductor sizes from #6 AWG to 795 MCM.

Southern California Edison (SCE)

The Southern California Edison (SCE) Irvine Smart Grid Demonstration (ISGD) project has developed a full set of hypotheses for each of the eight sub-projects within ISGD. These hypotheses have been instrumental to the creation of the preliminary test plans and to the measurement instrument requirements for each of the sub-projects. They have been reviewed for completeness and accuracy to assure that the data being collected is adequate to analyze the performance of each of the sub-projects.

Other activities since the last newsletter include:

- The first of the quarterly build metrics reports was sent to the Department of Energy for the ISGD project.
- An extensive two-day, face-to-face review of the cyber security plans for the ISGD project was performed.
- Because of the changes in the vendor agreements from the original plans, new suppliers of equipment such as residential photovoltaic inverters have been identified for the zero net energy (ZNE) homes sub-project. These homes are part of the University of California-Irvine faculty housing infrastructure.

Block #1 of the four blocks of faculty homes for the zero net energy (ZNE) home sub-project at the University of California Irvine. On the left side of the road are Jerry Thode and Gordy Stecklein of SCE They are near the pad mounted transformer that feeds the eight homes that will have the maximum retrofit to become ZNE. On the right side of the road are Christina Haddad of EPRI and Dar Mardan of SCE. They are near the location where the community energy storage (CES) battery system will be installed.

Exelon (ComEd/PECO) Smart Grid Demonstration Update

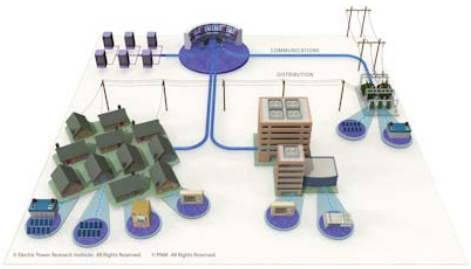
ComEd – A report of supplemental information and appendices for the phase 2 final report for the Consumer Applications Plan (CAP) will be available in March (EPRI report 1024865). In addition to details behind the analysis, the supplemental report includes the data from the closing survey.

EPRI and ComEd established a set of 47 hypotheses to guide the CAP analysis. The purpose of the hypotheses, which are grouped according to topic, was to construct concise statements of what quantifiable effects might be expected from the CAP applications.

This supplemental appendix is organized into sub-sections corresponding to each topic. Within a sub-section each hypothesis is stated, the analytical method used to test the hypothesis is discussed, and results of the hypothesis test are presented. In instances where hypotheses could not be tested, an explanation of data issues affecting the analysis is provided. Hypotheses that require the use of electricity consumption data are separated into summer and non-summer time periods with the results presented separately.

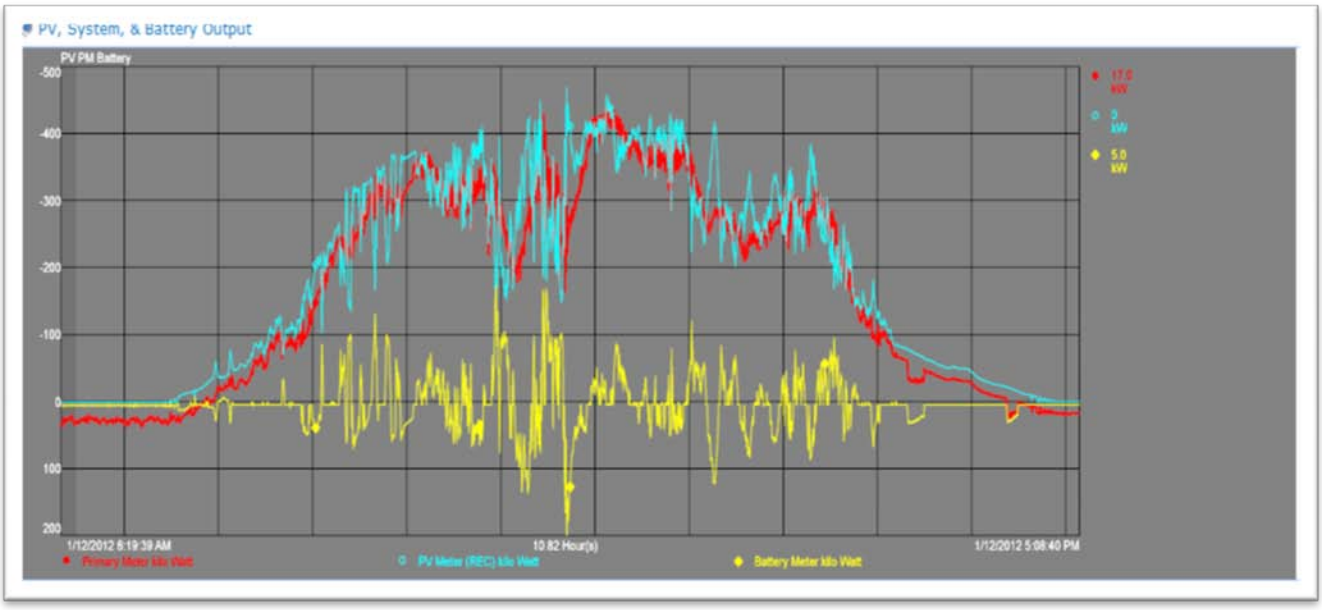
Throughout the discussion in this appendix, specific treatment cells are referenced that contain the groups of customers whose behavior relates to the hypotheses being tested. These are referenced via alpha-numeric IDs found in the phase 2 report. These IDs are descriptive of the experimental design in terms of rate and enabling technology treatments.

PNM Smart Grid Demonstration Update



PNM's Prosperity Energy Storage Project continues to progress with development and demonstration of PV shifting and smoothing with advanced lead acid battery technology.

The graph below highlights the latest configuration of the smoothing algorithm that has been developed by Sandia Labs and Ecoult—a fully owned subsidiary of Project Partner East Penn Manufacturing. The varied output of the PV is evidenced by the blue line, the yellow line shows the smoothing battery in action and the resulting red line shows the smoothed output seen by the utility grid.



Sacramento Municipal Utility District (SMUD)

SMUD has elected to replace the Solar Highway project with a new project called Simply Solar. The original project focused on installing two photovoltaic installations, a 300kW concentrating plant and a 1,100 kW flat panel installation, along a major throughfare within their service territory. It was canceled because of the complexities of deploying this type of power generation on an urban highway right of way.

The new project, Simply Solar, will consist of 1,500 kW of solar panels installed on roughly 10 acres of underused land in urban areas. The goals are still the same as those of the Solar Highway: using vacant land, demonstrating the efficient use of community-sized solar installations, and calling public attention to solar power. The planned completion date for Simply Solar is June 2013.

Southern Company Smart Grid Demonstration Update

With the majority of their AMI meters installed, Southern Company has moved from installation mode to innovation mode. One example of this is the use of an AMI meter to monitor the health of a fixed capacitor bank. For more than 50 years, Southern Company installed a VARP meter in the substation to monitor the health of the capacitor bank. This was accomplished by measuring the VAR reading of the capacitor bank neutral conductor to determine when a capacitor failed. Monthly manual downloads and analyses of the VAR readings helped technicians determine the health of the unit. The inspection procedure for distribution capacitor banks was also a manual process done annually just before summer.

Using the original substation health monitoring concept, combined with the communications ability of their AMI meters, Southern Company has changed the inspection schedule of distribution capacitor banks from one inspection yearly to daily. This advancement has and will continue to improve their ability to maintain adequate VAR support for their T&D system. Southern Company has installed thousands of these monitoring units on capacitor banks without SCADA communications. As shown in the picture, the capacitor bank health monitor consists of a pole mounted meter base with an embedded neutral current CT, AMI meter, and a 120V power source.

Hydro-Québec Smart Grid Demonstration Update

Hydro-Québec's electric vehicle project ramped up in 2011 with 30 Mitsubushi i-MiEV cars hitting the road in the Smart Zone. These cars will be loaned to customers in the town of Boucherville over the next three years. The picture to the right shows one of the vehicles at a local restaurant, ready to be used for food deliveries.

The cars are instrumented with ISAAC data acquisition units to capture charging and vehicle usage patterns.

The vehicles are charging both in the morning (at workplace) and in the evening (at home). Although the evening charging time is shorter than expected, the evening peak remains as expected for the i-MiEV project.

To accommodate the charging of these vehicles, a total of 45 Level 1 and Level 2 chargers have been installed in the Smart Zone. Of these 45 chargers, 15 have built-in intelligence to monitor and communicate charging data back to Hydro-Québec. A DC fast charger is planned for installation in the Smart Zone in 2012 after testing is conducted at Hydro-Québec's research institute, the IREQ (Institut de recherche d'Québec)

List of Deliverables Since Last Newsletter

Product ID	Name	Published
1024839	Hydro-Quebec Smart Grid Host Site Progress Report	02-Feb-12
1023489	Smart Grid Cyber Security Training – Smart Grid Training Session #3	15-Dec-11
1024620	Sacramento Municipal Utility District Smart Grid Host Site Progress Report	09-Dec-11
1024590	A Utility Application Implementation Strategy Using the EPRI IntelliGrid Methodology and the GridWise Architecture Stack as a Model	14-Nov-11

CVR Training Video Available

The training DVD "Conservation Voltage Reduction (CVR) and Volt VAR Optimization (VVO) for the Smart Grid – Smart Grid Training Session #4" is now available. You can order this training video by linking to EPRI product ID #1024628.

This training DVD was developed as part of the 2011 CVR VVO Strategic Topic and features two EPRI experts (Jared Green, Project Manager and Jeff Roark, Senior Project Manager) who present the following topics:

Part 1

- Basics of CVR and VVO
- Methods of control
- Measurement and verification
- Methods to increase benefits
- Future of CVR and VVO

Part 2

- Economic benefits of CVR and VVO
- Identification and monetization of VVO impacts
- Estimating the benefits of CVR

KEY EPRI SMART GRID DATES

Smart Grid Demonstration Advisory Meeting – March 6-8, 2012

Location: The meeting will take place at CenterPoint Energy in Houston, Texas. An EPRI room block has been set aside at the Hyatt Regency Houston. **Please make your reservations online at** https://resweb.passkey.com/go/EPRIMar2012 **by February 10, 2012** to guarantee you secure the group rate.

Agenda: The March meeting will feature several case studies presented by demonstration members. Selected programs or technologies that are at a point where sharable learning's have resulted will be featured. This should bring some closure to certain project aspects or technologies for the benefit of participants. Results related to energy storage and dynamic monitoring of equipment are among case studies that are likely to be covered in presentations.

Tentative agenda for the March 2012 Smart Grid Advisory Meeting:

	Tuesday, March 6	Wednesday, March 7	Thursday, March 8
Morning	Training Session on Cost/Benefit Analysis	Case Study Presentations	Discussion on Format of Smart Grid Reference Guide Wrap-Up Discussions CenterPoint Tours
Afternoon	CenterPoint Introduction and Project Briefing Smart Grid Demo Updates Strategic Topics Updates	Case Study Presentations Roundtable Discussion	ADJOURN
Evening		EPRI-Sponsored Dinner	

Schedule of All 2012 EPRI Smart Grid Demonstration Advisory Meetings

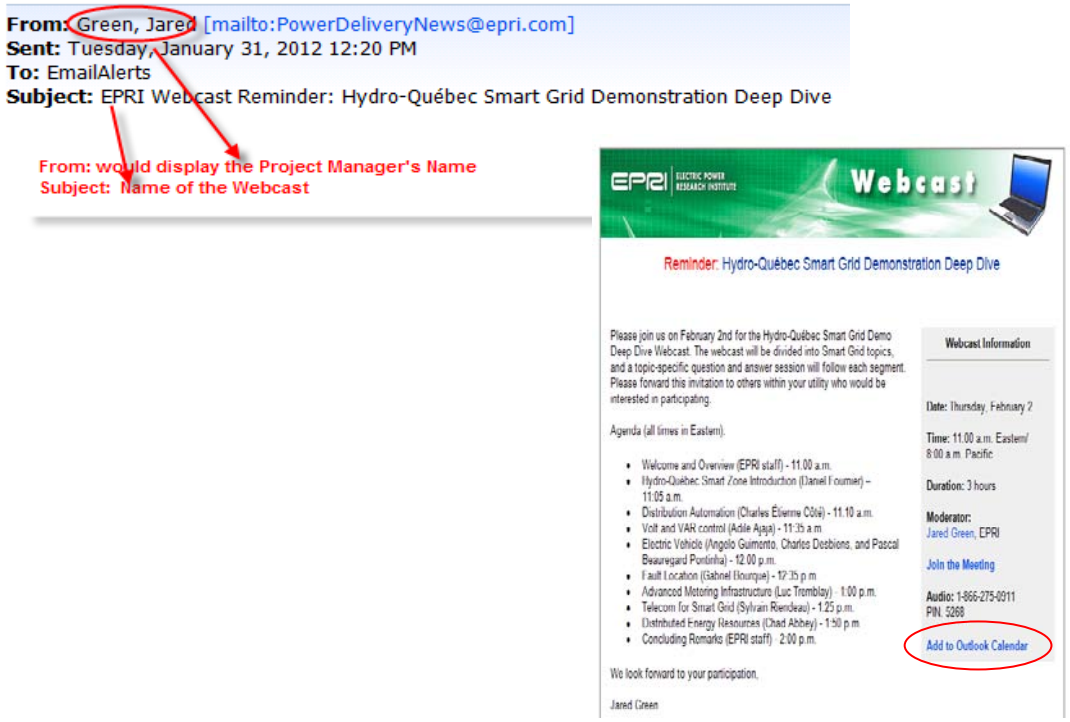
2012	March 6-8	Meeting Hosted by **CenterPoint Energy**, in Houston, Texas
	June 12–14	Meeting Hosted by **Southern California Edison**, in Huntington Beach, California
	October 16-18	Meeting Hosted by **Sacramento Municipal Utility District**, in Sacramento, California
2013	3 Meetings	Meeting Hosts TBD
2014	3 Meetings	Meeting Hosts TBD

All Smart Grid Demonstration Members (not just host-sites) are invited to host future meetings. Members interested in hosting one should contact Matt Wakefield (mwakefield@epri.com) or Gale Horst (ghorst@epri.com).

2012 Smart Grid Demonstration Host-Site "Deep Dive" Webcasts

Throughout 2012, host site utilities will provide an update on their projects. Look for email invitations to these webcasts, rather than the Outlook meeting invitations that were sent previously. Just click on the link in the email to add the meeting on your calendar, as shown below.

A New Look for Announcements of Smart Grid Demonstration Webcasts



2012 Smart Grid Demonstration Host-Site Webcast Schedule (3rd Thursday of the month at 11am (Eastern) for 1 ½ to 3 hours)

- February 2, Hydro-Québec **(COMPLETE)**
- February 23, ESB Networks
- March 15, Exelon
- April 19, First Energy
- May 17, Electricité de France
- June 21, American Electric Power
- July 19, PNM Resources
- August 16, Southern California Edison
- September 27, Southern Company
- October 25, Duke Energy
- November 15, Consolidated Edison
- December 20, Kansas City Power & Light

A continuous thank you to the 23 member utilities of EPRI's Smart Grid Demonstration Initiative

American Electric Power | Ameren | Central Hudson Gas & Electric | CenterPoint Energy | Consolidated Edison | Duke Energy Electricité de France | Entergy | Ergon | ESB Networks | Exelon (ComEd & PECO) | HECO | Hydro-Québec | FirstEnergy | KCP&L | PNM Resources | Sacramento Municipal Utility District | Southern California Edison | Southern Company | Southwest Power Pool | Salt River Project| Tennessee Valley Authority | Wisconsin Public Service Corporation

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