Quarterly Update

Pacific Northwest SMART GRID DEMONSTRATION PROJECT

Spring 2013

Powering up energy storage and lessons learned so far

Last week, Oregon's U.S. Senator Ron Wyden and Pat Hoffman, assistant secretary for DOE's Office of Electricity Delivery and Energy Reliability were among several VIP guests to celebrate the grand opening of the Salem Smart Power Center. As part of the Pacific Northwest Smartgrid Demonstration Project (PNW-Demo), the Salem Smart Power Center houses a 5MW Lithium-Ion battery- the largest installed in the PNW-Demo. Assets like the Smart Power Center are visible milestones showing the progress we have been making since kicking off our journey in 2010.

While on our five year journey, it's always a good idea to take a step back and evaluate your progress about mid-way through a project. Working with BPA, we were in the process of doing just that, when the Department of Energy asked the PNW-Demo participants to answer a questionnaire about lessons learned so far. Great timing!

This edition of the PNW-Demo quarterly update will also focus on our "aha" moments at the project level, as well as insights from the utility perspective. We'll use responses from the DOE survey, interviews that BPA has conducted, plus information we've gathered and heard along the way.

We've heard some great news; utilities appreciate the diversity of smart grid assets being installed around the region, and the collaboration we have all shared. And we've heard about areas that were not as easy to navigate, such as the complexity of the project and the infancy of vendor interoperability and readiness.

We've also learned a lot about what it takes to implement the transactive control signal – we've adjusted the math to make it more accurate, and we're working with utilities to make sure they can receive and use it.

This is a research project, so we're making modifications in real time. We're also doing great things across the region that will help integrate renewables, keep costs lower than they otherwise would be, enhance reliability of the power grid, and give consumers choices.

Ron

Ronald B. Melton, PhD
Project Director

What's inside

Project Objectives and Attributes

Primary Objectives:

- Develop and validate an interoperable distributed communication and control infrastructure using transactive control signals;
- Measure and validate smart grid costs and benefits;
- Contribute to the development of standards and transactive control; and
- Apply smart grid capabilities to support the integration of renewable resources.

Operational Objectives:

- Manage peak demand;
- Facilitate wind integration;
- Address constrained resources;
- Improve system reliability;
- Improve system efficiency; and
- Select economical resources.

Key Attributes:

- Leave an installed operational base of smart grid assets and successful operational strategies for the region.
- Stimulate the regional and national economy by creating jobs and a vibrant smart grid industry.

Salem Smart Power Center going online

Alongside invited VIP guests and several local and regional media representatives, PGE unveiled its Salem Smart Power Center on Friday, May 31. As a self-proclaimed "big fan" of energy storage, Senator Wyden, who chairs the U.S. Senate Energy and Natural Resources Committee, noted the critical role the PNW Demo was playing in advancing grid modernization, integrating renewable energy and testing storage. "I applaud the Department of Energy, Battelle, Bonneville Power, Portland General Electric, and all the project partners for their hard work getting this Smart Grid project going," said Wyden. "It's critically important that demonstration projects like this one lead to real transformation in our energy sector."

Secretary Hoffman highlighted the PNW-Demo's successful public-private partnership involving 17 organizations across five Northwest states and the testing of transactive control, the technology at the heart of the PNW-Demo. "It is a highly innovative project demonstrating transactive energy management, which is a promising, cost-effective way to integrate variable renewable energy, energy storage and demand response at scale."

U.S. Senator Ron Wyden addressing the crowd at PGE's Smart Power Center

Together with PGE, the PNW-Demo is testing how transactive control, can help engage the battery in ways that support storing energy when energy market prices are low, and releasing energy storage, rather than buying power, when market prices are high. This way, transactive control helps power producers and users to save by enabling better management of generation and consumption through market and economic signals.

BPA's Deputy Administrator Elliot Mainzer, Secretary Hoffman, PNW-Demo Director Ron Melton, Senator Ron Wyden and Salem Mayor Anna Peterson touring the Salem Smart Power Center

For PGE, the battery, specifically built by EnerDel and its partners for this project, is the centerpiece of a new "high-reliability zone," a microgrid that connects remotely-operated power line switches, demand response mechanisms, local solar generation, and dispatchable standby power units at key State of Oregon facilities, including the Oregon State Data Center, Oregon Military Department and the Anderson Readiness Center. Taken together, these assets will support reliable, clean energy for about 500 strategic state operations, local businesses and residents.

Many moving parts

The most widely heard comment from all project participants is that the transactive control signal is very complex – as is the process of getting ready to receive it.

"Our staff had to learn new procedures and how to handle new equipment and software," one utility representative said. "On top of that that, we did not have a good understanding of transactive control, or challenges of implementing it at the beginning of the project."

System designers agree that transactive control is complex – in fact, that's one of the features that separates it from other systems that use two-way communication systems to optimize the power grid.

According to Battelle's Don Hammerstrom, who is the Principle Investigator for the project, "It's a mesh – like a pebble in a pond. The TCS represents an aggregate of many objectives, instead of a unique pairing between an objective and a responsive asset."

"The transactive control system is more than just up and down communication," says Battelle's Don Hammerstrom, who is the Principle Investigator for the project. "It's a mesh – like a pebble in a pond. The TCS represents an aggregate of many objectives, instead of a unique pairing between an objective and a responsive asset. There are many inputs and algorithms that we have to get right. Some are easy to understand and control, others are not so much. "

That complexity and uncertainty introduces a myriad of issues such as challenges with data collection and the varying quality of the transactive control signal, to questions raised about interoperability and integration.

But the project leaders and utility partners are learning from the experiences learned in implementation of the projects assets, and can also see the value of what the project is accomplishing overall. Most of the utilities have reported specific benefits such as reducing their demand charges from the Bonneville Power Administration, enhanced customer engagement, reduced system losses, better information on energy use, and new information that has led to optimized operations. Here is a sampling of what they have to say:

- Advanced metering infrastructure is providing a reduction of field visits and a "new reality in which visibility into the system state is so greatly enhanced that operational awareness is providing for optimization of assets and a complete understanding of system and customer load behavior."

- The project has provided significantly enhanced collaboration and sharing of issues and solutions across the utilities, including topics of consumer engagement, technical challenges and vendor interactions.

- Although interoperability for smart grid is in its infancy, the project is working to successfully demonstrate a distributed and interoperable architecture. For example, transactive nodes were deployed in different utility environments with different resources and varying security requirements. In addition, more than one vendor provided source code for the nodes, yet they are able to communicate effectively.

- The project has brought a rich diversity of smart grid assets to the region that will help enhance our grid's infrastructure and provide consumer choices, in addition to providing a variety of tests for utilities and their end-use customers.

And here are some of those all-important lessons learned:

- Flexibility in customer engagement is extremely important across the different utilities. Each must consider how to best engage their customers and frame up the context of "smart grid."

- Be aware of vendor limitations; do your research and ensure that products with perform as expected and will integrate with current systems. Choose vendors with a proven track record -- some vendors have even gone out of business during the course of the project.

- Develop a strong project plan and spend an appropriate allotment of time identifying requirements and basic design.

- It has been a particular challenge to simulate the bulk power system in the transactive control incentive signal, when we have limitations on the information to which we have access.

- Use a building block approach to producing a new system. Add successively more complex elements as results come in, validating the basic design.

Moving forward, participants in the project emphasize that communication with internal resources, regulatory agencies and customers is critical to the success of smart grid. And of course, you can't ignore the almighty dollar. The region definitely needs to show a strong business case for smart grid technologies and programs to advance. As one participant stated, "To take the technology forward, we need better ways to analyze the data and ensure that the cost savings is enough to roll out on a bigger scale."

Project description

The Pacific Northwest Smart Grid Demonstration project is a regional endeavor funded by the Department of Energy under the American Recovery and Reinvestment Act of 2009. The goal is to verify the viability of smart grid technology and quantify smart grid costs and benefits. This information will help validate new smart grid business models at a scale that can be adapted and replicated nationally.

With the 50 percent DOE matching funds, this project has a $178 million budget.

Smart grid can help meet increasing power demands, reduce greenhouse gas emissions, promote energy independence, enhance reliability and help improve national security. It is a system that uses technology to enhance power delivery and use through intelligent two-way communication. Power generators, suppliers and users are all part of the equation. With increased communication and information, smart grid can monitor activities in real time, exchange data about supply and demand and adjust power use to changing load requirements. Smart grid technology includes everything from interactive appliances in homes to substation automation and sensors on transmission lines.

The regional project, the largest smart grid demonstration project in the nation, is led by Battelle Memorial Institute, Pacific Northwest Division. Participants include the Bonneville Power Administration, utilities, universities and infrastructure partners. It includes 112 megawatts of responsive resources and will last for five years.