Quarterly Update

Pacific Northwest SMART GRID DEMONSTRATION PROJECT

Fall 2011

State of the project

In less than one year, the Pacific Northwest Smart Grid Demonstration Project's unique transactive control signal will be fully functional.

While much still needs to be accomplished to make that happen, work to date in the region represents a significant effort in terms of time, funds and brainpower to create an innovative system with the potential to optimize the power grid, enhance reliability and – of great interest to many – encourage the use of renewable resources. In fact, a recent article in ClimateWire featured the PNWSGDP's work, and called out renewables specifically, saying it is "Creating a novel market 'signal' meant to reflect a higher value for low-carbon electricity."

Another objective of the project, showing whether smart grid investments are smart economically for the long run, was featured in a 2010 White House report. It states that the project is "Validating the value of smart grid technologies in the Pacific Northwest through the creation of a regional business case."

These two aspects of the project will serve as the focus for this edition of the Quarterly Update; continued development of the project's transactive control system, and the progress were making to build out the business case.

Ron

Ronald B. Melton, PhD
Project Director

What's inside

Project Objectives and Attributes

Primary Objectives:

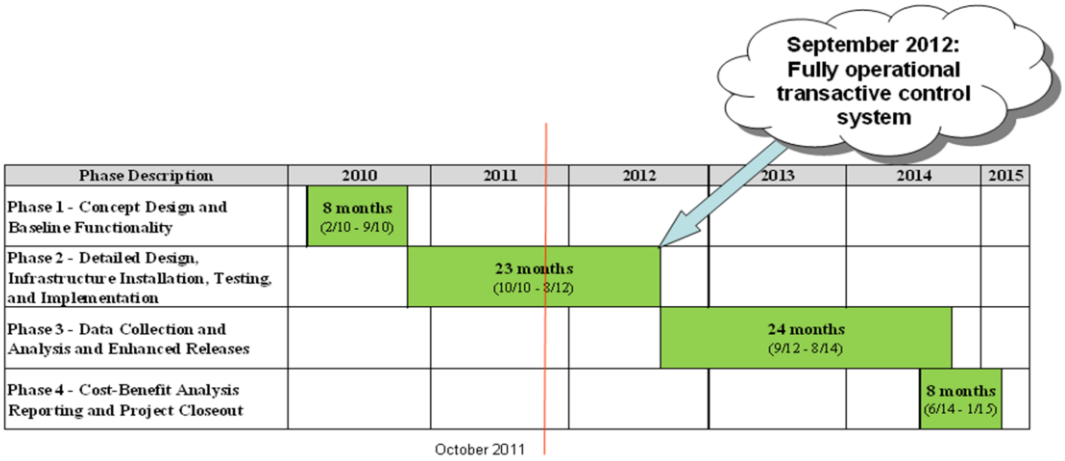
- Develop and validate an interoperable distributed communication and control infrastructure using transactive control signals;
- Measure and validate smart grid costs and benefits;
- Contribute to the development of standards and transactive control; and
- Apply smart grid capabilities to support the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



Countdown to the market signal

Two-way communication along the flow of energy is the cornerstone for the PNW-SGDP transactive control system. Now the project is one big step closer to solidifying that communication path with the development of toolkit functions (a set of generic algorithms) that utilities can use to join in the conversation.

First a little refresher on the transactive control system – it's the glue that bonds the PNW-SGDP and all of its participants, in the form of two-way, real-time communication. The system will send an incentive signal, and receive a feedback signal, throughout nodes, or specific locations, on the power system – all the way from generation of power, to the end user, and back. The signal will represent the monetary value of power in terms of dollars-per-megawatt-hour, at a given point in time and specific location, in an electronic form. This will incentivize the use of electricity to help enhance reliability, economics and the use of renewable resources. For example, if an abundance of wind power exists in a particular region of the grid, the transactive control signal will use information provided by the wind generator to lower the cost of the resource and encourage use of the energy at that particular time.

And that's where the toolkit functions come in. Utilities will use the various functions of the toolkit to attach assets, such as wind generation or water heater control devices, as well as local conditions, to the transactive control signal. Based on what the utility's goals are, the toolkit uses mathematical algorithms to interact with the signal and in essence, help develop content for the signal.

"The interface between the utility assets and the signal essentially provides the handshake between the demand for energy and the cost of energy," Linda Connell, PNWSGDP Deputy Director said. "That's why development of this toolkit is exciting – it allows for that interface."

The toolkit functions combine information about past and current conditions, and try to predict what the cost or load needs will be at the point where the node resides. A utility attaching generation, such as a wind farm to the signal would use the toolkit to predict generation of energy. A utility attaching load, such as water heater control devices, would use the toolkit to predict use of energy. Once the appropriate toolkit functions are installed, these interactions will happen automatically.

Within the next few months, utilities will take possession of the generic toolkit functions, assess which are appropriate for their assets, and customize them as needed in generating meaningful incentive and feedback transactive control signals. Whether generic toolkit functions are used as is, or highly customized, communicating with utility assets continues to move forward as the project makes excellent progress on the transactive control system.

Making the case

Are smart grid investments a wise choice economically? Figuring out that business case is one of four primary objectives of the Pacific Northwest Smart Grid Demonstration Project. To that end, a model is currently in development that will measure and validate smart grid costs and benefits. The computational model has been created to help show whether major infrastructure and technology investments will pay off in the long run, informing decision-makers as they determine if the region should move forward with the large expenditures and capital that will be required.

The Bonneville Power Administration, working closely with Battelle, is heading up development. "The business case is important at a regional level as well as for individual utilities," said BPA Smart Grid Program Manager Lee Hall. "The model can provide input and guidance for potential bulk grid investments in the region and it can serve as a potential source for utilities that are building their own business case. We also believe this cost/benefit analysis will be an important tool for the power industry nationally, as agencies and utilities make decisions about major investments."

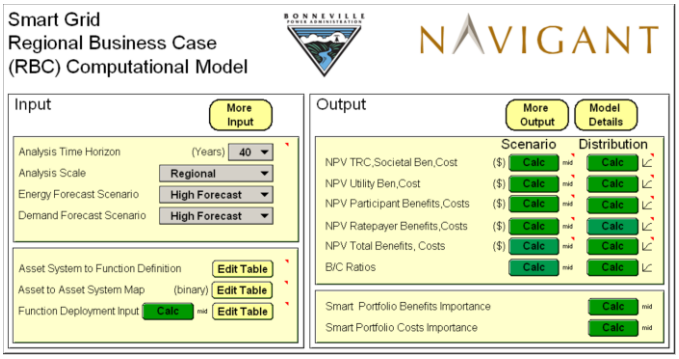
BPA, working with Navigant Consulting, developed an initial, assumption-based study which shows that smart grid may have significant benefit in the Pacific Northwest. The next phase will use a computational model (see screen shot right) to develop a bottom-up approach, using project data, to estimate costs and benefits.

The computational model is a complex spreadsheet that takes all of the assumptions about an asset, including its cost, lifespan and the quantity purchased, and combines them with data gathered from the project (and other sources) to provide an estimate of the benefit, such as avoided costs, efficiencies, et cetera. Battelle has been working extensively with PNW-SGDP participants to collect the information needed to populate the model. As more data becomes available during implementation of the project, it gets plugged into the computational model where the cost/benefit analysis will come to life.

The team expects the business case will reflect the following benefits:

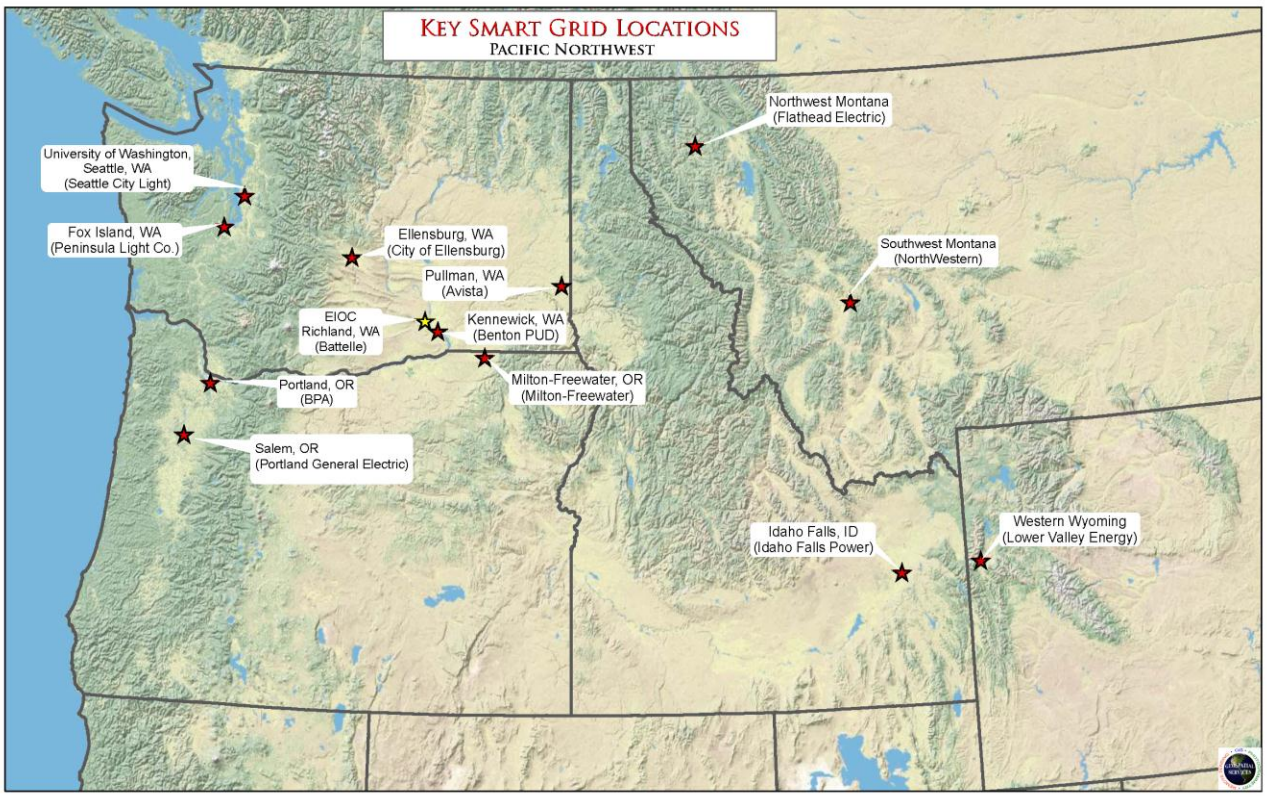
- Optimizing transmission and distribution systems
- Creating end use efficiency
- Increased grid reliability
- More dynamic and responsive assets
- Increased integration of renewable and distributed energy
- Increased efficiency for utility operations

"We'll use data from the project, and we'll also tap into other pilot projects in the region and nation for a holistic approach to the business case," Hall said. "It's important to gather as much data result as possible to support the cost/benefit analysis. This effort will have a significant impact on the future of smart grid."



Look for us!

- Dec. 5-8 – Project representatives will present at Grid-Interop in Phoenix, Ariz.
- Nov. 2 – Project representatives on hand at the Northwest Energy Efficiency Task Force Executive Committee meeting in Tacoma, Wash.



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. To date, the project has spent $59 million.

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.

Disclaimer

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