Fact Sheet

November 2010

Smart grid and BPA

The Bonneville Power Administration has long promoted smart grid technologies to improve transmission reliability and to reduce the need for new transmission infrastructure and power resources. Major smart grid projects in which BPA is involved today include:

- Pacific Northwest Smart Grid Demonstration Project
- Western Interconnection Synchrophasor Project
- Demand response pilot projects
- Storage studies and wind integration research
- Electric vehicles
- Improved fiber optic data transfer

Why BPA supports smart grid

A smart grid 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, a 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.

Smart grid tools offer several benefits

- Smart grid can help meet increasing power demands, reduce greenhouse gas emissions, promote energy independence, enhance reliability and help improve national security.
- Here in the Pacific Northwest, smart grid can help reduce demands on the hydro system, which is good for fish. It can help integrate variable resources such as wind into the transmission grid. And it can help contain power system costs.
- Smart grid adds value by offering consumers choices, just as cell phones provide many more options and flexibilities than old fashioned rotary phones.

BPA smart grid efforts today

BPA is supporting two major projects funded by the U.S. Department of Energy through the American Recovery and Reinvestment Act — the Pacific Northwest Smart Grid Demonstration Project and the Western Interconnection Synchrophasor Project. In addition, BPA is leading several smart grid research and pilot projects to explore how different smart grid technologies can benefit BPA's customers through cost containment and improved reliability.

Pacific Northwest Smart Grid Demonstration Project

BPA has joined 11 utilities, a major university and five technical firms across five states in a regional smart grid demonstration project. This large project involves $89 million in participant funds and the same amount in matching DOE funds through the Recovery Act. Directed by the Battelle Memorial Institute, Pacific Northwest Division in Richland, Wash., the project is expected to involve more than 60,000 metered customers. BPA is contributing $10 million to the five-year project, which is eligible for an additional $10 million in matching funds from DOE.

The project will measure and validate smart grid costs and benefits for consumers, utilities, regulatory bodies and the nation. Results will inform business cases for

future smart grid investments so utilities can select the most cost-effective technologies for their customers. Project participants will use and test a variety of smart grid technologies such as smart appliances, smart meters, distributed generation, in-home displays, home area networks, voltage optimization tools and electric vehicles. The project also will explore ways to improve the integration of renewable energy resources such as solar and wind.

BPA's role is to coordinate with Battelle to create a regional business case for smart grid technologies, lead the overall public outreach and communication effort and support research and infrastructure design. The project will result in an installed base of smart grid assets and smart grid implementation strategies for the region. It will stimulate the regional and national economy through job creation and development of smart grid related industry.

Western Interconnect Synchrophasor Project

Synchrophasor measurements are a type of smart grid technology that can help keep the grid stable and enhance reliability. This technology establishes a virtual firewall between generation and transmission to protect equipment. The units monitor specific properties of electricity in the three-phase alternating current high-voltage power grid (the phases). It uses an extensive communication network to help prevent the kind of grid instabilities that can occur when the system gets out of phase. BPA is one of the first transmission operators to use this technology.

In August, BPA joined public and private partners throughout the U.S. portion of the Western Interconnection in a Western Electricity Coordinating Council application for DOE funding of this smart grid technology. BPA is investing $20 million in the $53.9 million project as its share of participant matching funds. Recovery Act funding will provide an additional $53.9 million.

This project will deploy a large scale synchronized phasor measurement system with selected smart grid functions. It will include infrastructure and software applications to improve situational awareness, system-wide modeling, performance analysis and wide-area monitoring and controls for the Western Interconnection. Although the technology is complex, the outcome is simple: equipment gets protected. That helps keep the grid stable and prevents blackouts.

Demand Response Pilot Projects

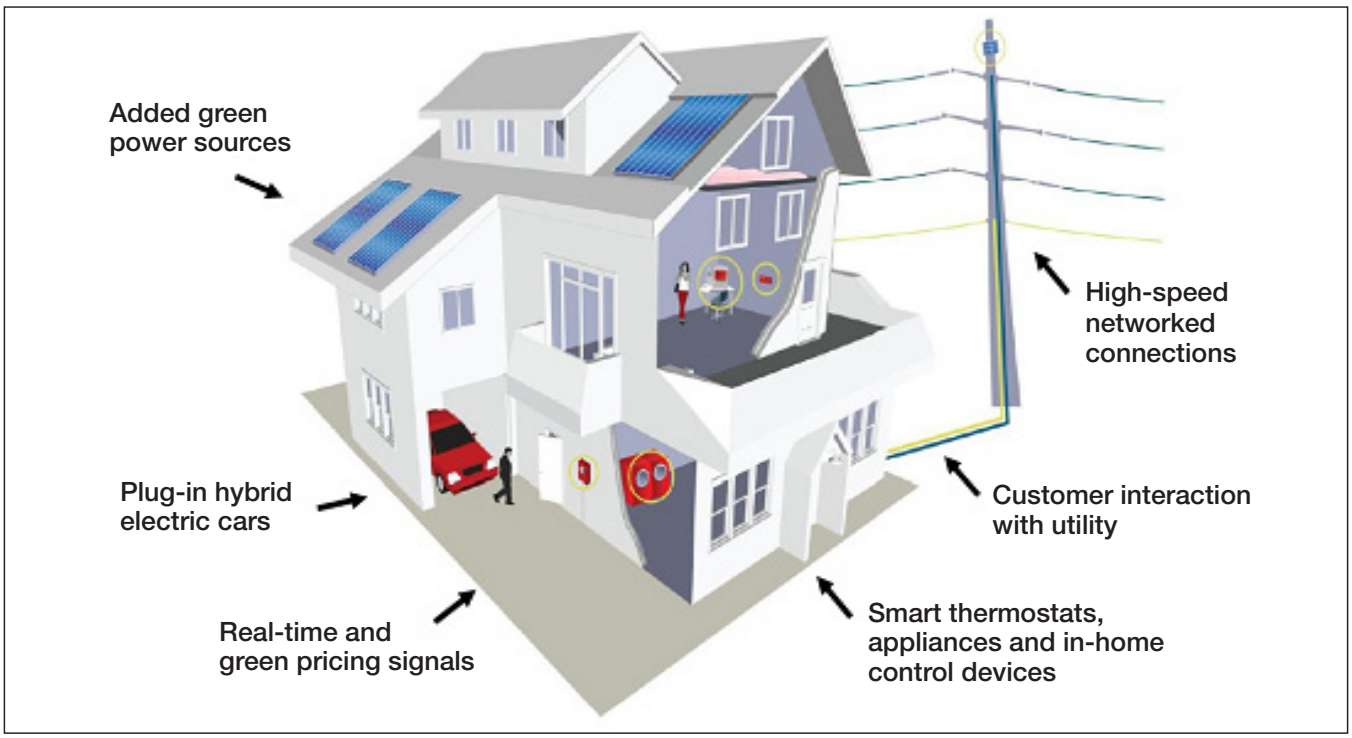
Demand response tools help utilities level out the spikes of energy consumption during times of peak use, such as in the morning when people wake up and turn on lights and appliances. Demand response can also potentially help integrate large amounts of wind energy in the Pacific Northwest system.

Demand response tools allow electricity providers and consumers to better manage how and when they consume electricity and, in some cases, at what price. For example, customers can volunteer for a program in which they allow their utility to reduce the energy consumption of certain appliances at times of the day when the demand for electricity is high. In another pilot, participants' water heaters are equipped so they can automatically turn on when a wind generator is producing power.

BPA currently has residential demand response pilot projects in progress with six utilities: Kootenai Electric Cooperative in northern Idaho; Central Electric Cooperative in central Oregon; Orcas Power and Light, the City of Port Angeles and Mason County PUD #3 in northwest Washington; and Emerald PUD in western Oregon. Additional demand response pilot projects for the commercial and industrial sectors are slated to begin in 2011.

At Kootenai Electric Cooperative, BPA is implementing a demand response program called The Peak Project. Working through Kootenai, BPA and the utility provide homeowners with a programmable thermostat and water heater controls to curtail home heating/cooling and water heater use at specific times of peak demand. At Central Electric Cooperative, the program includes controls that turn off water heaters from 5 a.m. to 9 a.m. daily, seven days a week. In both pilots, homeowners can override the curtailment at any time.

Variations of water and space heating control are also featured in projects being implemented by the City of Port Angeles, Orcas Power and Light, Mason County PUD #3 and Emerald PUD. Orcas will use home area



Why is Smart Grid important to BPA? *End-use consumers will have greater information about their energy consumption and will be able to make better choices in how they use electricity.*

networks and the internet to communicate real-time information about consumer behavior. The pilot for the City of Port Angeles will feature in-home displays with home area network capabilities and thermal electricity storage devices. Mason County PUD #3 will provide a direct signal from its wind resources to end-user hot water heaters to store renewable energy.

Demand response tools can be money savers for many utilities and their consumers, because they reduce the amount of energy used during peak times, reducing fees consumers pay for their peak power demand. Flattening out electricity use during peak hours can help keep rates lower by reducing the need for utilities to purchase more costly market energy to meet periods of higher demand. Ongoing consumer participation in demand response projects also can reduce the likelihood of potential "brown outs" and other disruptions during periods of peak energy use.

For the region, demand response can ease strain on the federal hydro system. Electricity use is growing, as are operational demands to protect fish runs and to integrate variable resources such as wind.

Storage studies and wind integration research

Storing energy can enhance the integration of wind, solar and other variable renewable energy resources. To that end, BPA is implementing an energy storage pilot with an international sustainable energy consulting company, Ecofys. The objectives of this project are:

- Help develop and deploy end-use, controllable electricity loads to help balance the variable nature of wind.
- Find and implement at least three commercial and/or industrial end use storage projects.
- Develop a demand response business case and marketing materials to support the participating utilities and other interested utilities.

Utilities participating in the project include Lower Valley Energy in Wyoming, Eugene Water and Electric Board in Oregon, and Cowlitz County Public Utility District in western Washington.

Through its Technology Innovation research program, BPA is working with the Pacific Northwest National

Laboratory and Oregon State University to further explore how to improve the integration of large amounts of wind energy to the regional grid.

Electric vehicles

BPA has small but important initiatives to explore the potential of electric vehicles. In the hydro-motion plug-in EV platform project, BPA will assess interest in and feasibility of creating a uniform technology platform. This will help utilities provide an easy way for their customers to charge electric vehicles. It will also make it possible to aggregate these charging units so that, by acting as a form of energy storage, they can help integrate variable renewable resources such as wind into the grid.

In addition, BPA is exploring opportunities to reduce fleet costs and meet DOE standards for reducing fossil fuel consumption. BPA is establishing four charging stations and evaluating lease options to add electric vehicles to the BPA fleet.

Improved fiber optic data transfer

Smart grid technologies require instant communication between many participants and the power grid and among elements of the grid. Fiber optics, which can carry very high volumes of communications, are essential. BPA is exploring the use of commercial ethernet routers to improve its fiber optic telecommunications system for data transfer. The benefits of using this technology compared with BPA's current system include reduced operational costs, enhanced security, lower cost to expand, less complexity (therefore less training, documentation, breakdown potential and human interaction), and increased bandwidth.

Earlier BPA smart grid projects

BPA partnered with Seattle City Light on several commercial smart grid projects during the winter and summer seasons of 2008 and 2009. For example, a project at the Seattle Municipal Tower reduced building system power demands at critical times by adjusting the temperature in specific building zones. Another project at the Northgate Target Store demonstrated the feasibility of using automated demand response controlled at a central offsite location. Although the building uses natural gas rather than electricity for winter heating, significant peak electrical load reductions were obtained through adjustments in lighting patterns and fan use.

In 2006, BPA partnered with PNNL and DOE to conduct the GridWise™ Demonstration Project. This tested whether smart grid technologies and consumers can play an active role in managing the grid. The GridWise™ Demonstration Project consisted of two separate demand response studies: The Grid Friendly Appliance Project and The Olympic Peninsula Project. While the GridWise Demonstration was conducted on a small scale, the project's findings included the following:

- An Internet-based network coordinating demand response can save consumers money on power and reduce peak load on the grid by approximately 15 percent over the course of one year.
- A significant number of customers will sign up for and respond to a real-time price that varies on a five-minute interval when they are provided with computer-based technology that automates their response and preserves the right to choose their preference for comfort and savings.
- On average, consumers saved approximately 10 percent on electricity bills.
- A combination of demand response and distributed generation reduced peak distribution loads by 50 percent.
- Utility dispatched demand response can alleviate the need to build expensive new infrastructure to address constraints on the distribution or transmission system during times of peak demand.

BPA has been promoting the concept now known as the smart grid since 1999, when it introduced the idea of an Energy Web in which all resources of the grid are intelligent and communicate with one another. The current projects that BPA is involved with will provide a deeper base of learning to help the region make wiser choices around smart grid investments and further understand the needs of utilities and the customers they serve.